WORCESTER COUNTY RECREATION CENTER
HVAC SYSTEM REPLACEMENTS

SNOW HILL, MARYLAND

GIPE ASSOCIATES PROJECT No. 25092

PROJECT MANUAL
BID DOCUMENTS

MARCH 12, 2026

Gipe Associates, Inc.
8719 Brooks Drive, Easton, MD 21601

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OF THE PROJECT MANUAL

FOR

WORCESTER COUNTY RECREATION CENTER HVAC SYSTEM REPLACEMENTS

SNOW HILL, MD

GIPE ASSOCIATES, INC. PROJECT No. 25092

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A. Copy of the Worcester County Procurement Bid Invitation is bound herein.

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NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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ADVERTISEMENT

Request For Proposals –
Worcester County Recreation Center – HVAC System Replacements

Worcester County is seeking Proposals from qualified Vendors for the **Worcester County Recreation Center – HVAC System Replacements project**. This project consists of HVAC renovations and supporting electrical renovations to portions of the existing Worcester County Recreation Center in conformity with the requirements contained in the Bid Documents.

Bid Documents for the above referenced project may be obtained from the Worcester County Commissioner's Office by either e-mailing the Procurement Officer at purchasing@worcestermd.gov, by calling 410-632-1194 during normal business hours, or via the County's on-line bid board. Vendors are responsible for checking that website for addenda prior to submitting their bids. Worcester County is not responsible for the content of any Bid Document received through any third party bid service. It is the sole responsibility of the vendor to ensure the completeness and accuracy of their Completed Bid Documents. Contractors that intend to submit an aggregate bid may request a complimentary electronic copy of the drawings and specifications.

A pre-bid meeting will be held on Wednesday, March 25, 2026, at 10 a.m. at the Worcester County Recreation Center located at 6030 Public Landing Road, Snow Hill, MD 21863. **Last date/time for bid questions shall be Friday, April 3, 2026, at noon.**

Sealed Bid Documents are due no later than Friday, April 10, 2026, at 2 p.m. and will be opened and read aloud in the Office of the County Commissioners, Worcester County Government Center – Room 1103, One West Market Street, Snow Hill, Maryland 21863.
Late Bid Documents cannot be accepted.

Envelopes shall be marked "RFP-Proposal for Worcester County Recreation Center HVAC" in the lower left-hand corner. After opening, bids will be forwarded to the County Engineer and Engineering Consultant for tabulation, review and recommendation to the County Commissioners for their consideration at a future meeting.

In awarding the proposal, the Commissioners reserve the right to reject any and all proposals, waive formalities, informalities and technicalities therein, and to take whatever proposal they determine to be in the best interest of the County considering lowest or best proposal, quality of goods and work, time of delivery or completion, responsibility of subcontractors being considered, previous experience of subcontractors with County contracts, or any other factors they deem appropriate.

All Bids shall be Lump Sum Amount, including allowances. Each Bid shall be accompanied by a Bid Guaranty, which shall be either by a certified check made payable to the "County Commissioners of Worcester County, Maryland" or a Bond in the form and by a Surety company approved by the County Commissioners of Worcester County, Maryland in the amount of 5% of the Bid amount. All responsive bids shall be held valid for at least 60 calendar days after the Bid Opening Date.

Minority vendors are encouraged to compete for award of this solicitation.

SECTION 001100 WORCESTER COUNTY REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. Copy of the Worcester County Requirements is bound herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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SECTION I: INTRODUCTION

A. **PURPOSE**

1. The purpose of this Invitation for Bid Document is for Worcester County ("County") to contract for Worcester County Recreation Center HVAC Replacement in conformity with the requirements contained herein ("Bid Document(s)").

B. **CLARIFICATION OF TERMS**

1. Firms or individuals that submit a bid for award of a contract ("Contract") are referred to as vendors ("Vendors") in this document. The Vendor that is awarded the Contract is herein referred to as the ("Successful Vendor").

C. **QUESTIONS AND INQUIRES**

1. Questions must be addressed in writing to the Worcester County Procurement Officer at purchasing@worcestermd.gov.
2. The last date to submit questions for clarification will be as indicated in the WORCESTER COUNTY PROCUREMENT BID INVITATION.
3. Addenda are posted on the County website at https://www.co.worcester.md.us/ under County Info: Bid Board: at https://www.co.worcester.md.us/commissioners/bids at least five calendar days before bid opening.
4. It is the Vendor's responsibly to make sure all addenda are acknowledged in their bid. Failure to do so could result in the bid being disqualified.

D. **FILLING OUT BID DOCUMENTS**

1. Use only forms supplied by the County.
2. One unbound original and two bound copies of the bid form and any required attachments must be submitted in the solicitation and can be submitted in the same envelope unless otherwise instructed.
3. Bid Documents should be compiled as follows: (1) Cover letter, (2) Form of Bid, (3) References, (4) Exceptions Document and Signed addenda, if necessary (5) Individual Principal Document, (6) Vendor's Affidavit of Qualification to Bid, (7) Non-Collusion Affidavit, and (8) Subcontractor's Manufacturer's Listing Form
4. Where so indicated by the make-up of the Bid Documents, sums will be expressed in both words and figures, and in the case of a discrepancy between the two, the amount written in words will govern. In the event there is a discrepancy between the unit price and the extended totals, the unit prices will govern.
5. Any interlineation, alteration, or erasure will be initialed by the signer of the Bid Documents.
6. Each copy of the Bid Documents will be signed by the person(s) legally authorized to bind the Vendor to a contract, using the legal name of the signer. Bid Documents submitted by an agent will have a current Power of Attorney attached certifying the agent's authority to bind the Vendor.
7. Vendor will supply all information and submittals required by the Bid Documents to constitute a proper and responsible completed Bid Document package.
8. Any ambiguity in the Bid Documents as a result of omission, error, lack of clarity or non-compliance by the Vendor with specifications, instructions, and/or all conditions of bidding will be construed in the light most favorable to the County.

E. **SUBMISSION OF BID DOCUMENTS**

1. All copies of the Bid Documents and any other documents required to be submitted with the Bid Documents will be enclosed in a sealed envelope. The envelope will be addressed to the Worcester County Commissioners and will be identified with the project name: Worcester County Recreation Center HVAC Replacement and the Vendor's name and address. If the Bid Documents are sent by mail, the sealed envelope will be enclosed in a separate mailing envelope with the notation "SEALED BID DOCUMENTS ENCLOSED" on the face thereof.
2. Bids must be mailed or hand carried to the **Worcester County Administration Office, 1 West Market Street, Room 1103, Snow Hill, MD 21863**, in order to be received **prior** to the announced bid deadline. *Bids received after said time or delivered to the wrong location will be returned to the Vendor unopened.*
3. **Bids are due and will be opened at the time listed on the front of this Bid Document.**
4. If you are delivering a bid in person please keep in mind to allow time to get through security and into the Administration Office. It is fully the responsibility of the Vendor to ensure that the bid is received on time.
5. The County will not speculate as to reasonableness of the postmark, nor comment on the apparent failure of a public carrier to have made prompt delivery of the bid.
6. Vendors, or their authorized agents, are expected to fully inform themselves as to the conditions, requirements, and specifications before submitting Bid Documents; failure to do so will be at the Vendor's own risk.
7. A fully executed Affidavit of Qualification to Bid will be attached to each Bid Document.
8. Minority vendors are encouraged to participate.
9. All Vendor submitted Bid Documents will be valid for a minimum of sixty days from the date of Bid Document opening.
10. Electronically mailed bids are **not** considered sealed bids and will **not** be accepted.

F. **OPENING OF BIDS**

1. Bid Documents received on time will be opened publicly and Vendors' names and total costs will be read aloud for the record.
2. The Contract will be awarded or all Bid Documents will be rejected within sixty days from the date of the Bid Document opening.

G. **ACCEPTANCE OR REJECTION OF BIDS**

1. Unless otherwise specified, the Contract will be awarded to the most responsible and responsive Vendor complying with the provisions of the Bid Documents, provided the bid does not exceed the funds available, and it is in the best interest of the County to accept it. The County reserves the right to reject the Bid Documents of any Vendor who has previously failed to perform properly in any way or complete on time contracts of a similar nature; or a Bid Document from a Vendor who, investigation shows, is not in a position to perform the Contract; or Bid Documents from any person, firm, or corporation which is in arrears or in default to the County for any debt or contract.
2. Completed Bid Documents from Vendors debarred from doing business with the State of Maryland or the Federal Government will not be accepted.
3. In determining a Vendor's responsibility, the County may consider the following qualifications, in addition to price:

a. Ability, capacity, and skill to provide the commodities or services required within the specified time, including future maintenance and service, and including current financial statement or other evidence of pecuniary resources and necessary facilities.
b. Character, integrity, reputation, experience and efficiency.
c. Quality of past performance on previous or existing contracts, including a list of current and past contracts and other evidence of performance ability.
d. Previous and existing compliance with laws and ordinances relating to contracts with the County and to the Vendor's employment practices.
e. Evidence of adequate insurance to comply with Contract terms and conditions.
f. Statement of current workload and capacity to perform/provide the Goods and/or Services.
g. Explanation of methods to be used in fulfilling the Contract.
h. The Vendor, if requested, will be prepared to supply evidence of its qualifications, listed above, and its capacity to provide/perform the Goods and/or Services; such evidence to be supplied within a specified time and to the satisfaction of the County.

4. In determining a Vendor's responsiveness, the County will consider whether the Bid Document conforms in all material respects to the Bid Documents. The County reserves the right to waive any irregularities that may be in its best interest to do so.
5. The County will have the right to reject any and all Bid Documents, where applicable to accept in whole or in part, to add or delete quantities, to waive any informalities or irregularities in the Bid Document received, to reject a Bid Document not accompanied by required Bid security or other data required by the Bid Documents, and to accept or reject any Bid Document which deviates from specifications when in the best interest of the County. Irrespective of any of the foregoing, the County will have the right to award the Contract in its own best interests.

H. **QUALIFICATIONS**

1. The Vendor must be in compliance with the laws regarding conducting business in the State of Maryland.
   All Vendors shall provide a copy Certificate of Status from the Maryland Department of Assessments and Taxation, evidencing the Vendor is in good standing with the State of Maryland. See https://sdatcert1.resiusa.org/certificate_net/ for information on obtaining the Certificate of Status. *Certificates of status are not available for trade names, name reservations, government agencies, sole proprietorships, and some other accounts as these are not legal entities and thus are not required for these categories of Vendors*. For more information on the Certificate of Status please see http://www.dat.state.md.us/sdatweb/COSinfo.html .
2. Worcester County reserves the right, at its sole discretion, to extend the date this documentation must be provided. The Vendor's inability to provide this documentation could result in the bid being rejected.

I. **DESCRIPTIVE LITERATURE**

1. The proposed descriptive literature fully describing the product bid is what is intended to be included as the price. Failure to do so may be cause for rejection of the bid.
2. Any items, systems or devices supplied in this bid that are proprietary in nature relative to maintenance, repair, servicing or updating must be disclosed on the bid form.

J. **NOTICE TO VENDORS**

1. Before a Vendor submits the Bid Documents it will need to become fully informed as to the extent and character of the Goods and/or Services required and are expected to completely familiarize themselves with the requirements of this Bid Document's specifications. Failure to do so will not relieve the Vendor of the responsibility to fully perform in accordance therewith. No consideration will be granted for any alleged misunderstanding of the material to be furnished or the Services to be performed, it being understood that the submission of a Bid Document is an agreement with all of the items and conditions referred to herein.

K. **GENERAL REQUIREMENTS**

1. The successful vendor must be licensed to perform work in the state of Maryland.

L. **PAYMENT**

1. The county will make payment(s) to the Successful Vendor within thirty (30) calendar days from the receipt of a proper invoice for approved and accepted work performed.

M. **QUESTIONS**

The last day for questions is listed under Section I, Subsection C.2.

N. **AWARD**

1. The county intends to award to the lowest responsive and responsible vendor meeting the specifications.

O. **PIGGYBACKING**

1. Worcester County may authorize, upon request, any governmental entity (hereafter Authorized User) within the County to purchase items under the contract awarded pursuant to this bid solicitation.
2. All purchase orders issued against the contract by an authorized User shall be honored by the Successful Vendor in accordance with all terms and conditions of this contract.
3. The issuance of a purchase order by an Authorized User pursuant to this provision shall constitute an express assumption of all contractual obligations, covenants, conditions and terms of the contract. A breach of the contract by any particular Authorized User shall neither constitute nor be deemed a breach of the contract as a whole which shall remain in full force and effect, and shall not affect the validity of the contract nor the obligations of the Successful Vendor thereunder respecting the County.
4. The County specifically and expressly disclaims any and all liability for any breach by an Authorized User other than the County and each such Authorized User and Successful Vendor guarantee to save the County, its officers, agents and employees harmless from any liability that may be or is imposed by the Authorized User's failure to perform in accordance with its obligations under the contract.

END OF SECTION

SECTION II: GENERAL INFORMATION

A. **ECONOMY OF BID**

1. Bid Documents will be prepared simply and economically, providing straightforward and concise description of the Vendor's capabilities to satisfy the requirements of the Bid Documents. Emphasis should be on completeness and clarity of content. Elaborate brochures and other representations beyond that sufficient to present a complete and effective Bid Document are neither required nor desired.

B. **PUBLIC INFORMATION ACT (PIA)**

1. Worcester County is subject to the Maryland Public Information Act and may be required to release bid submissions in accordance with the Act.
2. Any materials the Vendor deems to be proprietary or copyrighted must be marked as such; however, the material may still be subject to analysis under the Maryland Public Information Act.
    a. The Vendor may invoke proprietary information or trade secret protection for submission of any data/material by (1) identifying the data/material in a written description, (2) clearly marking the data/material as proprietary, and (3) providing a written statement detailing the reasons why protection is necessary. The County reserves the right to ask for additional clarification prior to establishing protection.

C. **CONTRACT AWARD**

1. A written award by the County to the Successful Vendor in the form of a Purchase Order or other contract document will result in a binding Contract without further action by either party. If the Successful Vendor fails or refuses to sign and deliver the Contract and the required insurance documentation, the County will have the right to award to the next responsible and responsive Vendor. Contract will be executed by the Successful Vendor within fourteen calendar days of receipt of the Contract.
2. Bid Documents and Contracts issued by the County will bind the Vendor to applicable conditions and requirements herein set forth, unless otherwise specified in the Bid Documents, and are subject to all federal, state, and municipal laws, rules, regulations, and limitations.
3. County personal property taxes ("Taxes") must be on a current basis; if any such Taxes are delinquent, they must be paid before award of Contract. Failure to pay will result in the award of Contract to another Vendor.
4. The County reserves the right to engage in individual discussions and interviews with those Vendors deemed fully qualified, responsible, suitable and professionally competent to provide the required Goods and/or Services should the project size warrant it. Vendors will be encouraged to elaborate on their qualifications, performance data, and staff expertise.

D. **AUDIT**

1. The Successful Vendor agrees to retain all books, records, and other documents relative to the awarded Contract for five years after final payment, or until audited. The County, its authorized agents, and/or State auditors will have full access to and the right to examine any of said materials during said period.

E. **NONPERFORMANCE**

1. The County reserves the right to inspect all operations and to withhold payment for any goods not performed or not performed in accordance with the specifications in this Bid Document. Errors, omissions or mistakes in performance will be corrected at no cost to the County. Failure to do so

will be cause for withholding of payment for that Goods and/or Services. In addition, if deficiencies are not corrected in a timely manner, the County may characterize the Successful Vendor as uncooperative, which may jeopardize future project order solicitations.

F. **MODIFICATION OR WITHDRAWL OF BID**

1. A Bid Document may not be modified, withdrawn, or cancelled by the Vendor during the stipulated time period following the time and date designated for the receipt of Bid Documents, and each Vendor so agrees in submitting Bid Documents.

G. **DEFAULT**

1. The Contract may be cancelled or annulled by the County in whole or in part by written notice of default to the Successful Vendor upon non-performance, violation of Contract terms, delivery failure, bankruptcy or insolvency, any violation of state or local laws, or the making of an assignment for the benefit of creditors. An award may then be made to the next most highly rated Vendor, or when time is of the essence, similar commodities and/or service may be purchased on the open market. In either event, the defaulting Vendor (or his surety) will be liable to the County for cost to the County in excess of the defaulted Contract price.
2. If a representative or warranty of either Party to the Contract is false or misleading in any material respect, or if either Party breaches a material provision of the Contract ("Cause"), the non-breaching Party will give the other Party written notice of such cause. If such Cause is not remedied within fifteen calendar days ("Cure Period") after receipt of such notice, (unless, with respect to those Causes which cannot be reasonably corrected or remedied within the Cure Period, the breaching Party will have commenced to correct or remedy the same within such Cure Period and thereafter will proceed with all due diligence to correct or remedy the same), the Party giving notice will have the right to terminate this Contract upon the expiration of the Cure Period.

H. **COLLUSION/FINANCIAL BENEFIT**

1. The Vendor certifies that his/her Bid is made without any previous understanding, agreement, or connection with any person, firm, or corporation making a Bid Document for the same project; without prior knowledge of competitive prices; and is in all respects fair, without outside control, collusion, fraud, or otherwise illegal action.
2. Upon signing the Bid Document, Vendor certifies that no member of the governing body of the County, or members of his/her immediate family, including spouse, parents or children, or any other officer or employee of the County, or any member or employee of a Commission, Board, or Corporation controlled or appointed by the County Commissioners has received or has been promised, directly or indirectly, any financial benefit, related to this Bid Document and subsequent Contract.

I. **TAX EXEMPTION**

1. In buying products directly from a Vendor, Worcester County is exempt from being *directly* charged Federal excise and Maryland sales tax. A copy of an exemption certificate shall be furnished upon request.
2. According to the Office of the Comptroller of Maryland, a *Contractor is responsible for paying sales tax* on his/her purchases relating to any projects or services and should incorporate it into their bid.
3. Successful Vendors **cannot** use the County tax exemption to buy materials or products used on County projects.

J. **CONTRACT CHANGES**

1. No claims may be made by anyone that the scope of the project or that the Vendor's Goods and/or Services have been changed (requiring changes to the amount of compensation to the Vendor or other adjustments to the Contract) unless such changes or adjustments have been made by an approved written amendment (Change Order) to the Contract signed by the Chief Administrative Officer (and the County Commissioners, if required), prior to additional Goods and/or Services being initiated. Extra Goods and/or Services performed without prior, approved, written authority will be considered as unauthorized and at the expense of the Vendor. Payment will not be made by the County.
2. No oral conversations, agreements, discussions, or suggestions, which involve changes to the scope of the Contract, made by anyone including any County employee, will be honored or valid. No written agreements or changes to the scope of the Contract made by anyone other than the Procurement Officer (with the Chief Administrative Officer and/or County Commissioners approval, if required) will be honored or valid.
3. If any Change Order in the Goods and/or Services results in a reduction in the Goods and/or Services, the Vendor will neither have, nor assert any claim for, nor be entitled to any additional compensation for damages or for loss of anticipated profits on Goods and/or Services that are eliminated.

K. **ADDENDUM**

1. No oral statements of any person will modify or otherwise affect or interpret the meaning of the Contract specifications, or the terms, conditions, or other portions of the Contract. All modifications and every request for any interpretation must be addressed to Worcester County's Procurement Officer and to be given consideration, must be received no later than the last day for questions listed in prior Section I, Subsection C.2.
2. Any and all interpretations, corrections, revisions, and amendments will be issued by the Procurement Officer to all holders of Bid Documents in the form of written addenda. Vendors are cautioned that any oral statements made by any County employee that materially change any portion of the Bid Documents cannot be relied upon unless subsequently ratified by a formal written amendment to the Bid Document.
3. All addenda will be issued so as to be received at least five days prior to the time set for receipt of Bid Documents, and will become part of the Contract and will be acknowledged in the Bid Document form. Failure of any Vendor to receive any such addenda will not relieve said Vendor from any obligation under the Bid Document as submitted.
4. Vendors are cautioned to refrain from including in their Bid Document any substitutions which are not confirmed by written addenda. To find out whether the County intends to issue an amendment reflecting an oral statement made by any employee, contact Worcester County's Procurement Officer during normal business hours.
5. The Worcester County Procurement Officer reserves the right to postpone the Bid Document opening for any major changes occurring in the five-day interim which would otherwise necessitate an Addendum.

L. **EXCEPTIONS/ SUBSTITUTIONS**

1. Any exceptions to the specifications requested should be marked on the bid form and listed on a separate sheet of paper attached to the bid.
2. An exception to the specifications may disqualify the bid. The County will determine if the exception is an essential deviation or a minor item.

3. In the case of a minor deviation, the County maintains the option to award to that Vendor if it determines the performance is not adversely affected by the exception.

M. **APPROVED EQUALS**

1. In all specifications where a material or article is defined by describing a proprietary product or by using the name of a Vendor or manufacturer, substitutions will only be allowed when addressed in a bid addendum prior to bid opening.
2. The use of a named product is an attempt to set a particular standard of quality and type that is familiar to the County. Such references are not intended to be restrictive.
3. However, the County shall decide if a product does in fact meet or exceed the quality of the specifications listed in the solicitation. It shall be the responsibility of the Vendor that claims his product is an equal to provide documentation to support such a claim.

N. **DELIVERY**

1. All items shall be delivered F.O.B. destination and delivery costs and charges included in the bid unless otherwise stated in the specifications or bid form.

O. **INSURANCE**

1. If required by the General Conditions or Terms and Conditions, the Successful Vendor shall provide the County with Certificates of Insurance within ten calendar days of bid award notification evidencing the required coverage.
2. Successful Vendor must provide Certificates of Insurance before commencing work in connection with the Contract.

P. **BID EVALUATION**

1. Bid tabulations will be posted on the County website at https://www.co.worcester.md.us/commissioners/bids. Click on the Expired Bids & Results tab and find the bid tabulation for the bid you are interested in. Bid tabulations will be posted as soon as reasonably possible after the Bid opening.

END OF SECTION

SECTION III: GENERAL CONDITIONS

A. **DRAWINGS AND SPECIFICATIONS**

1. Should any detail be omitted from the drawings or specifications, or should any errors appear in either, it shall be the duty of the Successful Vendor to notify the County's designated construction inspector.
2. In no case shall the Successful Vendor proceed with the work without notifying and receiving definite instructions from the County. Work wrongly constructed without such notification shall be corrected by the Successful Vendor at his own cost.

B. **MATERIALS, SERVICES AND FACILITIES**

1. It is understood that, except as otherwise specifically stated in the Bid Documents, the Successful Vendor will provide and pay for all materials, labor, tools, equipment, water, light, power and transportation, supervision, temporary construction of any nature, and all other services and

facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.

2. Materials and equipment will be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work will be located so as to facilitate prompt inspection.
3. Manufactured articles, materials, and equipment will be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.
4. Materials, supplies and equipment will be in accordance with samples submitted by the Successful Vendor and approved by the County.

C. **INSPECTION AND TESTING**

1. All materials and equipment used in the construction of the Work will be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Bid Documents.
2. The County or its representatives may, at any time, enter upon the work and the premises used by the Successful Vendor, and the Successful Vendor shall provide proper and safe facilities to secure convenient access to all parts of the work, and all other facilities necessary for inspection, as may be required.
3. The County will appoint such persons as deemed necessary to properly inspect the materials furnished or to be furnished, and the work done under the contract and to see that the same strictly corresponds with the drawings and specifications. All such materials and workmanship shall be subject to approval of the County. Approval or acceptance of payment shall not be misconstrued as approval of items or work not in conformance with specifications and drawings nor shall it prevent the rejection of said work or materials at any time thereafter during the existence of the contract, should said work or materials be found to be defective, or not in accordance with the requirements of the contract.
4. Work and material will be inspected promptly, but if for any reason should a delay occur, the Successful Vendor shall have no claim for damages or extra compensation.
5. The Successful Vendor shall pay for all inspection costs necessary to complete the work which may be incurred to comply with the requirements of any agency other than the County, such as a railroad, public service utility company, or any other governmental agency or any other agency whose jurisdiction affects the work in any manner unless otherwise specified herein.

D. **APPROVAL OF SUBSTITUTION OF MATERIALS**

1. Samples of materials shall be submitted by the Successful Vendor for approval before such materials are ordered from the manufacturers or distributors and shall be approved by the County before actual work is begun.
2. It is the intention of these specifications to permit all vendors bidding on this work to secure the fullest amount of competition on the various materials and specialties names herein. Wherever a material or article is defined by describing a proprietary product or by using the name of a vendor or manufacturer, the term or approved equal shall be presumed to be implied unless otherwise stated.

E. **PROTECTION OF WORK, PROPERTY AND PERSONS**

1. Successful Vendor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Successful Vendor will take all necessary precautions and programs in connection with the Work. Successful Vendor will take

all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to, all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

2. Successful Vendor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. Successful Vendor will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. Successful Vendor will notify owners of adjacent utilities when progress of the Work may affect them. The Successful Vendor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by Successful Vendor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable.
3. In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Successful Vendor, without special instruction or authorization from the County, will act to prevent threatened damage, injury or loss. Successful Vendor will give the County prompt Written Notice of any significant changes in the Work or deviations from the Bid Documents caused thereby, and a Change Order will thereupon be issued covering the changes and deviations involved.

F. **BARRICADES, DANGER, WARNING AND DETOUR SIGNS**

1. The Successful Vendor shall provide, erect and maintain all necessary barricades, sufficient red lights, flares, danger signals and signs, provide a sufficient number of watchmen and take all necessary precautions for the protection of the work and safety of the public.

G. **LICENSES AND PERMITS**

1. The Successful Vendor shall have all necessary licenses required to do the work and give all notices and obtain and pay all necessary permits required by local laws and regulations for building.
2. State and Federal permits (if applicable) to undertake work have been obtained by the County and accompany these specifications.

H. **SUPERVISION**

1. The Successful Vendor shall maintain, at all times during the progress of work, a competent and experienced supervisor who shall represent the Successful Vendor, and all directions given to him shall be binding. Important decisions regarding directions, if requested by the supervisor, shall be confirmed in writing.
2. Supervision by the County or its representative does not relieve the Successful Vendor of responsibility for defective work executed under the direct control of the Successful Vendor. Responsibility for defective work rests upon the Successful Vendor, whether discovered by the County prior to final payment or subsequent thereto.

I. **CLEAN UP**

1. Upon completion of the items within a given location as specified and before monthly estimates will be paid, the construction area and all other areas occupied by the Successful Vendor during the construction of said Contract shall be cleaned of all surplus and discarded materials, bracing, forms, rubbish and temporary structures that were placed there by the Successful Vendor.
2. Disposal of the aforementioned shall be the responsibility of the Successful Vendor.

J. **CHANGES IN WORK**

1. The County, without invalidating the contract, may order extra work or make changes by altering, adding or deducting from the work with the contract sum being adjusted accordingly.
2. All such work shall be executed under the conditions of the original contract, except that any claim for the extension of time caused thereby shall be adjusted at the time of ordering such change.
3. The value of any such extra work or change shall be determined in one or more of the following ways:
    a. By estimate and acceptance of lump sum.
    b. By unit prices named in the contract or subsequently agreed upon.

K. **TIME FOR COMPLETION**

1. The Work contemplated under this Contract shall be considered as continuous and be substantially completed within two hundred ten (210) calendar days after notice to proceed is issued by the owner or owner's designated representative. Final completion shall be thirty (30) calendar days thereafter.
2. The Successful Vendor will be allowed to work eight hours per day, Monday through Friday, except for holidays, fifty-two weeks per year.
3. The Successful Vendor will not be permitted to work on holidays observed by Worcester County or the State of Maryland or on Sundays unless otherwise authorized in writing.
4. In case of an emergency which may require that work be done on Saturdays, Sundays, and Holidays, the Successful Vendor shall request permission of the County to do so. If, in the opinion of the County, the emergency is Bonafide, permission may be granted to the Successful Vendor to work such hours as may be determined are necessary by the County. Also, if in the opinion of the County a Bonafide emergency exists, the Successful Vendor may be directed to work such hours as may be necessary whether or not the Successful Vendor requests permission to do so.
5. The Successful Vendor shall pay the County for all costs incurred for inspection services required for work permitted during holidays, weekends or in excess of eight hours per day.
6. The areas served by the replacement units shall be available to the Contractor for demolition and new work from September 8, 2026 to November 6, 2026.

L. **LIQUIDATED DAMAGES**

1. If the Successful Vendor shall fail to start and complete the project within the time frame stated above, the County shall assess liquidated damages in the amounts listed below per calendar day for each and every day the Successful Vendor fails to complete the contract.

Amount of Contract	Liquidated Damages per Day
Less than $10,000	$100.00
$10,000 or less than $100,000	$250.00
$100,000 or less than $500,000	$750.00
$500,000 or more	$1,000.00

Or will be based on actual cost to the County, whichever is greater.

2. The designated County project manager reserves the option to extend the scheduled completion date or waive the liquidated damages clause in its entirety if he is of the opinion that extenuating circumstances deemed such action appropriate.

M. **CORRECTION OF WORK**

1. The Successful Vendor will promptly remove from the premises all Work rejected by the County for failure to comply with the Bid Documents, whether incorporated in the construction or not, and the Successful Vendor will promptly replace and re-execute the Work in accordance with the Bid Documents and without expense to the County and will bear the expense of making good all Work of other Vendors destroyed or damaged by such removal or replacement.
2. All removal and replacement Work will be done at the Successful Vendor's expense. If the Successful Vendor does not act to remove such rejected Work within ten days after receipt of Written Notice, the County may remove such Work and store the materials at the expense of the Successful Vendor.

N. **CONSTRUCTION SAFETY AND HEALTH STANDARDS**

1. It is a condition of this contract, and shall be made a condition of each sub-contract entered into pursuant to this contract, that the Successful Vendor and any sub-contractor shall not require any laborer or mechanic employed in performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety, as determined under construction safety and health standards (Title 29, Code of Federal Regulations, Part 1926, formerly Part 1518, as revised from time to time, promulgated by the United States Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standard Act.) (83 Stat. 96).
2. Failure of Worcester County to inform the Successful Vendor of safety violations will not release the Successful Vendor of his responsibilities.

O. **BID BOND (As directed by Owner)**

1. Bid Documents must be accompanied by a Bid Bond if the Vendor's total Bid amount exceeds $100,000, payable to the County for five percent of the total amount of the bid. After the analysis of the Bid Documents the County will return Bid Bonds to all Vendors except the three lowest Responsive and Responsible Vendors. After execution of the Contract, and receipt, execution, and approval of the Successful Vendor's Payment and Performance bond, the Bid Bonds will be returned. A certified check may be used in lieu of a Bid Bond.
2. The County, at its discretion, may consider a Vendor in default if the Vendor fails to execute the Contract, in which the County will retain said Bid Bond.

P. **PERFORMANCE AND PAYMENT BONDS**

1. The Successful Vendor will be required to provide the County with a Performance Bond and Payment Bond if the total Contract amount exceeds $100,000, each in the amount of one hundred percent of the Contract Price, with a corporate surety approved by the County for the faithful performance of the Contract.
2. The Successful Vendor will within fourteen calendar days after the receipt of the Contract furnish the County with a Performance Bond and Payment Bond in penal sums equal to the amount of the Contract Price, conditioned upon the performance by the Successful Vendor of all undertakings, covenants, terms, conditions and agreements of the Bid Documents, and upon the prompt payment by the Successful Vendor to all persons supplying labor and materials in the prosecution of the Work provided by the Bid Document. Such Bonds will be executed by the Successful

Vendor and corporate bonding company licensed to transact such business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Circular Number 570. The expense of these Bonds will be borne by the Successful Vendor. If at any time a surety on any such Bond is declared bankrupt or loses its right to do business in the State of Maryland or is removed from the list of surety companies accepted on federal bonds, Successful Vendor will within ten calendar days after notice from the County to do so, substitute an acceptable Bond(s) in such form and sum and signed by such other surety or sureties as may be satisfactory to the County.

Q. **GUARANTEE**

1. The Successful Vendor shall furnish the County with a one-year guarantee of workmanship and materials, dating from time of acceptance of the project and shall make good any defects which may occur during that period.
2. If any special guarantees in excess of the one-year period are specified by the manufacturer, these guarantees shall take precedence over the one-year period guarantee.
3. Upon completion of work, and before final payment or release of retainage, the Successful Vendor shall submit, and obtain from each subcontractor, material supplier and equipment manufacture general warranties and a notarized asbestos free guarantee.

END OF SECTION

END OF SECTION

THIS AND PREVIOUS SECTIONS, OTHER THAN THE COVER PAGE, DO NOT NEED TO BE RETURNED WITH SUBMITTAL

REFERENCES

List three references for which the Vendor has provided Goods/Services similar to those requested in the Bid Document within the last 12-36 months. Include contact name, address, telephone number, email address and services provided.

Company Name:		Company Name:	
Type of Project:		Type of Project:	
Address:		Address:	
Town, State, Zip Code:		Town, State, Zip Code:	
Contact Person:		Contact Person:	
Telephone Number:		Telephone Number:	
Email:		Email:	
Date of Service:		Date of Service:	
Company Name:			
Type of Project:			
Address:			
Town, State, Zip Code:			
Contact Person:			
Telephone Number:			
Email:			
Date of Service:			

Sign for Identification Printed Name

EXCEPTIONS

The undersigned hereby certifies that, except as listed below, or on separate sheets attached hereto, the enclosed Completed Bid Document covers all items as specified.

EXCEPTIONS:

(If none, write none) _____

How did you hear about this solicitation?

Worcester County's Website

eMaryland Marketplace Advantage (eMMA)

Newspaper Advertisement

Direct email

Other _____

The vendor hereby acknowledges receipt of the following addenda.

Number	**Date**	**Initials**
_____	_____	_____
_____	_____	_____
_____	_____	_____

_____ _____

Sign for Identification Printed Name

INDIVIDUAL PRINCIPAL

Vendor Name: _____

Signed By: _____ In the presence of: _____

Address of Vendor: _____ Town, State, Zip _____

Telephone No.: _____ Fax: _____ Email: _____

****

CO-PARTNERSHIP PRINCIPAL

Name of Co-Partnership: _____

Address: _____ Town, State, Zip

_____

Telephone No.: _____ Fax: _____

Signed By: _____ In the presence of: _____
Partner Witness

Signed By: _____ In the presence of: _____
Partner Witness

Signed By: _____ In the presence of: _____
Partner Witness

****

CORPORATE PRINCIPAL

Name of Corporation: _____

Address: _____ Town, State, Zip

_____

Telephone No.: _____ Fax:

_____

Signed By: _____ In the presence of: _____
President Witness

Attest: _____
Corporate Secretary

Affix Corporate Seal

VENDOR'S AFFIDAVIT OF QUALIFICATION TO BID

I HEREBY AFFIRM THAT:

I, _____ am the _____
(Printed Name) (title)
and the duly authorized representative of the Vendor of
_____ whose address is
(name of corporation)
_____
_____
and that I possess the legal authority to make this affidavit on behalf of myself and the Vendor for which I am acting.

Except as described in paragraph 3 below, neither I nor the above Vendor, nor to the best of my knowledge and of its officers, directors or partners, or any of its employees directly involved in obtaining contracts with the State or any county, bi-county or multi-county agency, or subdivision of the State have been convicted of, or have pleaded nolo-contendere to a charge of, or have during the course of an official investigation or other proceeding admitted in writing or under oath acts or omissions which constitute, bribery, attempted bribery, or conspiracy to bribe under the provisions of Article 27 of the Annotated Code of Maryland or under the laws of any state or federal government (conduct prior to July 1, 1977 is not required to be reported).

(State "none" or, as appropriate, list any conviction, plea or admission described in paragraph 2 above, with the date, court, official or administrative body, the individuals involved and their position with the Vendor, and the sentence or disposition, if any.)

_____
_____
_____

I acknowledge that this affidavit is to be furnished to the County, I acknowledge that, if the representations set forth in this affidavit are not true and correct, the County may terminate any Contract awarded and take any other appropriate action. I further acknowledge that I am executing this affidavit in compliance with section 16D of Article 78A of the Annotated Code of Maryland, which provides that certain persons who have been convicted of or have admitted to bribery, attempted bribery or conspiracy to bribe may be disqualified, either by operation of law or after a hearing, from entering into contracts with the State or any of its agencies or subdivisions.

I do solemnly declare and affirm under the penalties of perjury that the contents of this affidavit are true and correct.

_____ _____
Sign for Identification Printed Name

NON-COLLUSION AFFIDAVIT

_____being first duly sworn, deposes and says that:

1. He/she is the _____, (Owner, Partner, Officer, Representative or Agent) of _____, the Vendor that has submitted the attached Bid Documents;
2. He/she is fully informed respecting the preparation and contents of the attached Bid Document and of all pertinent circumstances respecting such Bid Documents;
3. Such Bid Document is genuine and is not a collusive or sham Bid Document;
4. Neither the said Vendor nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, have in any way colluded, conspired, connived or agreed, directly or indirectly, with any other Vendor, firm, or person to submit a collusive or sham Bid Document in connection with the Work for which the attached Bid Document has been submitted; or to refrain from bidding in connection with such Work; or have in any manner, directly or indirectly, sought by agreement or collusion, or communication, or conference with any Vendor, firm, or person to fix the price or prices in the attached Bid Document or of any other Vendor, or to fix any overhead, profit, or cost elements on the Bid Document price or the Bid Document price of any other Vendor, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any disadvantage against (Recipient), or any person interested in the Work;
5. The price or prices quoted in the attached Bid Document are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the Vendor or any other of its agents, representatives, owners, employees or parties in interest, including this affiant.

Signed, sealed and delivered in the presence of:

_____ By: _____
Witness Signature

_____ _____
Witness Printed Name

_____
Title

EXHIBIT A

WORCESTER COUNTY MARYLAND
STANDARD TERMS AND CONDITIONS

The provisions below are applicable to all Worcester County ("County") contracts. These provisions are not a complete agreement. These provisions must be attached to an executed document that identifies the work to be performed, compensation, term, incorporated attachments, and any special conditions ("Contract"). If the Standard Terms and any other part of the Contract conflict, then the Standard Terms will prevail.

1. **Amendment**. Amendments to the Contract must be in writing and signed by the parties.
2. **Bankruptcy**. If a bankruptcy proceeding by or against the Contractor is filed, then:
    a. The Contractor must notify the County immediately; and
    b. The County may cancel the Contract or affirm the Contract and hold the Contractor responsible for damages.
3. **Compliance with Law.** Contractor must comply with all applicable federal, state, and local law. Contractor is qualified to do business in the State of Maryland. Contractor must obtain, at its expense, all licenses, permits, insurance, and governmental approvals needed to perform its obligations under the Contract.
4. **Contingent Fee Prohibition**. The Contractor has not directed anyone, other than its employee or agent, to solicit the Contract and it has not promised to pay anyone a commission, percentage, brokerage fee, contingent fee, or other consideration contingent on the making of the Contract.
5. **Counterparts and Signature**. The Contract may be executed in several counterparts, each of which may be an original and all of which will be the same instrument. The Contract may be signed in writing or by electronic signature, including by email. An electronic signature, a facsimile copy, or computer image of the Contract will have the same effect as an original signed copy.
6. **Exclusive Jurisdiction.** All legal proceedings related to this Contract must be exclusively filed, tried, and maintained in either the District Court of Maryland for Worcester County, Maryland or the Circuit Court of Worcester County, Maryland. The parties expressly waive any right to remove the matter to any other state or federal venue and waive any right to a jury trial.
7. **Force Majeure**. The parties are not responsible for delay or default caused by fire, riot, acts of God, County-declaration-of-emergency, or war beyond their reasonable control. The parties must make all reasonable efforts to eliminate a cause of delay or default and must, upon cessation, diligently pursue their obligations under the Contract.
8. **Governing Law**. The Contract is governed by the laws of Maryland and the County.
9. **Indemnification**. The Contractor must indemnify the County and its agents from all liability, penalties, costs, damages, or claims (including attorney's fees) resulting from personal injury, death, or damage to property that arises from or is connected to the performance of the work or failure to perform its obligations under the Contract. All indemnification provisions will survive the expiration or termination of the Contract.

10. **Independent Contractor**.

    a. Contractor is an "Independent Contractor", not an employee. Although the County may determine the delivery schedule for the work and evaluate the quality of the work, the County will not control the means or manner of the Contractor's performance.

    b. Contractor is responsible for all applicable taxes on any compensation paid under the Contract. Contractor is not eligible for any federal Social Security, unemployment insurance, or workers' compensation benefits under the Contract.

    c. Contractor must immediately provide the County notice of any claim made against Contractor by any third party.

11. **Insurance Requirements**.

    a. Contractor must have Commercial General Liability Insurance in the amounts listed below. The insurance must include coverage for personal injury, discrimination, and civil rights violation claims. All insurance must name County, its employees, and agents as "ADDITIONAL INSURED". A copy of the certificate of insurance must be filed with the County before the Contract is executed, providing coverage in the amount of $1,000,000 per occurrence, $2,000,000 general aggregate, and $500,000 for property damage.

    b. Contractor must have automobile insurance on all vehicles used in the Contract to protect Contractor against claims for damages resulting from bodily injury, including wrongful death, and property damage that may arise from the operations in connection with the Contract. All insurance must name County, its employees, and agents as "ADDITIONAL INSURED".

    c. Contractor must provide the County with a certification of Workers' Compensation Insurance, with employer's liability in the minimum amount required by Maryland law in effect for each year of the Contract.

    d. All insurance policies must have a minimum 30 days' notice of cancellation. The County must be notified immediately upon cancellation.

    e. When insurance coverage is renewed, Contractor must provide new certificates of insurance prior to expiration of current policies.

12. **Nondiscrimination**. Contractor must not discriminate against any worker, employee, or applicant because of religion, race, sex, age, sexual orientation, physical or mental disability, or perceived disability. This provision must be incorporated in all subcontracts related to the Contract.

13. **Ownership of Documents; Intellectual Property**.

    a. All documents prepared under the Contract must be available to the County upon request and will become the exclusive property of the County upon termination or completion of the services. The County may use the documents without restriction or without additional compensation to the Contractor. The County will be the owner of the documents for the purposes of copyright, patent, or trademark registration.

    b. If the Contractor obtains, uses, or subcontracts for any intellectual property, then it must provide an assignment to the County of ownership or use of the property.

    c. The Contractor must indemnify the County from all claims of infringement related to

the use of any patented design, device, materials, or process, or any trademark or copyright, and must indemnify the County, its officers, agents, and employees with respect to any claim, action, costs, or infringement, for royalties or user fees, arising out of purchase or use of materials, construction, supplies, equipment, or services covered by the Contract.

14. **Payments**. Payments to the Contractor under the Contract will be within 30 days of the County's receipt of a proper invoice from the Contractor. If an invoice remains unpaid 45 days after the invoice was received, interest will accrue at 6% per year.

15. **Records**. Contractor must maintain fiscal records relating to the Contract in accordance with generally accepted accounting principles. All other relevant records must be retained by Contractor and kept accessible for at least three years after final payment, termination of the Contract, or until the conclusion of any audit, controversy, or litigation related to the Contract. All subcontracts must comply with these provisions. County may access all records of the Contractor related to the Contract.

16. **Remedies**.

    a. **Corrections of errors and omissions**. Contractor must perform work necessary to correct errors and omissions in the services required under the Contract, without undue delays and cost to the County. The County's acceptance will not relieve the Contractor of the responsibility of subsequent corrections of errors.

    b. **Set-off**. The County may deduct from any amounts payable to the Contractor any back-charges, penalties, or damages sustained by the County, its agents, or employees caused by Contractor's breach. Contractor will not be relieved of liability for any costs caused by a failure to satisfactorily perform the services.

    c. **Cumulative**. These remedies are cumulative and without waiver of any others.

17. **Responsibility of Contractor**.

    a. The Contractor must perform the services with the standard of care, skill, and diligence normally provided by a Contractor in the performance of services similar the services.

    b. Notwithstanding any review, approval, acceptance, or payment for the services by the County, the Contractor will be responsible for the accuracy of any work, design, drawings, specifications, and materials furnished by the Contractor under the Contract.

    c. If the Contractor fails to conform with subparagraph (a) above, then it must, if required by the County, perform at its own expense any service necessary for the correction of any deficiencies or damages resulting from the Contractor's failure. This obligation is in addition to any other remedy available to the County.

18. **Severability/Waiver**. If a court finds any term of the Contract to be invalid, the validity of the remaining terms will not be affected. The failure of either party to enforce any term of the Contract is not a waiver by that party.

19. **Subcontracting or Assignment**. The Contractor may not subcontract or assign any part of the Contract without the prior written consent of the County. The County may withhold consent for any reason the County deems appropriate.

20. **Termination**. If the Contractor violates any provision of the Contract, the County may terminate the Contract by written notice. All finished or unfinished work provided by the Contractor will, at the County's option, become the County's property. The County will pay the Contractor fair compensation for satisfactory performance that occurred before termination less the amount of damages caused by the Contractor's breach. If the damages are more than the compensation payable to the Contractor, the Contractor will remain liable after termination and the County can affirmatively collect damages.
21. **Termination of Contract for Convenience**. Upon written notice, the County may terminate the Contract when the County determines termination is in the County's best interest. Termination for convenience is effective on the date specified in the County's written notice. The County will pay for reasonable costs allocable to the Contract for costs incurred by the Contractor up to the date of termination. But the Contractor will not be reimbursed for any anticipatory profits that have not been earned before termination.
22. **Termination of Multi-year Contract**. If funds are not available for any fiscal period of the Contract after the first fiscal period, then the Contract will be terminated automatically as of the beginning of unfunded fiscal period. Termination will discharge the Contractor and the County from future performance of the Contract, but not from their rights and obligations existing at the time of termination.
23. **Third Party Beneficiaries**. The County and Contractor are the only parties to the Contract and are the only parties entitled to enforce its terms. Nothing in the Contract gives any benefit or right to third persons unless individually identified by name and expressly described as intended beneficiaries of the Contract.
24. **Use of County Facilities**. Contractor may only County facilities that are needed to perform the Contract. County has no responsibility for the loss or damage to Contractor's personal property which may be stored on County property.
25. **Whole Contract**. The Contract, the Standard Terms, and attachments are the complete agreement between the parties and supersede all earlier agreements, proposals, or other communications between the parties relating to the subject matter of the Contract.

SECTION 002000: INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.1 DESCRIPTION

A. The Instructions to Bidders, AIA Document A701, 1997 edition, as modified.

B. Copy of AIA Document A701 - 1997 editions bound herein.

C. Supplementary Instructions to Bidders as attached in Section 002100.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

1997 Edition -Electronic Format

AIA Document A701 - 1997

Instructions to Bidders

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ARTICLE 1 DEFINITIONS

1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted

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INSTRUCTIONS TO BIDDERS

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from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

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ARTICLE 2 BIDDER'S REPRESENTATIONS

2.1 The Bidder by making a Bid represents that:

2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

2.1.2 The Bid is made in compliance with the Bidding Documents.

2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

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3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

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3.3 SUBSTITUTIONS

3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

3.4 ADDENDA

3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

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INSTRUCTIONS TO BIDDERS

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'LE 4 BIDDING PROCEDURES

) PREPARATION OF BIDS

4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

' 2 BID SECURITY

1 Each Bid shall be accompanied by a bid security in the form and amount required if stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Paragraph 6.2.

4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

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

4.3 SUBMISSION OF BIDS

4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the

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Bidder's name and address and, if applicable, the designated portion of the Work for which Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

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4.4 MODIFICATION OR WITHDRAWAL OF BID

4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

5.2 REJECTION OF BIDS

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

5.3 ACCEPTANCE OF BID (AWARD)

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

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

ARTICLE 6 POST-BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

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6.3 SUBMITTALS

6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

7.1 BOND REQUIREMENTS

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7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the ithful performance of the Contract and payment of all obligations arising thereunder. Bonds be secured through the Bidder's usual sources.

7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

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7.2 TIME OF DELIVERY AND FORM OF BONDS

7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Subparagraph 7.2.1.

7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

7.2.3 The bonds shall be dated on or after the date of the Contract.

7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

E 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ss otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

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SECTION 002100: SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.1 DESCRIPTION

A. The Supplementary Instructions to Bidders is bound herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

SECTION 002100: SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following supplements modify "Instructions to Bidders", AIA Document A701, 1997 Edition. Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, the unaltered portions of the Instructions to Bidders shall remain in effect.

ARTICLE 1 - DEFINITIONS

Add the following:

1.10 Whenever the word "Architect" shall appear on standard printed documents published by the American Institute of Architects (AIA), it shall mean "Engineer" and shall refer to Gipe Associates, Inc. or its appointed staff or sub-consultant.

1.11 Wherever the word "Owner" shall appear on standard printed document published by the American Institute of Architects (AIA), it shall mean the Worcester County Commissioners.

ARTICLE 3 - BIDDING DOCUMENTS

3.1 - COPIES

Delete present 3.1.1. and insert new as follows:

3.1.1. "Bidders may obtain complete sets of the bidding documents as designated in the Worcester County Procurement Bid Invitation".

Add the following:

3.1.5 Direct inquires and request for information (AIA G716) to: Gipe Associates, ATTN: David R. Hoffman, P.E., Phone (410) 822-8688, dhoffman@gipe.net no later than seven (7) days prior to bid due date.

3.3 – SUBSTITUTIONS

Add new paragraph:

3.3.5 "Refer to Section 016000 Product Requirements Substitutions for additional requirement and procedures regarding substitutions."

ARTICLE 4 - BIDDING PROCEDURES

4.2 - BID SECURITY

4.2.1 Delete the last sentence, "The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2."

Add new paragraphs:

4.2.4 "Bid security is required and shall be in the amount of five percent (5%) of the base bid amount, shall be a surety bond written in the form of AIA Document A310 - Bid Bond, by a company satisfactory to the Owner, or equivalent."(A copy of AIA Document A310 – Bid Bond is enclosed at the end of this Section.)

4.2.5 "Bids shall be accompanied by a Bid Guaranty, which shall either be a certified check made payable to the Worcester County Commissioners or a bond in a form by a surety company approved by the Worcester County Commissioners".

4.3 - SUBMISSION OF BIDS

Add new paragraph:

4.3.5 "Bids must be enclosed in sealed envelopes as described in the Bid Solicitation".

4.4 - MODIFICATION OR WITHDRAWAL OF BID

Add new paragraph:

4.4.5 "The bid shall be held open by bidders for acceptance for sixty (60) days. This time period shall be irrevocable."

ARTICLE 6 - POST BID INFORMATION

6.1 – CONTRACTOR'S QUALIFICATION STATEMENT

Add the following:

6.1.1 If requested by Engineer, Bidder shall execute A-305 Contractor Qualification Statement and submit with Bid Form.

6.2 – OWNER'S FINANCIAL CAPABILITY

Delete paragraph 6.2 in its entirety.

6.3 - SUBMITTALS

Delete present 6.3.1 and insert new as follows:

6.3.1: "The bidder shall submit a list of subcontractors/manufacturers with names and addresses of all subcontractors/manufacturers identified on the Subcontractor's/Manufacturer's Listing Form with Bid Form at time of Bid. List all subcontractors/manufacturers whose percent of work is 5% or greater. Types of work not listed indicate that the Contractor intends to perform the work with his own force. Failure of Contractor to list subcontractors may result in disqualification of bid. "

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

7.1 - BOND REQUIREMENTS

Add new paragraphs:

7.1.4 "The Contractor shall provide a Performance Bond in the amount of one hundred percent (100%) of the Contract Award written in the standard form of AIA Document A312. The cost of the bond shall be paid by the Contractor and included in his Bid." (AIA Document A312 Performance Bond is enclosed at the end of Division 0 Contracting Requirements.)

7.1.5 "The Contractor shall provide a Labor and Material Payment Bond in the amount of one hundred percent (100%) of the Contract Award written in the standard form of AIA Document A312. The cost of the bond shall be paid by the

Contractor and included in his Bid." (AIA Document 312 – Payment Bond is enclosed at the end of Division 0 Contracting Requirements.)

7.1.6 "Bonds shall be written by companies satisfactory to the Owner and licensed in Maryland."

7.1.7 "The bonds shall also contain the successful bidder's guarantee to indemnify and save harmless the County Commissioners of Worcester County, MD and their agents, servants and employees from all costs, damages, and expenses growing out of or by reason of the successful bidder's failure to comply and perform the work and complete the contract in accordance with the Agreement and Contract Documents".

Add the following:

ARTICLE 9 - ADDITIONAL INSTRUCTIONS TO BIDDERS

9.1- TIME OF COMPLETION

9.1.1 The Owner desires substantial completion of total project to be no later than two hundred ten (210) calendar days from Notice to Proceed and final completion thirty (30) calendar days thereafter. This provision is of the essence.

9.2 - LIQUIDATED DAMAGES

9.2.1 Liquidated damages shall be assessed to compensate the Owner by the contractor to compensate the Owner's cost associated with late completion of the project. Liquidated damages shall be deducted from the final payment utilizing a change order. Refer to the Worcester County Requirements, Bid Form, and Supplementary General Conditions for additional information.

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT:

PROJECT:
(Name, location or address, and Project number, if any)

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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of

(Witness)	*(Contractor as Principal)* *(Seal)*
	(Title)
(Witness)	*(Surety)* *(Seal)*
	(Title)

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

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ACD43070810

Sample

INFORMATION AVAILABLE TO BIDDERS

The available information is for the bidder's use in preparing bids, but is not part of the Contract Documents and does not relieve the bidder from doing his own investigations to determine the accuracy of the information. The information provided includes:

1. Mechanical Drawings dated March 2, 2004
2. Electrical Drawings dated May 31, 2007
3. Mechanical/Electrical/Plumbing Drawings dated February 7, 2014
4. Air Balance Report dated October 15, 2007

SPECIAL NOTES (APPLY TO THIS DRAWING ONLY)

1. DUCTS SHALL BE OFFSET OVER LOBBY AREA TO CLEAR CEILING HEIGHT DIFFERENCES.
2. 10"ø TYPE B GAS VENT UP THROUGH ROOF.
3. ROUTE PROPANE GAS PIPING ON GYM WALL ABOVE FINISHED DRYWALL, WHERE PIPING IS EXPOSED IN GYM.
4. SECOND STAGE PRESSURE REGULATOR 10 PSIG INLET PRESSURE, 11"WG. OUTLET PRESSURE. 540 MBH.
5. 54"x144" EXHAUST HOOD

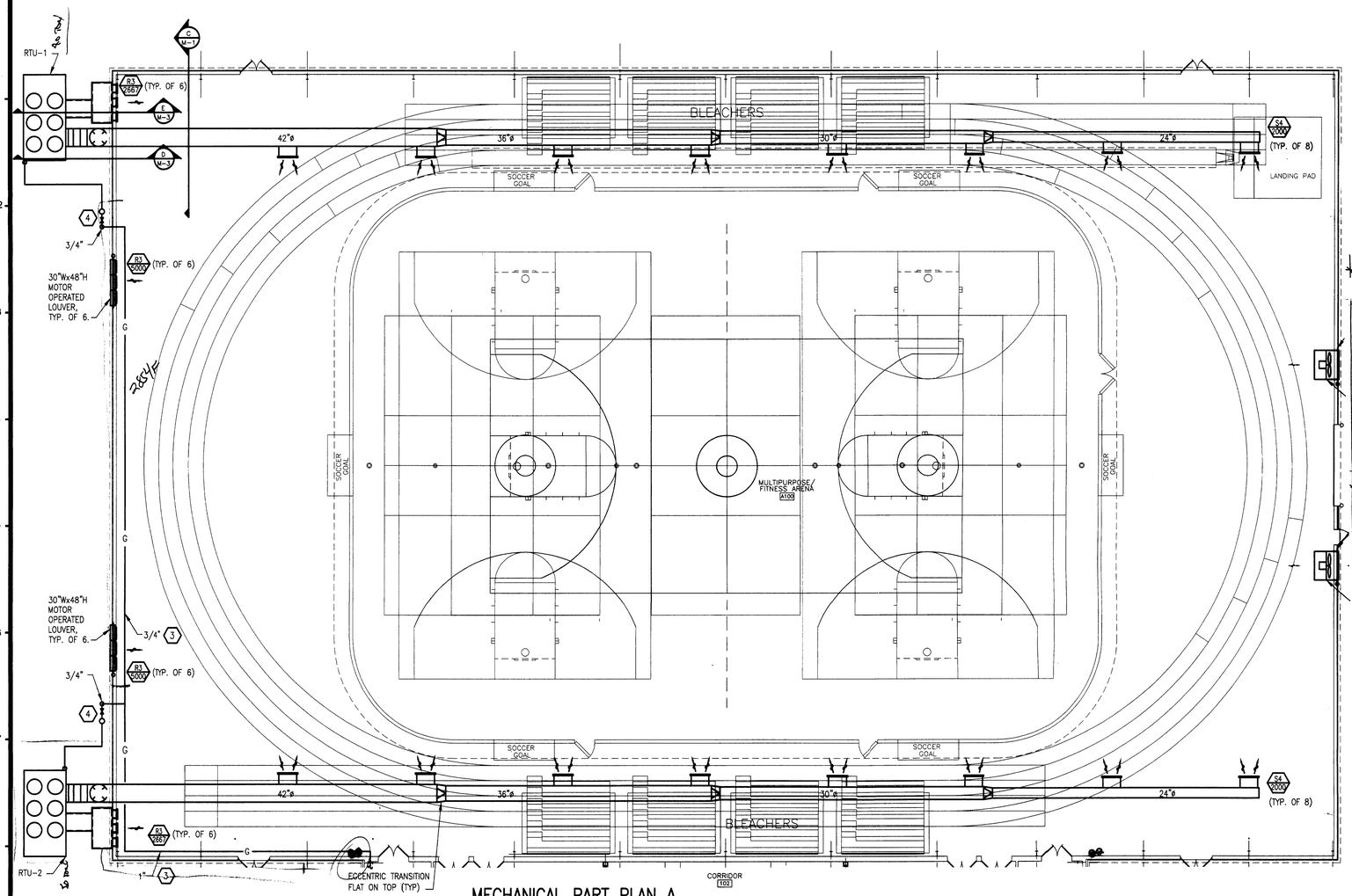
12x24 EXHAUST DUCT CONNECTION TO HOOD AND 16x16 UP TO FAN-1 ON ROOF.

9x24 MAKE-UP AIR DUCT CONNECTION TO HOOD.

DUCT CONTINUES UP TO AND CONNECTS TO UPPER LOUVER NEAR ROOF PEAK. PROVIDE BLANK OFF TOP HALF OF LOUVER WITH 8" DEEP SHEET METAL PLENUM FOR ERV-1 AND MUA UNIT O.A. CONNECTION.

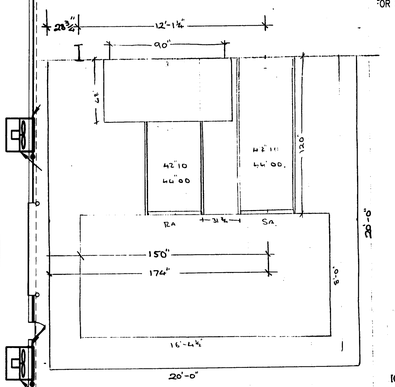
LOUVER BY OTHERS. PROVIDE 6" DEEP SHEET METAL PLENUM ON BOTTOM HALF FOR CONNECTION TO 18x18 ERV-1 EXHAUST DISCHARGE. PROVIDE SEPARATE SHEET METAL PLENUM OM TOP HALF FOR MOUNTING OF FAN-4.

FOR CONTINUATION SEE SHEET M-2.



MECHANICAL PART PLAN A

SCALE: 3/32"=1'-0"

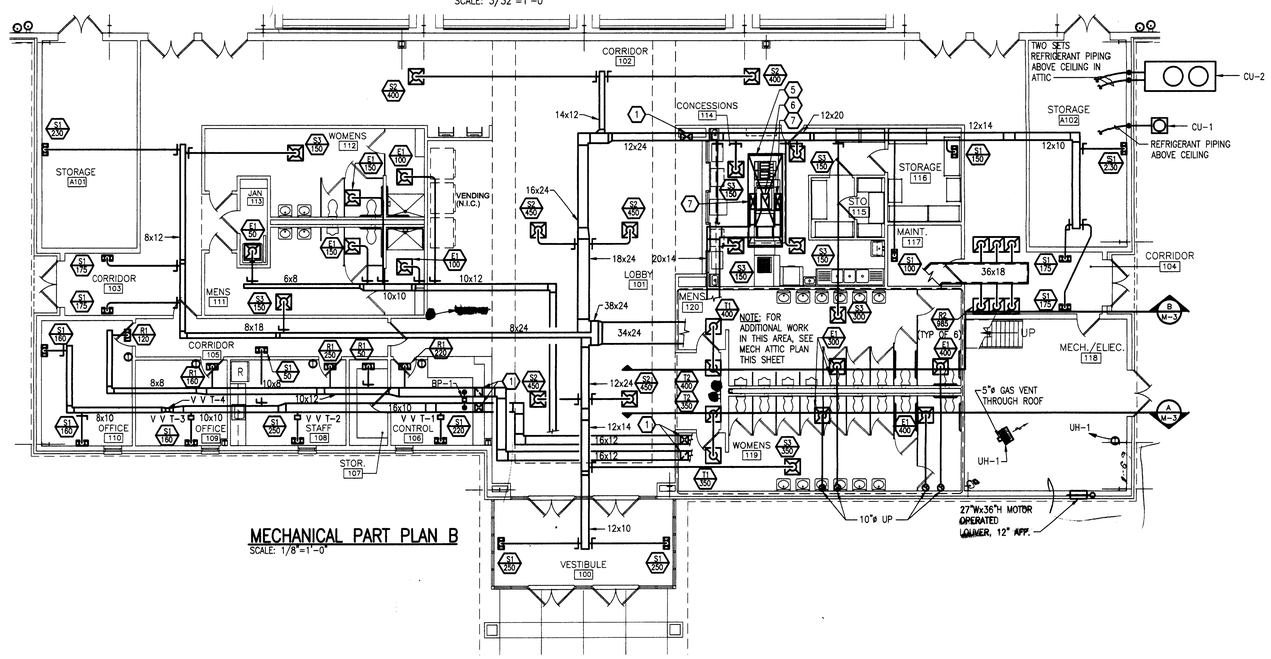


ION CENTER

Addendum Items:

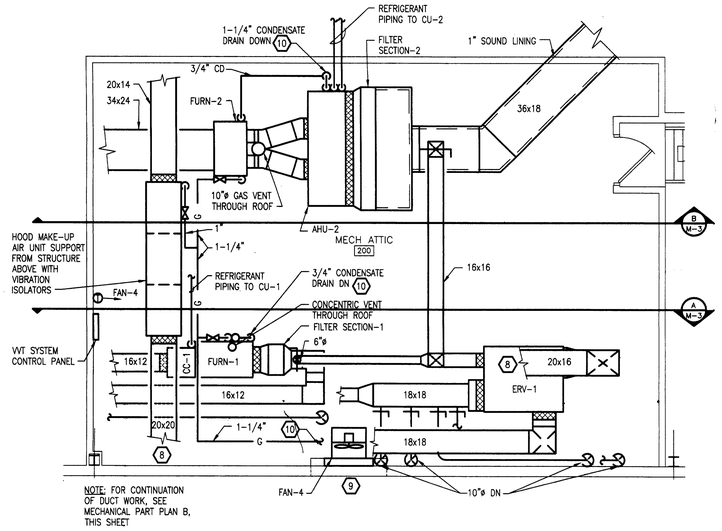
Mechanical

1. Provide alternate pricing for deletion of exposed spiral ductwork and air supply registers in Multipurpose/Fitness Area A100 and providing flexible fabric duct (sock duct), Ductsox or approved equal. Sock duct shall be non-porous polyester based reinforced heavy duty fabric with colored finish, high throw outlets, adjustable airflow control, and cable and snap clip support. Provide sock duct shop drawing showing locations and dimensions of outlets and flow control and air distribution performance.
2. Kitchen fixtures and appliances scheduled on Kitchen Equipment Rough-in Schedule on Sheet M-2 shall be furnished by others. Mechanical and plumbing connections to equipment shall be provided by the mechanical contractor.
3. Curb supports for RTU-1 and RTU-2 shall be provided by the mechanical contractor. These curbs are specified with the RTU's in Section 15870 Part II.E.14. Rooftop unit manufacturer shall be responsible for structural integrity of the curbs.



MECHANICAL PART PLAN B

SCALE: 1/8"=1'-0"



NOTE: FOR CONTINUATION OF DUCT WORK, SEE MECHANICAL PART PLAN B, THIS SHEET

MECH ATTIC PLAN

SCALE: 1/4"=1'-0"

REVISIONS

No	Date	Item	Ref

SEAL

STATE OF MARYLAND — JAMES T. CLAGGETT — 21676 — REGISTERED PROFESSIONAL ENGINEER

CLAGGETT ENGINEERING
18 GOLDSBOROUGH STREET
EASTON, MARYLAND 21601
TEL (410) 820-9173
FAX (410) 820-7220
CE# TA40203

Todd & Associates Inc Architects
218 North Division Street
Salisbury Maryland
410-749-2447

Worcester County Recreation Center

Snow Hill, Maryland

Mechanical Part Plans

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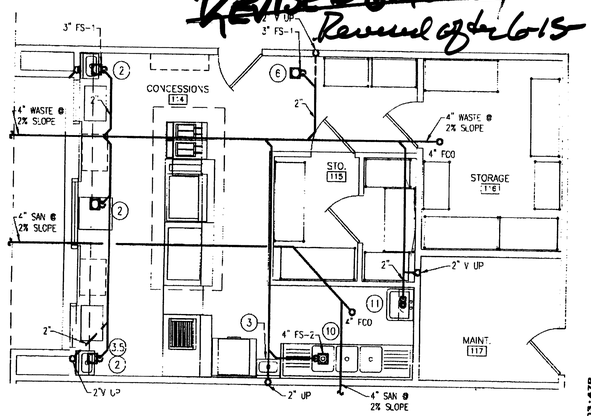
Project	0127
Scale	AS NOTED
Date	3-2-04
Last Rev	

M-1

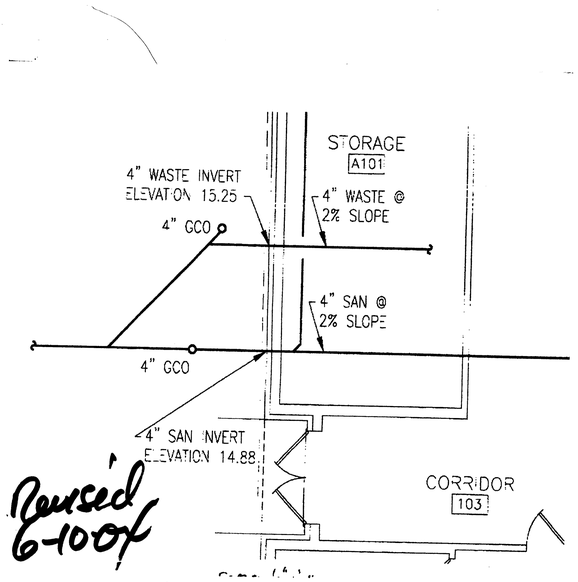
P.02
Jun-09-04 03:47P

REVISED 6-10-04
Revised after 6-15



CONCESSION SANITARY AND BELOW SLAB PLUMBING PART PLAN
SCALE: 1/4"=1'-0"

P.03
Jun-09-04 03:47P



Revised 6-10-04

CLAGGETT ENGINEERING **Fax Transmittal**

18 Goldsborough Street – P.O. Box 1746 – Easton, Maryland 21601
(410) 820-9173 – FAX (410) 820-7220

DATE 5-28-04	JOB NO. 7040303
ATTENTION George Phillepsen	
RE Wm. C. Lee Center	

TO SPN
410-632-5647

WE ARE FAXING TO YOU 1 PAGES, INCLUDING THIS COVER SHEET.

REMARKS:

George: We understand there is to be no commercial kitchen facilities at the Rec. Center, just holdups, sodas, vending and the like.

No grease trap would be required as there would be NO grease laden waste. (IPC 1003.3.1)

Building sanitary drainage fixture units without kitchen drains are 150.

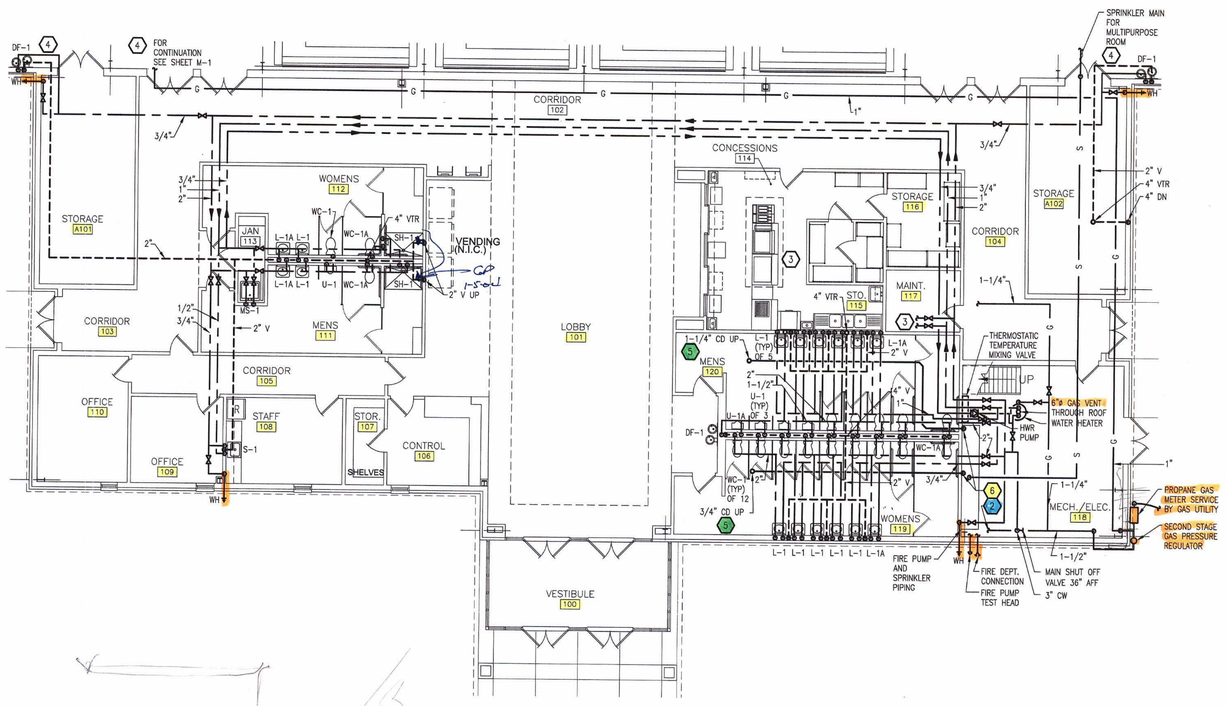
A 4" sanitary drain line at 2 percent slope can handle that discharge (IPC 710.1

The building sanitary piping need NOT be 6".

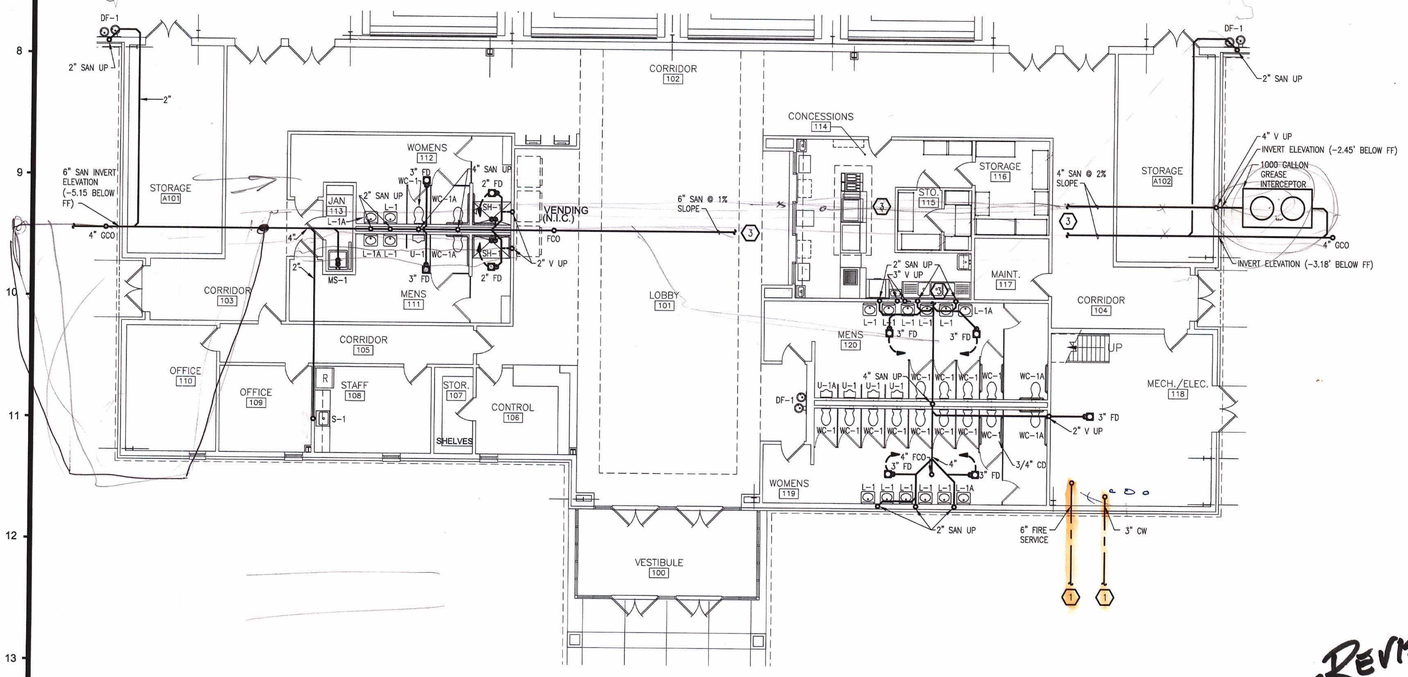
CC: Ed Todd
410-749-8480

SIGNED: L. Claggett

P.01
MAY-28-04 08:58A



PLUMBING PLAN
SCALE: 1/8"=1'-0"



SANITARY AND BELOW SLAB PLUMBING PLAN
SCALE: 1/8"=1'-0"

KITCHEN EQUIPMENT ROUGH-IN SCHEDULE

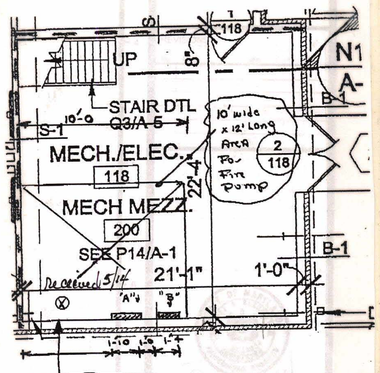
ITEM #	FIXTURE DESCRIPTION	MOUNTING HEIGHT	MIN CONNECTIONS CW	HW	WASTE	GAS (MBH)	NOTES
3	SINK, HAND	34"	(2) 1/2"	1/2"	1-1/2"	–	W/ EYE WASHING AND ELECTRIC FAUCET
3.5	UNDERBAR ADD-ON UNIT	–	1/2"	1/2"	1-1/2"	–	–
6	ICE MAKER, CUBE-STYLE	–	1/2"	–	(2) 3/4" IW	–	W/ WATER FILTER IW TO FS W/ AIR GAP
8	WALK-IN EVAPORATORS	–	–	–	(2) 3/4" IW	–	IW TO 11 W/ AIR GAP. PROVIDE HEAT TAPE ON FREEZER DRAIN
10	SINK, THREE-COMPARTMENT	–	(2) 1/2"	(2) 1/2"	(3) 1-1/2" IW	–	IW TO FS W/ AIR GAP
11	MOP SINK	–	1/2"	1/2"	2"	–	–
16	FRYER, MULTIPLE DEEP FAT, GAS	–	–	–	–	3/4" (220)	PROVIDE FLEX HOSE W/ QUICK DISCONNECT
18	CHARBROILER, GAS, COUNTER MODEL	–	–	–	–	3/4" (100)	PROVIDE FLEX HOSE W/ QUICK DISCONNECT
19	FREEZER BASE	–	–	–	3/4" IW	–	IW TO FS

SPECIAL NOTES (APPLY TO THIS DRAWING ONLY)

1. FOR CONTINUATION SEE SITE UTILITIES PLAN SHEET SP-1.
2. 1-1/4" PROPANE GAS, LOW PRESSURE TO MEZZANINE FOR CONTINUATION SEE PART PLAN B ON SHEET M-1.
3. FOR CONTINUATION AND ADDITIONAL WORK IN THIS AREA SEE PART PLAN THIS SHEET
4. ROUTE PIPING ON GYM WALL ABOVE DRYWALL, WHERE PIPING IS EXPOSED IN GYM.
5. FOR CONTINUATION SEE PART PLAN B ON SHEET M-1
6. PIPE CD TO FLOOR DRAIN IN MECH/ELEC 118
7. PROVIDE 1-1/4" PROPANE GAS TO KITCHEN APPLIANCES 16 AND 18. INSTALL PIPING UNDER FINISHED FLOOR. PROVIDE SHUTOFF VALVE AT FLOOR FOR CONNECTION TO FLEX HOSE FOR EACH APPLIANCE.
8. HOOD FIRE SUPPRESSION SYSTEM EMERGENCY GAS SHUT OFF VALVE.

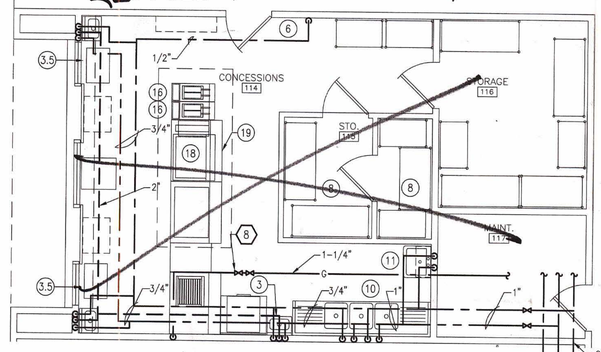
05/14/2004 13:08 FAX 410 860 8407 BAYSIDE FIRE PROT

"A" = Fire Pump Controller
"B" = Jowkey Pump Controller

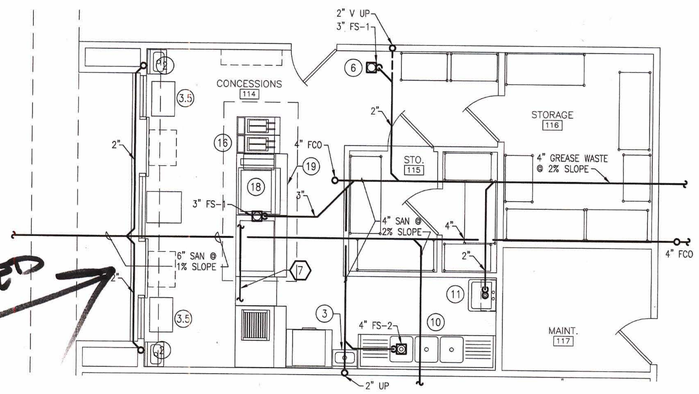


6" underground piping located 1'-6" from inside face of finished wall to center of pipe. Leave from 6"-8" above finished floor.

REVISED AFTER 6-15-04



CONCESSION ABOVE SLAB PLUMBING PART PLAN
SCALE: 1/4"=1'-0"



SEE REVISED

CONCESSION SANITARY AND BELOW SLAB PLUMBING PART PLAN
SCALE: 1/4"=1'-0"

CLAGGETT ENGINEERING
18 GOLDSBOROUGH STREET
EASTON, MARYLAND 21601
TEL (410) 820-9173
FAX (410) 820-7220
CE# TA00203

Todd & Associates Inc Architects
218 North Division Street
Salisbury Maryland
410-749-2447

Worcester County Recreation Center

Snow Hill, Maryland

PLUMBING PART PLANS

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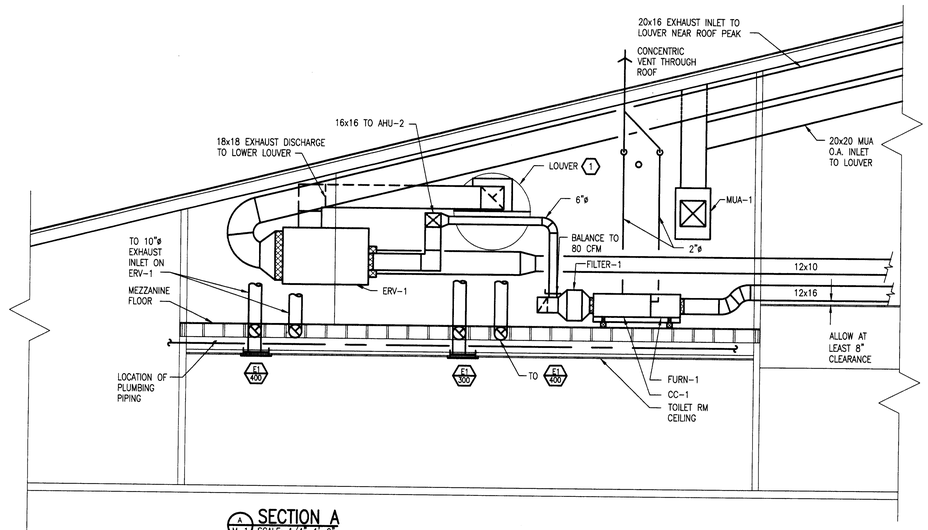
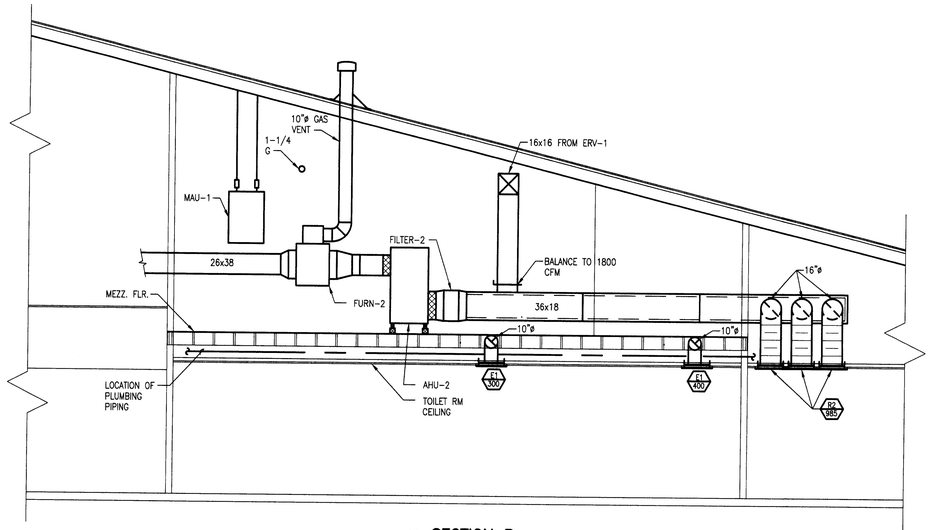
Project	0127
Scale	AS NOTED
Date	3-2-04
Last Rev	

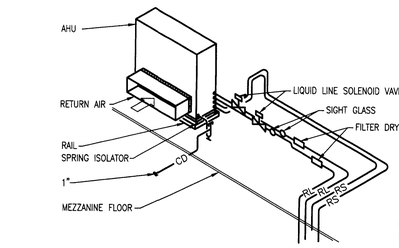
M-2

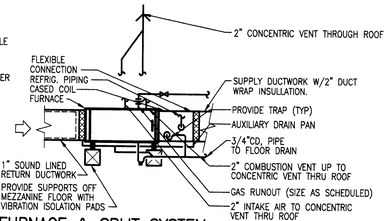


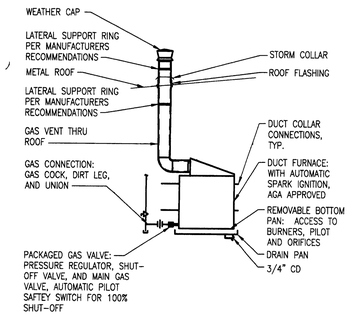
A / M-1 SECTION A
SCALE: 1/4"=1'-0"



B / M-1 SECTION B
SCALE: 1/4"=1'-0"







GAS FURNACE & SPLIT SYSTEM COOLING DETAIL AND SCHEDULE

NO SCALE

SYSTEM	FURN-1, CC-1, CU-1	FURN-2, AHU-2, CU-2	UNIT HEATER-1 (UH-1)
FURNACE MODEL	YORK P3DHB12N055	STERLING QVS	STERLING QVF
WEIGHT	150	400	100
OUTPUT CAPACITY MBH	55	280	48
INPUT MBH	60	350	60
AFUE	91	80	81
GAS RUNOUT	3/4	1-1/4"	3/4"
COMB. VENT	2"	10"	5"
INTAKE AIR	2"	–	–
AHU MOTOR	–	LB180C006	–
E.S.P. (HEATING/COOLING)	0.5/0.8	1.2	–
CFM (HEATING/COOLING)	870/1000	6000	1,100
RPM-SPEEDS	3	BELT 940	–
BLOWER FAN H.P.	1/2	5	1/30
UNIT MCA	7.0/120	9.5/460/3	2.1/120/1
CONDESING UNIT	H40H030	HB180C00A4	
CASED COIL MODEL – YORK	G2FD030	–	
NOMINAL TONS	2.5	15	
CFM (NOMINAL COOLING)	1000	6000	
TOTAL COOLING (MBH)	26.1	178	
SENSIBLE COOLING (MBH)	23.6	137	
ENT. AIR DB/WB	80/67	80/67	
COND FAN RLA (EA.)	0.9	(2) 1.96	
COND FAN RPM	1075	–	
COMP. LRA (EA.)	14.1	(2) 12.8	
COMP. RLA	78	95	
UNIT MCA	18.5	32.5	
MAX OVER-CURRENT	30	45	
VOLTS/PHASE	208/1	460/3	
SEER-EER	12	9.4	
MODEL – FARR	FILTER-1 30/30-4"	FILTER-2 30/30-4"	
CFM	1000	6000	
FACE VELOCITY (FPM)	250	375	
INITIAL RESISTANCE	0.07	0.16	
FINAL RESISTANCE	0.25	0.50	
HOUSING FARR 4P GLIDEPAK	1x1	1x4	

MUA & GAS RTU SCHEDULE

NO SCALE

DESIGNATION ROOMS SERVED	RTU-1 GYM	RTU-2 GYM	MUA-1 CONCESSION
MANUFACTURER	AAON	AAON	GREENHECK
MODEL	RN-040-3-0-AB04-7A2 HBFF-MOB-GEH-OBA-RGOBDN0-00-0A000000B	RN-050-3-0-AB04-7A2 HBFF-MOB-GFS-OBA-RGOBDN0-00-0A000000B	DG-110-H10
APPROX. OPERATING WIEGHT – LB.	8332	8842	700
NOMINAL TONS	40	50	–
CAPACITY – TOTAL MBH	521.24	664.44	–
CAPACITY – SENSIBLE MBH	363.84	421.06	–
E.A.T. (DB/WB)	81/70	81/70	–
L.A.T. (DB/WB)	62/60.5	59/57.5	–
HEATING (E.A.T) (DB/WB)	66/49	66/49	10/9
HEATING CAP (MBH)	437	437	185
PROPANE GAS INPUT (MBH)	540	540	201
REHEAT CAP (MBH)	323	410	–
SUPPLY FAN HORSEPOWER (2)	10	7.5	2
EXHAUST FAN HORSEPOWER (2)	5	5	–
CFM – SUPPLY/OUTSIDE	16000/5150	16000/5150	2830
EXTERNAL STATIC PRESSURE – IN. WG	1	1	0.5
ELECTRICAL VOLTAGE/PHASE	460/3	460/3	460/3
COMPRESSOR RLA EA	(4) 15.5	(4) 17.6	–
CONDENSER FAN FLA EA	(4) 2.8	(6) 2.8	–
EVAPORATOR FAN FLA EA	(2) 14.0	(2) 11.0	(1) 7.8
MINIMUM CIRCUIT AMPS	123	131	–
MAXIMUM FUSE AMPS	125	150	–
SYSTEM EER:	11	11	–
AFUE %	81	81	92

SPECIAL NOTES (APPLY TO THIS DRAWING ONLY)

1 LOUVER BY OTHERS. BLANK OFF TOP HALF WITH 6" DEEP SHEET METAL PLENUM (PAINT BLACK ON INSIDE) FOR CONNECTION TO 18x18 ERV-1 EXHAUST DISCHARGE.

AIR DEVICE SCHEDULE

MARK	TYPE	CFM	NECK	RUNOUT	PRICE MODEL #
S1	CEILING SUPPLY	50–100	4x8	6"ø	32/C/S/T/B12 WITH BOOT
		110–200	4x12	7"ø	32/C/S/T/B12 WITH BOOT
		210–250	4x14	8"ø	32/C/S/T/B12 WITH BOOT
S2	CEILING SUPPLY	200–250	12x12	8"ø	SMD/3P/4A/B12/SR
		260–350	12x12	10"ø	SMD/3P/4A/B12/SR
		360–400	15x15	12"ø	SMD/3P/4A/B12/SR
S3	CEILING SUPPLY	200–250	12x12	8"ø	AMD/1/4A/B12/SR
		260–350	12x12	10"ø	AMD/1/4A/B12/SR
		360–500	15x15	12"ø	AMD/1/4A/B12/SR
S4	SIDE SUPPLY	2000	–	14.5x43.5	12x42 HCD2/A/B12
R1	CEILING RETURN	50–90	9x9	6"ø	635/TB/B12
		100–180	9x9	8"ø	635/TB/B12
		190–320	12x12	10"ø	635/TB/B12
		330–500	15x15	128"ø	635/TB/B12
R2	CEILING RETURN	985	22x22	16"ø	80/C/A/B12
R3	SIDE RETURN	2667	20x36	–	90/S/A/B12
		5000	24x36	–	90/S/A/B12
E1	CEILING EXHAUST	SAME AS	R-1	–	635/F/A/B12
T1	TRANSFER GRILLE	SAME AS	R-1	–	635/TB/B12
T2	TRANSFER GRILLE	SAME AS	R-1	–	635/F/A/B12

NOTE: DUCT RUNOUTS SHALL BE FLEXIBLE DUCT, MINIMUM 6 FEET, MAXIMUN 15 FEET, UNLESS NOTED OTHERWISE.

V V T DAMPER SCHEDULE

MARK	AREA SERVED	CFM	DAMPER SIZE (INCHES)	YORK MODEL #	UNIT
V V T-1	106	220	8"ø	URD	FURN-1
V V T-2	108	250	9"ø	URD	FURN-1
V V T-3	109	160	8"ø	URD	FURN-1
V V T-4	110	320	10"ø	URD	FURN-1
BP-1	–	800	12"ø	URD	FURN-1

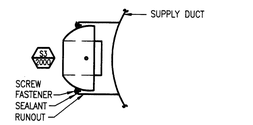
ENERGY RECOVERY VENTILATOR SCHEDULE

NO SCALE

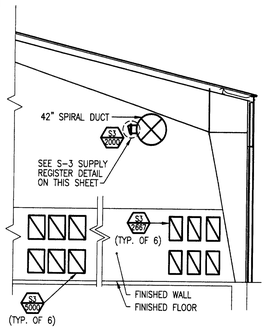
DESIGNATION	ERV-1
AREA SERVED	TOILETS
LOCATION	MEZZANINE
MANUFACTURER	GREENHECK
GREENHECK MODEL NUMBER	ERV-521S-15-A
WEIGHT – LBS	1200
MOTOR ELEC. (V/C/P)	208/60/1
SUPPLY	
VOLUME (CFM)	1900
EXTERNAL S.P. (IN. W.G.)	0.3
FAN (RPM)	845
MOTOR SIZE (HP)	3/4
EXHAUST	
VOLUME (CFM)	1750
EXTERNAL S.P. (IN. W.G.)	0.6
FAN (RPM)	95
MOTOR SIZE (HP)	3/4
WINTER PERFORMANCE	
ENT. EXHAUST AIR TEMP(DB/%RH)	70/35
ENT. O.A. TEMP (DB/WB)	13/10
SUPPLY AIR TEMP. (DB/WB)	57/47
SUMMER PERFORMANCE	
ENT. EXHAUST AIR TEMP(DB/%RH)	77/50
ENT. O.A. TEMP (DB/WB)	93/77
SUPPLY AIR TEMP. (DB/WB)	81/68

MECHANICAL LEGEND

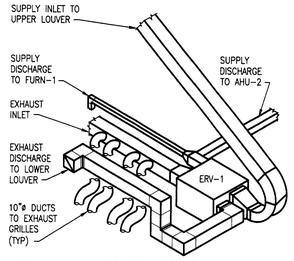
SYMBOL	ABBREV.	DEFINITION
	CW	COLD WATER
	HW	HOT WATER
	HWR	HOT WATER RECIRCULATED
	V	VENT
	SAN	SANITARY, SOIL OR WASTE
S	S	SPRINKLER PIPING
G	G	PROPANE GAS
CD	CD	CONDENSATE DRAIN
		SHUTOFF VALVE
		CHECK VALVE
	FD	FLOOR DRAIN
		TRAP PRIMER
		TRAP PRIMER VALVE
		PIPE DOWN
		PIPE UP
		UNION
	WCO, CO, WCO	GRADE CLEAN OUT, WALL CLEAN OUT
	WH	WALL HYDRANT
		PUMP
		RELIEF VALVE
		TEMPERATURE MIXING VALVE
		TEMPERATURE GAUGE
		WATER HAMMER ARRESTOR
	VD	VOLUME DAMPER
	SA	SUPPLY AIR DUCT (UP, DOWN)
	RA	RETURN AIR DUCT (UP, DOWN)
	EA	EXHAUST AIR DUCT (UP, DOWN)
	SD	SUPPLY DIFFUSER , RUNOUT DUCT
	RD	RETURN GRILLE, RUNOUT DUCT
	ED	EXHAUST GRILLE, RUNOUT DUCT
		THERMOSTAT
		FLEXIBLE CONNECTION
	AFF	ABOVE FINISHED FLOOR



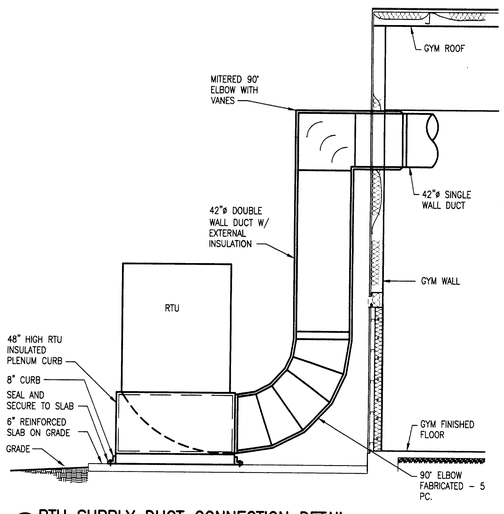
S-3 SUPPLY REGISTER DETAIL
SCALE: 1"=1'-0"



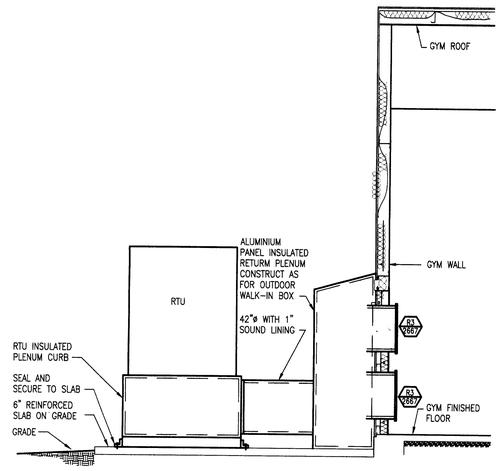
C / M-1 SECTION C
SCALE: 1/8"=1'-0"



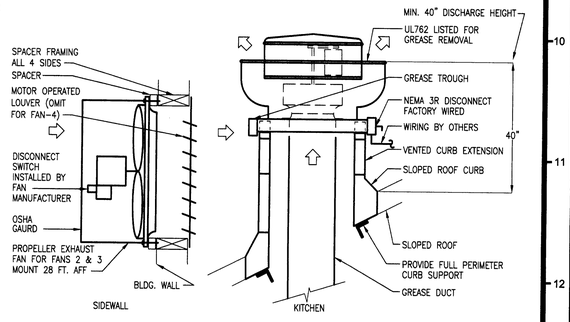
ERV-1 DUCT CONNECTION DETAIL
NO SCALE



D / M-1 RTU SUPPLY DUCT CONNECTION DETAIL
SCALE: 1/4"=1'-0"



E / M-1 RTU RETURN DUCT CONNECTION DETAIL
SCALE: 1/4"=1'-0"



FAN SCHEDULE & DETAILS

NO SCALE

DESIGNATION	FAN-1	FAN-2 AND 3	FAN-4
AREA SERVED	CONCESSIONS	GYM SMOKE CONTROL	MECH ATTIC 200
FAN TYPE	KITCHEN	SIDEWALL	SIDEWALL
GREENHECK MODEL #	CUBE-200-20	SB-2H60-30	SB-2H60-30
DRIVE TYPE	BELT	BELT	DIRECT
WEIGHT – LBS	200	300	50
CAPACITY – CFM	3530	30,000	3,300
STATIC PRESSURE " WG	1.25	0.25	0.15
FAN RPM	1070	415	1160
MOTOR HP	2	3	1/3
MOTOR VOLTAGE	460/3PH	460/3PH	120/1
CONTROL	LOCAL SWITCH	SMOKE CONTROL	T'STAT
INTERLOCK WITH:	MUA-1	INTAKE LOUVER	INTAKE LOUVER

REVISIONS

No	Date	Item	Ref

SEAL

SEAL

STATE OF MARYLAND · STEPHEN E. CLAGGETT · No. 11666 · REGISTERED PROFESSIONAL ENGINEER

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410-749-2447

Worcester County Recreation Center

Snow Hill, Maryland

Mechanical Schedules, Legends Details & Sections

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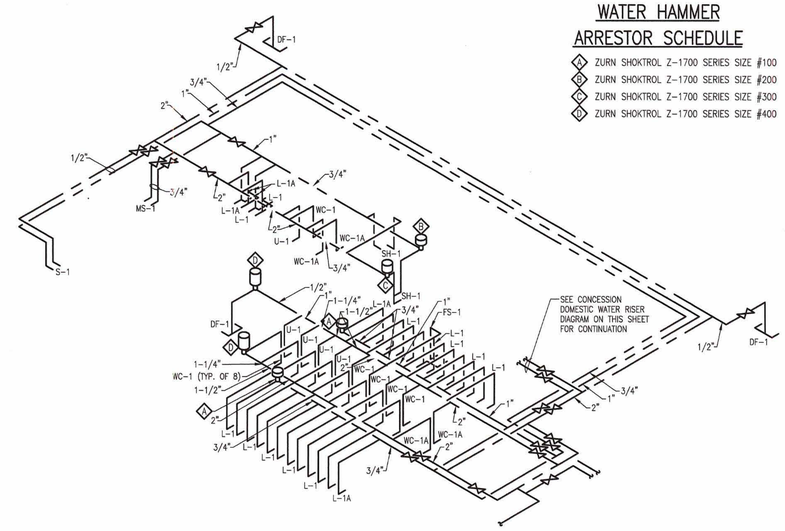
Project	0127	M-3
Scale	AS NOTED	
Date	3-2-04	
Last Rev		

PLUMBING FIXTURE SCHEDULE

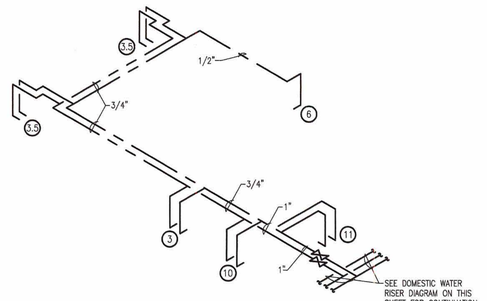
MARK	FIXTURE DESCRIPTION	MOUNTING HEIGHT	MIN CONNECTIONS CW	HW	WASTE	MANUFACTURER	FIXTURE	TRIM/ACCESSORIES/CONTROLS
DF-1	DRINKING FOUNTAIN MOUNTING HEIGHT FOR HANDICAPPED ACCESS.	36" TO BUBBLER	(2)1/2"	–	(2)1-1/4"	SUNROC	NWCA-8F-BL	–
FD	FLOOR DRAIN PROVIDE TRAP PRIME CONNECTION WHERE INDICATED	-1/2"	–	–	2"	ZURN	Z415	WITH TYPE "B" STYLE STRAINER
FS-1	FLOOR SINK –	–	–	–	4"	ZURN	Z-1901-2	–
L-1	LAVATORY –	31"	1/2"	1/2"	1-1/4"	AMERICAN STANDARD	LUCERNE: 0356.015	FAUCET: AMARILIS HERITAGE 4801.862 ZURN: Z-1231 CONCEALED ARM CARRIER
L-1A	LAVATORY HANDICAP ACCESSIBLE AND ADA COMPLIANT, OFFSET TRAP, INSULATE PIPING.	34"	1/2"	1/2"	1-1/4"	AMERICAN STANDARD	LUCERNE: 0356.015	FAUCET: AMARILIS HERITAGE 4801.862 ZURN: Z-1231 CONCEALED ARM CARRIER
MS-1	MOP SINK –	–	1/2"	1/2"	3"	FIAT	MSB 2424	FAUCET: 830-AA STRAINER: 1453-BB S/S WALL GUARDS
S-1	SINK –	–	1/2"	1/2"	1-1/2"	ELKAY	LR-2521	FAUCET: LK4100 W/ LK99 STRAINER DRAIN
SH-1	SHOWER ONE PIECE GEL COATED FIBERGLASS WITH FACTORY MOUNTED GRAB BAR AND FOLDING SEAT, HANDICAP ACCESSIBLE AND ADA COMPLIANT.	–	1/2"	1/2"	2"	AKER	ADA-S63	AMERICAN STANDARD: 1662.600 HAND HELD SHOWER ASSEMBLY, 1660.400 VACUUM BREAKER, 1660.440 TWO WAY DIVERTER
U-1	URINAL MOUNT HANDICAPPED URINAL 17" TO LIP.	24"	1"	–	2"	AMERICAN STANDARD	TRIMBROOK: 6561.017	SLOAN: OPTIMA PLUS 8186 AUTOMATIC FLUSH VALVE ZURN: Z-1222 CARRIER
WC-1	WATER CLOSET –	15"	1-1/4"	–	4"	AMERICAN STANDARD	AFWALL: 2257.103	OPEN FRONT SEAT, SLOAN: OPTIMA PLUS 8111 AUTOMATIC FLUSH VALVE, ZURN: 1200 SERIES CHAIR CARRIER
WC-1A	WATER CLOSET HANDICAP ACCESSIBLE AND ADA COMPLIANT	17"	1-1/4"	–	4"	AMERICAN STANDARD	AFWALL: 2257.103	OPEN FRONT SEAT, SLOAN: OPTIMA PLUS 8111 AUTOMATIC FLUSH VALVE, ZURN: 1200 SERIES CHAIR CARRIER

WATER HAMMER ARRESTOR SCHEDULE

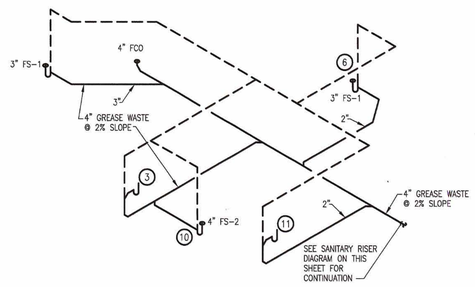
- ⓐ ZURN SHOKTROL Z-1700 SERIES SIZE #100
- ⓑ ZURN SHOKTROL Z-1700 SERIES SIZE #200
- ⓒ ZURN SHOKTROL Z-1700 SERIES SIZE #300
- ⓓ ZURN SHOKTROL Z-1700 SERIES SIZE #400



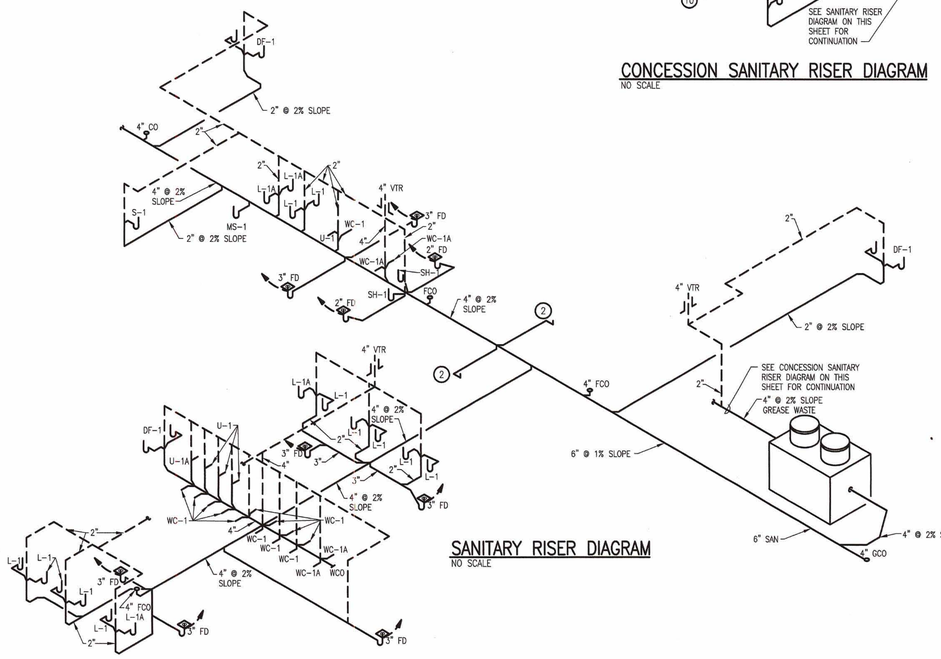
DOMESTIC WATER RISER DIAGRAM
NO SCALE



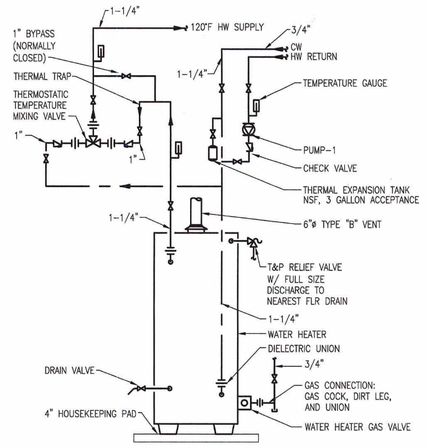
CONCESSION DOMESTIC WATER RISER DIAGRAM
NO SCALE



CONCESSION SANITARY RISER DIAGRAM
NO SCALE



SANITARY RISER DIAGRAM
NO SCALE

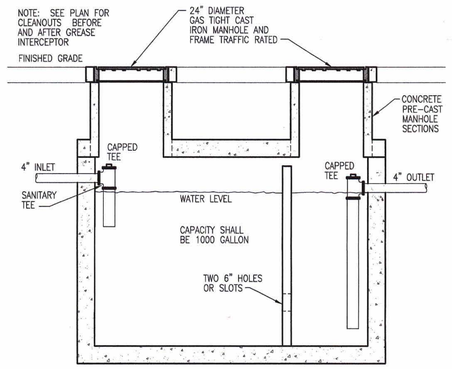


WATER HEATER DETAIL AND SCHEDULE
NO SCALE

WATER HEATER: LOCHINVAR CNR-199-100 OR APPROVED EQUAL, 100 GALLON STORAGE, 199 MBH GAS INPUT, 194 GPH RECOVERY @ 100° F TEMPERATURE RISE (40 TO 140), 120V/1 PHASE.

THERMOSTATIC TEMPERATURE MIXING VALVE: CAPACITY TO DELIVER 20 GPM OF 120° F WITH 30 PSIG PRESSURE DROP AND 140° F HOT INLET, POWERS HYDROGUARD 431-1085, OR EQUAL.

HWR PUMP: BELL & GOSSETT MODEL PL-30B OR APPROVED EQUAL, 5 GPM, 20 FT HEAD, 2050 RPM, 1/12 HP, 3/4" FLANFE, BRONZE CONSTRUCTION.



GREASE INTERCEPTOR DETAIL
SCALE: NOT TO SCALE

NOTE:
1. STRENGTH DESIGN SHALL BE IN ACCORDANCE TO H-20 BRIDGE LOADING WITH 4500# PSI CONCRETE, #4, GRADE 60, REBAR.
2. CONTRACTOR SHALL OBTAIN APPROVAL AND COMPLY WITH ALL REQUIREMENTS OF LOCAL HEALTH DEPARTMENT AND OFFICIALS PRIOR TO INSTALLATION.

REVISIONS

No	Date	Item	Ref

SEAL

SEAL

STATE OF MARYLAND — TIMOTHY C. CLAGGETT — No. 11,635 — REGISTERED PROFESSIONAL ENGINEER

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Worcester County Recreation Center

Snow Hill, Maryland

Plumbing Schedules, Risers Details & Sections

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Project	0127
Scale	AS NOTED
Date	3-2-04
Last Rev	

M-4

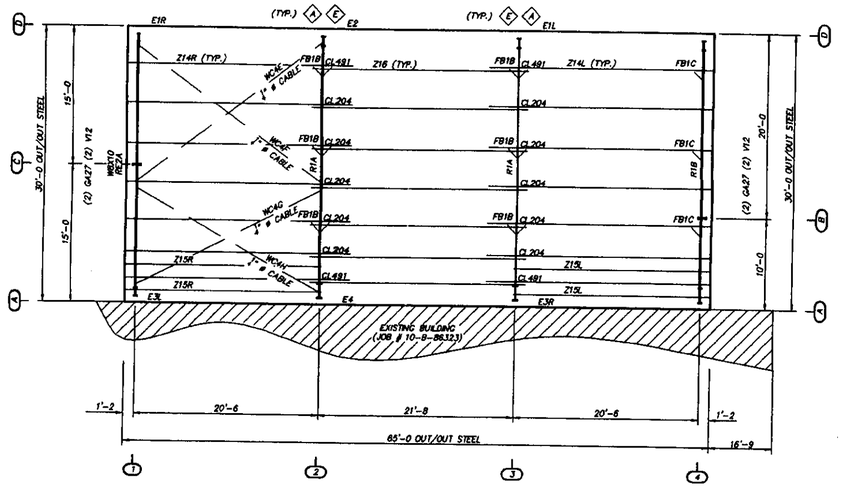
BUILDING 1 NOTES

CL493- PURLIN ANCHORAGE CLIP, CONNECTED TO ALL PEAK PURLINS AT EVERY FRAME.

CL493- PURLIN ANCHORAGE CLIP CONNECTED TO ALL PURLINS 25'-10 FROM THE PEAK AT EVERY FRAME.

-USE CL78 RAKE ANGLE STRAP AT EACH PURLIN AT BOTH ENDWALLS REFER TO DETAIL SHEETS FOR ADDITIONAL INFORMATION.

-CL79 USED AT CABLE ANGLE (12" FROM EAVE STRUT & MIDWAY IN EACH PURLIN SPACE EXCEPT AT PEAK PURLIN SPACE) REFER TO CABLE/RAKE ANGLE INSTALLATION DETAIL FOR ADDITIONAL INFORMATION.



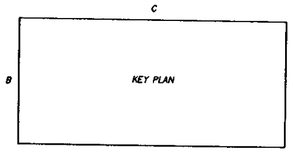
ROOF FRAMING PLAN

General Notes

1) All glazing must be impact resistant or protected with impact resistant covering meeting the requirements of an approved impact resistant standard or ASTM E1996 and ASTM E1886.

2) The contractor is responsible for compliance with all state and federal safety guidelines.

3) The contractor is responsible for all construction site erection and safety.



Z_SECTION LAP TABLE			
SYMBOL	LAP (LENGTH)	SYMBOL	LAP (LENGTH)
A	1'-0 (1'-1)	D	2'-6 (2'-7)
B	1'-6 (1'-7)	E	3'-0 (3'-2½)
C	2'-0 (2'-1)	F	3'-6 (3'-7)

REVISION	DESCRIPTION	DETAILER	DATE	ENG.	DATE

STATE OF MARYLAND
STEPHEN J. PRZELOMSKI
REGISTERED
PROFESSIONAL ENGINEER

CONTRACTOR SET

DRAWING USAGE
APPROVAL DRAWINGS

DRAWN	KS	DATE 05-25-07
PRE CHECKED	MJ	DATE 05-30-07
PRE ENGINEER	SJP	DATE 5-31-07
SCALE	N.T.S.	

Ceco Building Systems
a Robertson Ceco company
EASTERN REGION
P.O. DRAWER 2387
ROCKY MOUNT, NC 27802-2387
(252) 977-2131

CUSTOMER:
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1212 UNIONVILLE ROAD
POCOMOKE CITY, MD 21851
ATTN: MATT ESHAM

SHIP TO:
WORCESTER COUNTY COMMISIONERS
8030 PUBLIC LANDING ROAD
SNOW HILL, MD 21863

JOB NO. 11-B-74358-1
MEMBER MBMA
SHEET NO. E2 of 4

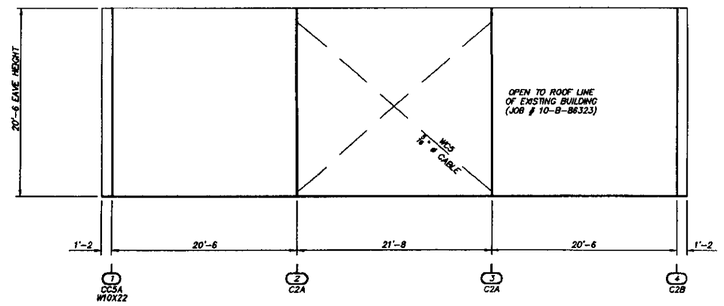
SCHEDULE OF ACCESSORIES

NO. REQD	DESCRIPTION
1	10'-0 X 9'-11 FACTORY LOCATED FRAMED OPENING
1	3070 DOMINION WALK DOOR

CL264– CONNECTS THE TOPS OF THE HIGH SIDEWALL EAVE STRUTS TOGETHER.

CL268– AT ALL EAVE STRUT TO COLUMN CONNECTIONS, EXCEPT AT THE CORNER COLUMNS.

CL269– AT ALL EAVE STRUT TO CORNER COLUMN CONNECTIONS.

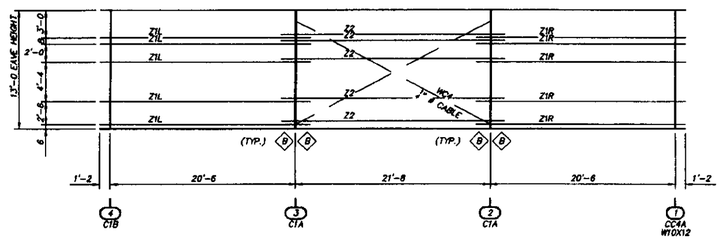


SIDEWALL ELEVATION "A" AT GRID LINE "A"

CL255– CONNECTS THE TOPS OF THE LOW SIDEWALL EAVE STRUTS TOGETHER.

CL268– AT ALL EAVE STRUT TO COLUMN CONNECTIONS, EXCEPT AT THE CORNER COLUMNS.

CL269– AT ALL EAVE STRUT TO CORNER COLUMN CONNECTIONS.

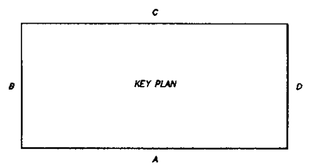


ONE FB1A @ 7'-4 RIGHT | TWO FB1A @ 7'-4 | TWO FB1A @ 7'-4

SIDEWALL ELEVATION "C" AT GRID LINE "D"

Wall Notes

1) The endwall at column line 4 is not designed for expansion. Any future expansion of this wall may require reinforcement or replacement of endwall beams, columns, or foundations.



Z_SECTION LAP TABLE			
SYMBOL	LAP (LENGTH)	SYMBOL	LAP (LENGTH)
A	1'-0 (1'-1)	D	2'-6 (2'-7)
B	1'-6 (1'-7)	E	3'-0 (3'-2½)
C	2'-0 (2'-1)	F	3'-6 (3'-7)

REVISION	DESCRIPTION	DETAILER	DATE	ENG.	DATE

STATE OF MARYLAND · STEPHEN J. PRZELOMSKI · 19766 · REGISTERED PROFESSIONAL ENGINEER

CONTRACTOR SET

DRAWING USAGE: **APPROVAL DRAWINGS**

DRAWN: KS	DATE: 05-25-07	
PRE CHECKED: MJ	DATE: 05-30-07	
PRE ENGINEER: SJP	DATE: 5-31-07	
SCALE: N.T.S.		

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JOB NO. 11-B-74358-1

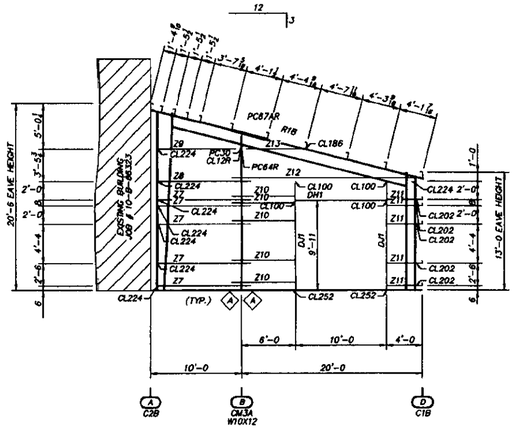
MEMBER MBMA

SHEET NO. E3 of 4

CL205– CONNECTS EACH ENDWALL GIRT TO THE COLUMN WEB.

CL207– FASTENS BETWEEN THE GIRTS ON EACH SIDE OF THE ENDWALL COLUMNS, AT ALL GIRT ELEVATIONS.

CL202 CONNECTS EACH ENDWALL GIRT TO THE SIDEWALL GIRT, UNLESS NOTED OTHERWISE.



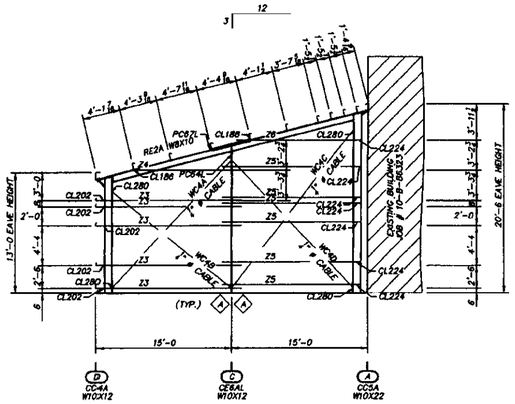
TWO FB1 @ 7'-4
TWO FB1 @ 12'-0

ENDWALL ELEVATION "D" AT GRID LINE "4"

CL207– FASTENS BETWEEN THE GIRTS ON EACH SIDE OF THE ENDWALL COLUMNS, AT ALL GIRT ELEVATIONS.

CL202 CONNECTS EACH ENDWALL GIRT TO THE SIDEWALL GIRT, UNLESS NOTED OTHERWISE.

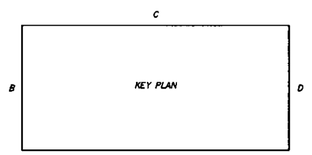
CL280 AT COR. COLUMN ENDS OF X-BRACING



TWO FB1 @ 9'-4

ENDWALL ELEVATION "B" AT GRID LINE "1"

CONTRACTOR SET



Z_SECTION LAP TABLE			
SYMBOL	LAP (LENGTH)	SYMBOL	LAP (LENGTH)
A	1'–0 (1'–1)	D	2'–6 (2'–7)
B	1'–6 (1'–7)	E	3'–0 (3'–2½)
C	2'–0 (2'–1)	F	3'–6 (3'–7)

REVISION	DESCRIPTION	DETAILER	DATE	ENG.	DATE

DRAWING USAGE: **APPROVAL DRAWINGS**

DRAWN: KS	DATE: 05–25–07	
PRE CHECKED: MJ	DATE: 05–30–07	
PRE ENGINEER: SJP	DATE: 5-31-07	
SCALE: N.T.S.		

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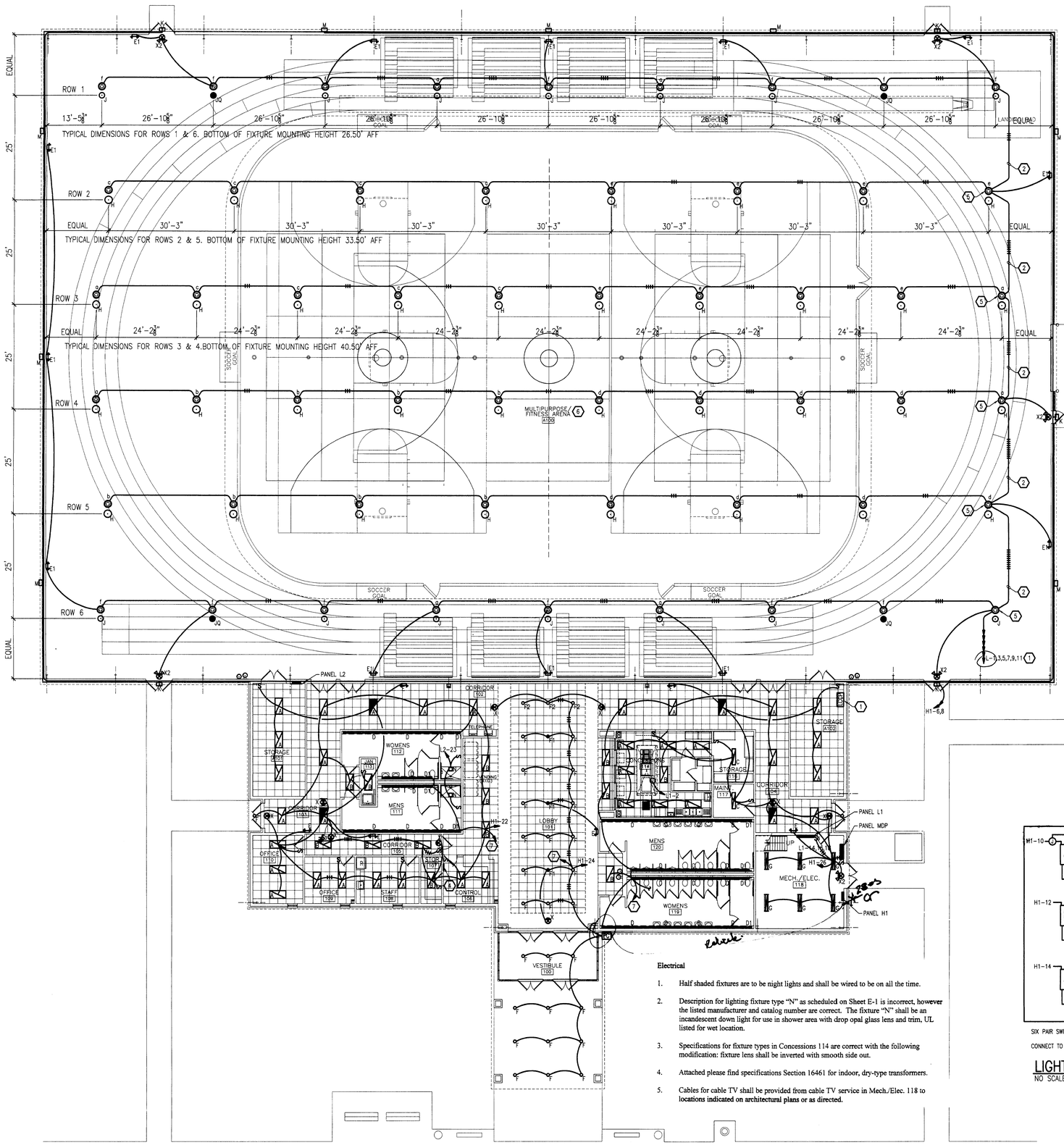
JOB NO. 11–B–74358–1
MEMBER MBMA
SHEET NO. E4 of 4



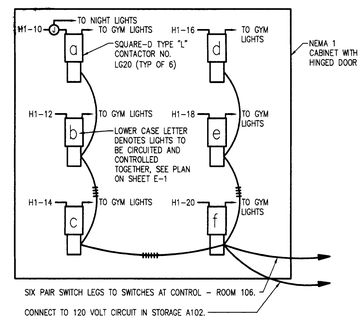
LIGHTING FIXTURE SCHEDULE

TYPE	SYMBOL	DESCRIPTION	LAMPS	MOUNTING	MANUFACTURER/ CATALOG. NO.
A		RECESSED 2'x4' FLUORESENT FIXTURE, STEEL HOUSING, FLUSH STEEL DOOR FRAME, 0.125" PRISMATIC ACRYLIC LENS, U.L. LISTED.	(3) 32W T8 277V	CEILING RECESSED	METALUX: 2GR8-332A125-277-EB81
B		RECESSED 2'x4' FLUORESENT FIXTURE, STEEL HOUSING, FLUSH STEEL DOOR FRAME, 0.125" PRISMATIC ACRYLIC LENS, U.L. LISTED.	(2) 32W T8 277V	CEILING RECESSED	METALUX: 2GR8-232A125-277-EB81
C		SURFACE MOUNTED 1'x4' FLUORESENT FIXTURE, STEEL HOUSING, FLUSH STEEL DOOR FRAME, ONE PIECE INJECTION MOLDED ACRYLIC LENS, U.L. LISTED.	(2) 32W T8 277V	CEILING SURFACE	METALUX: WBI-232MA-277-EB81
D		96" NARROW STAGGERED STRIPLITE FIXTURE, COLD ROLLED STEEL HOUSING, 2" ACCESSORY END CAP (SNL1) TO BE ADDED TO EACH END OF RUN, BAKED WHITE ENAMEL FINISH.	(2) 32W T8 277V STAGGERED	SURFACE SOFFIT, SEE ARCH. DETAIL	METALUX: 8ISNL/232/277/EB81/ SNL-1
D1		48" NARROW STAGGERED STRIPLITE FIXTURE, COLD ROLLED STEEL HOUSING, 2" ACCESSORY END CAP (SNL1) TO BE ADDED TO EACH END OF RUN, BAKED WHITE ENAMEL FINISH.	(1) 32W T8 277V STAGGERED	SURFACE SOFFIT, SEE ARCH. DETAIL	METALUX: SNL/232/120/EB81/SNL-1
E		EMERGENCY BATTERY PACK LIGHT, THERMO PLASTIC HOUSING, TWO ADJUSTABLE 6 WATT HEADS, REMOTE CAPABILITY.	(2) 6W 120/277V	WALL 7'-6" AFF	SURE-LITES CC-7
E1		EMERGENCY BATTERY PACK LIGHT, COLD ROLLED STEEL HOUSING, TWO ADJUSTABLE HIGH IMPACT THERMOPLASTIC 6 WATT HEADS, REMOTE CAPABILITY.	(2) 6W 120/277V	WALL 7'-6" AFF	SURE-LITES XR-9/WG1
F		8" WIDE BEAM DOWNLIGHT, COMPACT FLUORESCENT, DIE CAST ALUMINUM, UNIVERSAL MOUNTING BRACKET, U.L. LISTED DAMP LOCATION.	(1) 42W TTT COMP. FLUOR.	CEILING RECESSED	PORTFOLIO: C7042-7451-LI
F1		8" WIDE BEAM DOWNLIGHT, COMPACT FLUORESCENT, DIE CAST ALUMINUM, UNIVERSAL MOUNTING BRACKET, U.L. LISTED DAMP LOCATION.	(1) 42W TTT COMP. FLUOR.	CEILING RECESSED	PORTFOLIO: C7042-7451-LI
F2		8" WIDE BEAM DOWNLIGHT, COMPACT FLUORESCENT, DIE CAST ALUMINUM, UNIVERSAL MOUNTING BRACKET, U.L. LISTED DAMP LOCATION.	(1) 42W TTT COMP. FLUOR.	CEILING RECESSED	PORTFOLIO: C7042-7451-LI
G		48" LIGHT DUTY INDUSTRIAL FIXTURE, DIE FORMED CHANNELS, HEAVY GUAGE APERTURED REFLECTOR, WIRE GUARD, ENERGY SAVING BALLAST, BAKED WHITE ENAMEL FINISH, MOUNTING METHOD AND HEIGHT TO BE DETERMINED.	(2) 32W T8 277V	CEILING SUSPENDED	METALUX: IA-232-277-EB81-WG/IC -4FT-U
H		HEAVY-DUTY INDUSTRIAL DIE-CAST ALUMINUM AISLE FIXTURE, WHITE POLYESTER POWDER COAT FINISH, HIGH POWER FACTOR BALLAST, ANOD. ALUMINUM REFLECTOR W/PRISMATIC ACRYLIC REFRACTOR, U.L. LISTED.	(1) 350W MH 277V	CEILING PENDANT	LUMARK: MP-SS-PD-22-M-350-MT-QD-SCF-SHK-PC3-WG22/GLC
J		HEAVY-DUTY INDUSTRIAL DIE-CAST ALUMINUM AISLE FIXTURE, WHITE POLYESTER POWDER COAT FINISH, HIGH POWER FACTOR BALLAST, ANOD. ALUMINUM REFLECTOR W/PRISMATIC ACRYLIC REFRACTOR, U.L. LISTED.	(1) 200W MH 277V	CEILING PENDANT	LUMARK: MP-SS-PD-16-M-200-MT-QD-SCF-SHK-PC3-WG22/GLC
JQ		HEAVY-DUTY INDUSTRIAL DIE-CAST ALUMINUM AISLE FIXTURE, WHITE POLYESTER POWDER COAT FINISH, HIGH POWER FACTOR BALLAST, ANOD. ALUMINUM REFLECTOR W/PRISMATIC ACRYLIC REFRACTOR, U.L. LISTED.	200W MH/ 150W QRTZ 277V/120V	CEILING PENDANT	LUMARK: MP-SS-PD-16-M-200-MT-QD-EM-SCF-SHK-PC3-WG22/GLC
K		ARCHITECTURAL WALL LUMINAIRE, ONE PIECE DIE-CAST ALUMINUM CONSTRUCTION, TEMPERED GLASS, CLEAR, POLYESTER POWDER COAT PAINT, BLACK, U.L. LISTED WET LOCATIONS, TYPE IV DISTRIBUTION.	(1) 175W MH 480V TYPE IV	WALL SURFACE	INVUE: VWS-70-MH-480-4S-BK-PC
M		ARCHITECTURAL WALL LUMINAIRE, ONE PIECE DIE-CAST ALUMINUM CONSTRUCTION, TEMPERED GLASS, CLEAR, POLYESTER POWDER COAT PAINT, BLACK, U.L. LISTED WET LOCATIONS, TYPE III DISTRIBUTION.	(1) 175W MH 480V TYPE III	WALL SURFACE	INVUE: VWM-175-MH-480-3S-BK-PC
N		METAL HALIDE, WALL MOUNT LUMINAIRE, CLEAR TEMPERED GLASS LENS, BUTTON PHOTOCONTROL, UL LISTED FOR WET LOCATION, BLACK FINISH.	(1) 100W A19 130V	CEILING RECESSED	PROGRESS LIGHTING: P1-1G/P6631-29
R1		ARCHITECTURAL AREA LUMINAIRE, MEDIUM, ONE PIECE DIE-CAST ALUMINUM HOUSING, IMPACT RESISTANT CLEAR TEMPERED GLASS, MULTI TAP BALLAST, U.L. LISTED, STRAIGHT SQUARE POLE. TYPE IV DISTRIBUTION.	(1) 250W MH 480V TYPE IV DIST.	20' POLE	INVUE: VXM-250-MH-480-4S-BK/ MA1050-BK
R2		ARCHITECTURAL AREA LUMINAIRE, MEDIUM, ONE PIECE DIE-CAST ALUMINUM HOUSING, IMPACT RESISTANT CLEAR TEMPERED GLASS, MULTI TAP BALLAST, U.L. LISTED, STRAIGHT SQUARE POLE. TYPE V DISTRIBUTION.	(1) 250W MH 480V TYPE V DIST.	20' POLE	INVUE: VXM-250-MH-480-5S-BK/ MA1050-BK
R3		ARCHITECTURAL AREA LUMINAIRE, MEDIUM, ONE PIECE DIE-CAST ALUMINUM HOUSING, IMPACT RESISTANT CLEAR TEMPERED GLASS, MULTI TAP BALLAST, U.L. LISTED, STRAIGHT SQUARE POLE. TYPE III DISTRIBUTION.	(2) 250W MH 480V TYPE III DIST.	20' POLE	INVUE: VXM-250-MH-480-3S-BK/ MA1018-BK/MA1018-BK
R4		ARCHITECTURAL AREA LUMINAIRE, MEDIUM, ONE PIECE DIE-CAST ALUMINUM HOUSING, IMPACT RESISTANT CLEAR TEMPERED GLASS, MULTI TAP BALLAST, U.L. LISTED, STRAIGHT SQUARE POLE. TYPE IV DISTRIBUTION.	(2) 250W MH 480V TYPE IV DIST.	20' POLE	INVUE: VXM-250-MH-480-4S-BK/ MA1018-BK/MA1018-BK
R5		ARCHITECTURAL AREA LUMINAIRE, SMALL, ONE PIECE DIE-CAST ALUM. HOUSING, CLEAR TEMPERED GLASS, MULTI TAP BALLAST, U.L. LISTED, STRAIGHT SQUARE POLE. TYPE IV DIST., HEAD MOUNTED @ 10'-0" A.F.G..	(1) 100W MH 480V TYPE IV DIST.	12' POLE	INVUE: VXM-100-MH-480-5S-BK-PROP5/MA1050-BK
S					
X		THERMOPLASTIC LED EXIT SIGN, ONE OR TWO SIDED WITH KNOCKOUT ARROWS, RED LETTERS, 120V, DIRECTIONAL. (W) DENOTES WALL MOUNTED.	LED 120/277V	CEILING/ WALL 7'-6" AFF	SURE-LITES LPXH/7/0/R/WH
X1		SAME AS "X" EXCEPT W/ TWO HIGH PERFORMANCE RECTANGULAR LAMP HEADS. (W) DENOTES WALL MOUNTED.	LED 120/277V	CEILING/ WALL 7'-6" AFF	SURE-LITES LPXH/7/0/R/WH
X2		THIN PROFILE, SELF POWERED, LED EXIT SIGN, SINGLE FACE, FLASHER, RED LETTERS, WHITE FINISH, WIRE GUARD. (W) DENOTES WALL MOUNTED.	LED 120/277V	WALL 7'-6" AFF OR 6" ABV. DR.	SURE-LITES TPX-7-1-70-20-R /W-TPX-71-VS

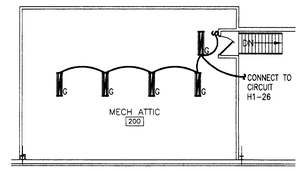
Electrical

1. Half shaded fixtures are to be night lights and shall be wired to be on all the time.
2. Description for lighting fixture type "N" as scheduled on Sheet E-1 is incorrect, however the listed manufacturer and catalog number are correct. The fixture "N" shall be an incandescent down light for use in shower area with drop opal glass lens and trim, UL listed for wet location.
3. Specifications for fixture types in Concessions 114 are correct with the following modification: fixture lens shall be inverted with smooth side out.
4. Attached please find specifications Section 16461 for indoor, dry-type transformers.
5. Cables for cable TV shall be provided from cable TV service in Mech./Elec. 118 to locations indicated on architectural plans or as directed.

LIGHTING PLAN
SCALE: 3/32"=1'-0"



LIGHTING CONTACTOR PANEL
NO SCALE



ATTIC LIGHTING PLAN
SCALE: 3/32"=1'-0"

SPECIAL NOTES (APPLY TO THIS DRAWING ONLY)

1. PROVIDE 10 #8 AND 1 #10 GROUND IN 1-1/2" CONDUIT TO LIGHTING CONTACTOR PANEL. SEE DETAIL THIS SHEET.
2. PROVIDE 10 #8 AND 1 #10 GROUND IN 1-1/2" CONDUIT.
3. PROVIDE 7 #8 AND 1 #10 GROUND IN 1-1/4" CONDUIT.
4. LOBBY 101, TOILETS AND MULTI-PURPOSE/FITNESS AREA A100 LIGHTING SWITCH CONTROL LOCATION. SEE DETAIL SHEET E-7.
5. PROVIDE JUNCTION OR PULL BOXES AS NECESSARY.
6. UNLESS NOTED OTHERWISE, ALL CONDUCTORS AND GROUND TO LIGHT FIXTURES "H" AND "J" SHALL BE #10 AND ALL CONDUIT SHALL BE 3/4"
7. TO LIGHTING SWITCH CONTROL LOCATION.

REVISIONS

No	Date	Item	Ref

SEAL

SEAL

STATE OF MARYLAND
CLIFFORD L. CLAGGETT III
No. 15887
REGISTERED PROFESSIONAL ENGINEER

CLAGGETT ENGINEERING
18 GOLDSBOROUGH STREET
EASTON, MARYLAND 21601
TEL (410) 820-9173
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CE#: TAA0203

Todd & Associates Inc Architects
218 North Division Street
Salisbury Maryland
410-749-2447

Worcester County Recreation Center

Snow Hill, Maryland

Lighting Floor Plans, Lighting Fixture Schedule & Notes

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Project	0127
Scale	AS NOTED
Date	3-2-04
Last Rev	

E-1

460f

JOHN W TIPPER (CANNON MORRISON) 7/6/2004

1) LIGHTS ON THE SIDE BUILDING TYPE "K" & "M" NEED TO KNOW HOW HIGH TO MOUNT ON WALLS ✓ IN CENTER OF BAND @ 9'-8" 16' ABOVE GRD

2) PRINT "E-1" SPECIAL NOTE #4 NEED TO KNOW MORE ABOUT WHAT YOU HAD IN MIND. THE NOTE #4 SAID (SEE DETAIL SHEET E-2). I SEE LIGHTING CONTACTOR PANEL IN STORAGE ROOM "A-102" BUT I DO NOT SEE ANYTHING FOR SWITCH CONTROLS IN CONTROL ROOM "106" SEE ATTACHED.

3) NEED TO KNOW LOCATION OF CONTROLS FOR CURTAIN IN MULTIPURPOSE / FITNESS ARENA. ARCH. TO RESPOND

4) NEED TO KNOW LOCATION OF CONTROLS FOR BASKETBALL NETS IN MULTIPURPOSE / FITNESS ARENA ARCH. TO RESPOND.

5) NEED TO KNOW IF THE WALL IN STORAGE RM. "A-101" WILL HOLD THE 45 KVA TRANSFORMER. IT IS CALLED FOR WALL BRACKET AT 8'-0" AFF. THE TRANSFORMER WEIGHT IS 338 LB.? ARCH. TO RESPOND.

CLAGGETT ENGINEERING

18 Goldsborough Street – P.O. Box 1746 – Easton, Maryland 21601
(410) 820-9173 – FAX (410) 820-7220

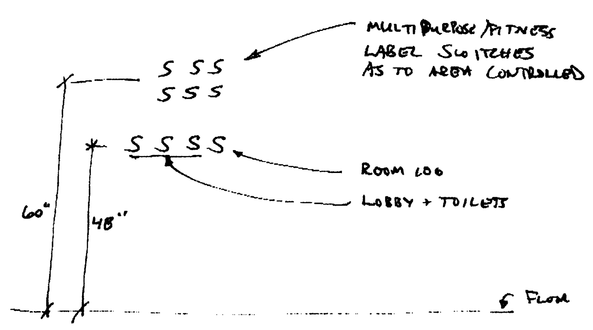
Fax Transmittal

DATE	7-6-04	JOB NO.	TARVLIB
ATTENTION	George Phillipson		
RE	Worcester Co. Rec Center		

TO SPN
1-410-632-3647

WE ARE FAXING TO YOU 2 PAGES, INCLUDING THIS COVER SHEET.

REMARKS: SWITCH CONTROL LOCATION DETAIL:



ROOM 106 WALL ELEVATION
NO SCALE.

PAM CAY. TODD + ASSOCIATES
1-410-749-8480

SIGNED: L. Claggett

JUL-06-04 10:22A P.01

SURFACE MOUNTED
120/208V, 3PH, 4W.

PANEL "L1"
(DOUBLE PANEL WITH FEED THROUGH LUGS)

MAIN BKR 200A
MAIN LUGS —

POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES	LOAD K.V.A. A ~	LOAD K.V.A. B ~	LOAD K.V.A. C ~	POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES
1	20	1				BEV. COOLER & WARM DRAWER	1.1 / 0.2			2	20	1	2#12	1#12	1/2	HOOD LIGHTS
3	20	1	4#12	1#12	3/4	BEV. COOLER & WARM DRAWER		1.1 / 0.2		4	20	1	2#12	1#12	1/2	HOOD FIRE EXTINGUISHING SYSTEM
5	20	1				BEV. COOLER			0.8 / 0.6	6	20	1	2#10	1#10	3/4	GYM RECEPTACLE
7	20	1	2#12	1#12	3/4	ICE MAKER	1.4 / 0.8			8	20	1				WOMENS TOILET – 116
9	20	1	2#12	1#12	3/4	FOOD WARMER		0.4 / 0.4		10	20	1	4#12	1#12	3/4	MENS TOILET – 115
11	–	–	–	–	–	SHUNT TRIP			0.4	12	20	1				LOBBY –MISC. RECEPTACLES
13	20	1	2#12	1#12	1/2	FIRE ALARM CONTROL PANEL	0.2 / 0.4			14	20	1				RECEPTACLES – 118, 117
15	20	1	2#12	1#12	3/4	FREEZER BASE		1.2 / 0.4		16	20	1	4#12	1#12	3/4	RECEPTACLES – 104, A100
17	–	–	–	–	–	SHUNT TRIP			0.4	18	20	1				RECEPTACLES – A100, EXT. RECEPT.
19							2.4 / 0.2			20	20	1	2#12	1#12	1/2	WATER HEATER AND PUMP
21	30	3	3#10	1#10	3/4	PIZZA OVEN		2.4 / 0.2		22	20	1	2#12	1#12	1/2	FURN–1
23									2.4 / 0.2	24	20	1	2#12	1#12	1/2	FURN–2
25	20	1	2#12	1#12	1/2	REFRIG. COUNTER	1.0 / 0.8			26	20	1	2#12	1#12	1/2	FAN–4 AND MOTOR LOUVER
27	20	1	2#12	1#12	3/4	REFRIG. COUNTER		1.0 / 0.4		28	20	1	2#12	1#12	1/2	RECEPTACLES – MECH. ATTIC–200
29	–	–	–	–	–	SHUNT TRIP			1.4 / 0.2	30	20	1	2#10	1#10	3/4	EXTERIOR DOOR LIGHTS
31	20	1	2#12	1#12	1/2	HOT DOG ROLLER GRILLE	– / 0.4			32	20	1				
33	20	1	2#12	1#12	1/2	HOT FOOD DISPLAY		1.5 / 0.4		34	20	1	4#12	1#12	3/4	KITCHEN RECEPTACLES
35	20	1	2#12	1#12	3/4	HOT HOLDING BIN			1.3 / 0.8	36	20	1				
37	–	–	–	–	–	SHUNT TRIP	– / 0.2			38	20	1	2#12	1#12	1/2	DRY PIPE AIR COMPRESSOR
39	30	2	2#10	1#10	3/4	WALK–IN CONDENSER		1.9 / 1.3		40	25	2	2#10	1#10	3/4	ERV–1
41									1.9 / 2.1	42						
43	15	1	2#12	1#12	1/2	WALK–IN EVAPORATOR	1.0 / 0.7			44	20	1	2#12	1#12	1/2	VVT CONTROLS
45	15	1	2#12	1#12	1/2	WALK–IN EVAPORATOR		1.0 / 0.7		46	15	1	2#12	1#12	1/2	UH–1
47									0.4	48	20	1	2#12	1#12	1/2	TEL. RECEPTACLE MECH. 118
49							– / 1.9			50	30	2	2#10	1#10	3/4	CU–1
51								– / 1.9		52						
53									–	54	20	1	–	–	–	SPARE
55							–			56	20	1	–	–	–	SPARE
57								–		58	20	1	–	–	–	SPARE
59	–	–	–	–	–	SPACE			–	60	20	1	–	–	–	SPARE
–						CONNECTED K.V.A. PER PHASE	13.2	16.8	12.7							
–						CONNECTED AMPS PER PHASE	–	–	–							

42.7 KVA x 1.25 D.F. = 53.4 KVA /1.73/.208 = 149 AMPS.

CONTROL SHUNT TRIP WITH HOOD FIRE SUPRESSION SYSTEM.

FLUSH MOUNTED
277/480V, 3PH, 4W.

PANEL "L2"

MAIN BKR 125A
MAIN LUGS —

POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES	LOAD K.V.A. A ~	LOAD K.V.A. B ~	LOAD K.V.A. C ~	POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES
1	20	1	2#10	1#10	3/4	GYM RECEPTACLES	0.4 / 0.6			2	20	1				OFFICE RECEPTACLES – 109
3	20	1	2#10	1#10	3/4	NET WINCH		1.7 / 0.8		4	20	1	4#12	1#12	3/4	OFFICE RECEPTACLES – 110
5	20	1	2#10	1#10	3/4	NET WINCH			1.7 / 0.8	6	20	1				MISC. RECEPTACLES
7	20	1	2#10	1#10	3/4	NET WINCH	1.7 / 0.4			8	20	1				
9	20	1	2#10	1#10	3/4	NET WINCH		1.7 / 0.4		10	20	1	4#12	1#12	3/4	LOUNGE RECEPTACLES
11	20	1	2#10	1#10	3/4	NET WINCH			1.7 / 0.4	12	20	1				
13	20	1	2#10	1#10	3/4	NET WINCH	1.7 / 0.8			14	20	1				
15	20	1	2#10	1#10	3/4	NET WINCH		1.7 / 0.8		16	20	1	4#12	1#12	3/4	CONTROL RECEPTACLE
17	20	1	2#10	1#10	3/4	NET WINCH			1.7 / 0.8	18	20	1				
19	20	1	2#8	1#10	3/4	CEILING FANS	1.0 / 0.8			20	20	1				
21	20	1	2#10	1#10	3/4	EXTERIOR DOOR LIGHTS		0.2 / 0.8		22	20	1	4#12	1#12	3/4	VENDING RECEPTACLE
23									0.8	24	20	1				MISC. RECEPTACLE
25							– / 1.2			26	20	1	2#10	1#10	3/4	MOTOR OPERATED LOUVERS
27	20	1	–	–	–	SPARE		1.2		28	20	1	2#10	1#10	3/4	MOTOR OPERATED LOUVERS
29	–	–	–	–	–	SPACE			–	30	–	–	–	–	–	SPACE
–						CONNECTED K.V.A. PER PHASE	8.2	8.7	7.3							
–						CONNECTED AMPS PER PHASE	–	–	–							

24.2 KVA x 1.25 D.F. = 30.3 KVA /1.73/.208 = 84 AMPS.

SURFACE MOUNTED
277/480V, 3PH, 4W.

PANEL "H1"

MAIN BKR —
MAIN LUGS 200A

POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES	LOAD K.V.A. A ~	LOAD K.V.A. B ~	LOAD K.V.A. C ~	POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES
1							0.9 / 1.8			2						
3	15	3	3#12	1#12	3/4	OVERHEAD DOOR		0.9 / 1.8		4	20	2	2#8	1#10	1	SITE & WALKWAY LIGHTS
5									0.9 / 1.1	6	20	2	2#10	1#10	3/4	BUILDING LIGHTS
7							1.0 / 1.1			8						
9	15	3	3#12	1#12	3/4	JOCKEY PUMP		1.0 / 3.4		10	20	1				
11									1.0 / 3.4	12	20	1				
13							1.0 / 3.4			14	20	1				
15	15*	3	3#12	1#12	3/4	FAN–1		1.0 / 3.4		16	20	1	10#8	1#10	1–1/2	GYM LIGHTS
17									1.0 / 3.4	18	20	1				
19							1.0 / 3.4			20	20	1				
21	15*	3	3#12	1#12	3/4	MUA–1		1.0 / 3.2		22	20	1	2#12	1#12	3/4	LGHTS – 102, 103 & 105–112 & A101
23									1.0 / 1.3	24	20	1	2#12	1#12	3/4	LGHTS – 100, 101 & EXT. ENTRY
25							2.6 / 3.8			26	20	1	2#12	1#12	3/4	LGHTS – 114–120, 200 & A101
27	20*	3	3#12	1#12	3/4	AHU–2		2.6 / 1.3		28						
29									2.6 / 1.3	30	20*	3	3#10	1#10	3/4	FAN–2
31							8.0 / 1.3			32						
33	45*	3	3#6	1#10	1	CU–2		8.0 / 1.3		34						
35									8.0 / 1.3	36	20*	3	3#10	1#10	3/4	FAN–3
37							1.0 / 1.3			38						
39	20	3	3#10	1#10	3/4	SEWAGE LIFT PUMP		1.0 / –		40	20	1	–	–	–	SPARE
41									1.0	42	–	–	–	–	–	SPACE
–						CONNECTED K.V.A. PER PHASE	32.6	30.9	28.5							
–						CONNECTED AMPS PER PHASE	–	–	–							

92 KVA x 1.2 D.F. = 110 KVA /1.73/.480 = 133 AMPS.

* NOTE: ASTERISK INDICATES HACR BREAKER

SURFACE MOUNTED
277/480V, 3PH, 4W.

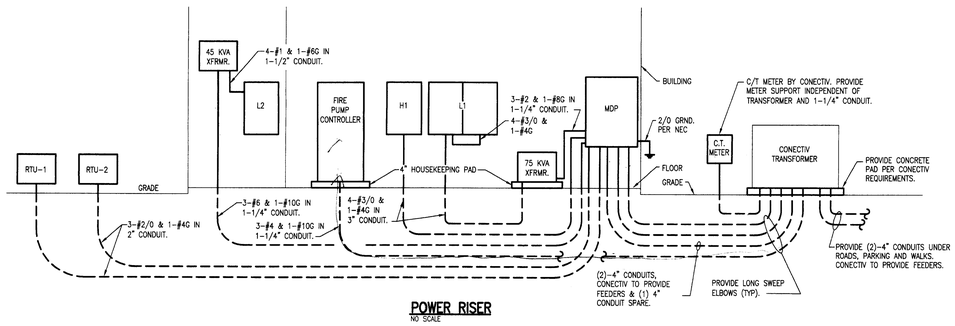
PANEL "MDP"

MAINS: 800A
MAIN CKT BKR: 600A

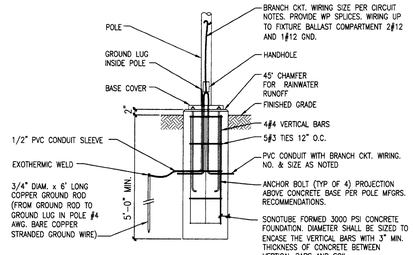
CKT NO.	EQUIPMENT SERVED	BREAKER FRAME	BREAKER TRIP	BREAKER POLE	FEEDER WIRE NO. AND SIZE	FEEDER WIRE GRND.	FEEDER WIRE COND.	LOAD KVA	REMARKS
1	PANEL–H1	225	200	3	4#3/0	1 #4	3"	110	–
2	PANEL–L1	125	125	3	3#2	1 #8	1–1/4"	54	VIA 75 KVA TRANSFORMER
3	PANEL–L2	125	100	3	3#6	1 #10	1–1/4"	30	VIA 45 KVA TRANSFORMER
4	RTU–1	225	125	3	3#2/0	1 #4	2"	102	–
5	RTU–2	225	150	3	3#2/0	1 #4	2"	108	–
6	SPARE	225	200	3					
7	SPACE	225	–						
8	SPACE	225	–						
9	SPACE	225	–						
							TOTAL	401 KVA	

DRY TYPE TRANSFORMER SCHEDULE

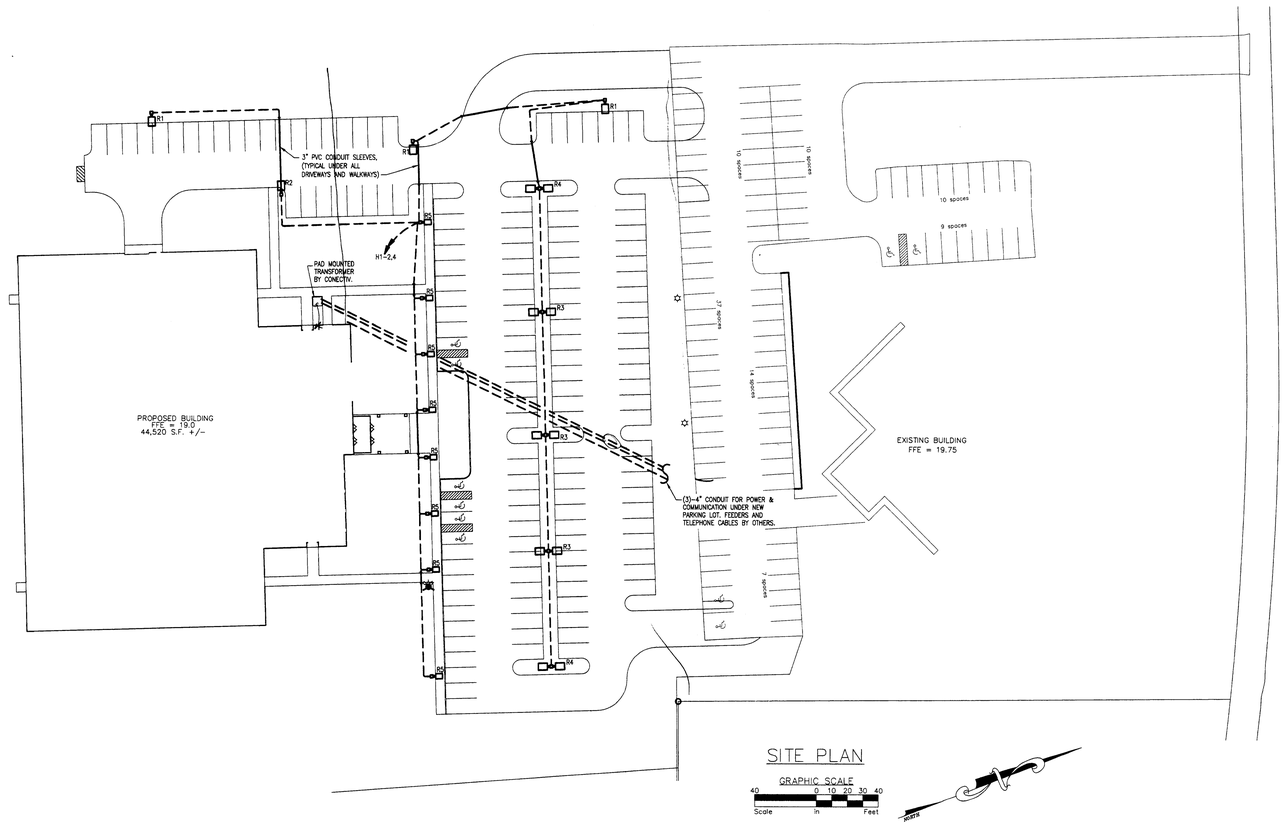
KVA	PRIMARY DELTA ø	PRIMARY DELTA VOLTS	SECONDARY "Y" VOLTS	SECONDARY "Y" WIRING NO.	SECONDARY "Y" WIRING SIZE	SECONDARY "Y" WIRING C.	SYSTEM GROUND NO.	SYSTEM GROUND SIZE	SYSTEM GROUND C.	MOUNTING
75	3	480	120/208	4	3/0	3	1	4	3/4	FLOOR ON 4" PAD
				1	4G					
45	3	480	120/208	4	1	1–1/2	1	6	3/4	WALL BRACKET 8'–0" AFF
				1	6G					



POWER RISER
NO SCALE



POLE BASE DETAIL
NO SCALE



SITE PLAN
GRAPHIC SCALE
40 0 10 20 30 40
Scale in Feet

REVISIONS

No	Date	Item	Ref

SEAL

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Snow Hill, Maryland

Lighting Site Plan, Schedules, Power Riser & Misc. Details

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Project	0127
Scale	AS NOTED
Date	3-2-04
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E-3

SURFACE MOUNTED
120/208V, 3PH, 4W.

PANEL "L1"
(DOUBLE PANEL WITH FEED THROUGH LUGS)

MAIN BKR 200A
MAIN LUGS –

POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES	LOAD K.V.A. A ~	LOAD K.V.A. B ~	LOAD K.V.A. C ~	POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES
1	20	1					1.1 0.2			2	20	1	2#12	1#12	1/2	HOOD LIGHTS
3	20	1	4#12	1#12	3/4	BEV. COOLER & WARM DRAWER		1.1 0.2		4	20	1	2#12	1#12	1/2	HOOD FIRE EXTINGUISHING SYSTEM
5	20	1							0.8 0.6	6	20	1	2#10	1#10	3/4	GYM RECEPTACLE
7	20	1	2#12	1#12	3/4	ICE MAKER	1.4 0.8			8	20	1				WOMENS TOILET – 116
9	20	1	2#12	1#12	3/4	FOOD WARMER		0.5 0.4		10	20	1	4#12	1#12	3/4	MENS TOILET – 115
11	–	–	–	–	–	SHUNT TRIP			– 0.4	12	20	1				LOBBY –MISC. RECEPTACLES
13	20	1	2#12	1#12	1/2	FIRE ALARM CONTROL PANEL	0.8 0.4			14	20	1				RECEPTACLES – 118, 117
15	20	1	2#12	1#12	3/4	FREEZER BASE		1.2 0.4		16	20	1	4#12	1#12	3/4	RECEPTACLES – 104, A100
17	–	–	–	–	–	SHUNT TRIP			– 0.4	18	20	1				RECEPTACLES – A100, EXT. RECEPT.
19							2.3 0.3			20	20	1	2#12	1#12	1/2	WATER HEATER AND PUMP
21	30	3	3#10	1#10	3/4	PIZZA OVEN		2.5 0.2		22	20	1	2#12	1#12	1/2	FURN–1
23									2.4 0.2	24	20	1	2#12	1#12	1/2	FURN–2
25	20	1	2#12	1#12	1/2	REFRIG. COUNTER	1.0 0.8			26	20	1	2#12	1#12	1/2	FAN–4 AND MOTOR LOUVER
27	20	1	2#12	1#12	3/4	REFRIG. COUNTER		1.0 0.4		28	20	1	2#12	1#12	1/2	RECEPTACLES – MECH. ATTIC–200
29	–	–	–	–	–	SHUNT TRIP			1.4 0.2	30	20	1	2#10	1#10	3/4	EXTERIOR DOOR LIGHTS
31	20	1	2#12	1#12	1/2	HOT DOG ROLLER GRILLE	– 0.4			32	20	1				
33	20	1	2#12	1#12	1/2	HOT FOOD DISPLAY		1.5 0.4		34	20	1	4#12	1#12	3/4	KITCHEN RECEPTACLES
35	20	1	2#12	1#12	3/4	HOT HOLDING BIN			1.1 0.8	36	20	1				
37	–	–	–	–	–	SHUNT TRIP	– 0.2			38	20	1	2#12	1#12	1/2	DRY PIPE AIR COMPRESSOR
39	30	2	2#10	1#10	3/4	WALK–IN CONDENSER		1.9 2.1		40	25	2	2#10	1#10	3/4	ERV–1
41									1.9 2.1	42						
43	15	1	2#12	1#12	1/2	WALK–IN EVAPORATOR	1.9 0.7			44	20	1	2#12	1#12	1/2	VVT CONTROLS
45	15	1	2#12	1#12	1/2	WALK–IN EVAPORATOR		1.0 0.2		46	15	1	2#12	1#12	1/2	UH–1
47							– 1.9		– 0.4	48	20	1	2#12	1#12	1/2	TEL. RECEPTACLE MECH. 118
49								– 1.9		50						
51									–	52						
53							–			54	20	1	–	–	–	SPARE
55								–		56	20	1	–	–	–	SPARE
57							–			58	20	1	–	–	–	SPARE
59	–	–	–	–	–	SPACE		–	–	60	20	1	–	–	–	SPARE
–						CONNECTED K.V.A. PER PHASE	13.2	16.8	12.7							
–						CONNECTED AMPS PER PHASE	–	–	–							

42.7 KVA x 1.25 D.F. = 53.4 KVA /1.73/.208 = 149 AMPS.

CONTROL SHUNT TRIP WITH HOOD FIRE SUPRESSION SYSTEM.

FLUSH MOUNTED
277/480V, 3PH, 4W.

PANEL "L2"

MAIN BKR 125A
MAIN LUGS –

POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES	LOAD K.V.A. A ~	LOAD K.V.A. B ~	LOAD K.V.A. C ~	POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES
1	20	1	2#10	1#10	3/4	GYM RECEPTACLES	0.6 0.6			2	20	1				OFFICE RECEPTACLES – 109
3	20	1	2#10	1#10	3/4	NET WINCH		1.7 0.8		4	20	1	4#12	1#12	3/4	OFFICE RECEPTACLES – 110
5	20	1	2#10	1#10	3/4	NET WINCH			1.7 0.8	6	20	1				MISC. RECEPTACLES
7	20	1	2#10	1#10	3/4	NET WINCH	1.7 0.4			8	20	1				
9	20	1	2#10	1#10	3/4	NET WINCH		1.7 0.4		10	20	1	4#12	1#12	3/4	LOUNGE RECEPTACLES
11	20	1	2#10	1#10	3/4	NET WINCH			1.7 0.4	12	20	1				
13	20	1	2#10	1#10	3/4	NET WINCH	1.7 0.6			14	20	1				
15	20	1	2#10	1#10	3/4	NET WINCH		1.7 0.4		16	20	1	4#12	1#12	3/4	CONTROL RECEPTACLE
17	20	1	2#10	1#10	3/4	NET WINCH			1.7 0.4	18	20	1				
19	20	1	2#8	1#10	3/4	CEILING FANS	1.0 0.8			20	20	1				
21	20	1	2#10	1#10	3/4	EXTERIOR DOOR LIGHTS		0.2 0.6		22	20	1	4#12	1#12	3/4	VENDING RECEPTACLE
23									0.8	24	20	1				MISC. RECEPTACLE
25							– 1.2			26	20	1	2#10	1#10	3/4	MOTOR OPERATED LOUVERS
27	20	1	–	–	–	SPARE		1.2 –		28	20	1	2#10	1#10	3/4	MOTOR OPERATED LOUVERS
29	–	–	–	–	–	SPACE			–	30	–	–	–	–	–	SPACE
–						CONNECTED K.V.A. PER PHASE	8.2	8.7	7.3							
–						CONNECTED AMPS PER PHASE	–	–	–							

24.2 KVA x 1.25 D.F. = 30.3 KVA /1.73/.208 = 84 AMPS.

SURFACE MOUNTED
277/480V, 3PH, 4W.

PANEL "H1"

MAIN BKR –
MAIN LUGS 200A

POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES	LOAD K.V.A. A ~	LOAD K.V.A. B ~	LOAD K.V.A. C ~	POLE NO.	TRIP AMP	BKR POLE	WIRE	GND WIRE	COND	SERVES
1							0.9 1.8			2						
3	15	3	3#12	1#12	3/4	OVERHEAD DOOR		0.9 1.8		4	20	2	2#8	1#10	1	SITE & WALKWAY LIGHTS
5									0.9 1.1	6						
7							1.0 1.1			8	20	2	2#10	1#10	3/4	BUILDING LIGHTS
9	15	3	3#12	1#12	3/4	JOCKEY PUMP		1.0 3.4		10	20	1				
11									1.0 3.4	12	20	1				
13							1.0 3.4			14	20	1	10#8	1#10	1–1/2	GYM LIGHTS
15	15*	3	3#12	1#12	3/4	FAN–1		1.0 3.4		16	20	1				
17									1.0 3.4	18	20	1				
19							1.0 3.4			20	20	1				
21	15*	3	3#12	1#12	3/4	MUA–1		1.0 3.2		22	20	1	2#12	1#12	3/4	LGHTS – 102, 103 & 105–112 & A101
23									1.0 1.5	24	20	1	2#12	1#12	3/4	LGHTS – 100, 101 & EXT. ENTRY
25							2.5 3.8			26	20	1	2#12	1#12	3/4	LGHTS – 114–120, 200 & A101
27	20*	3	3#12	1#12	3/4	AHU–2		2.5 1.3		28						
29									2.5 1.3	30	20*	3	3#10	1#10	3/4	FAN–2
31							0.0 1.3			32						
33	45*	3	3#6	1#10	1	CU–2		0.0 1.3		34						
35									0.0 1.3	36	20*	3	3#10	1#10	3/4	FAN–3
37							1.0 1.3			38						
39	20	3	3#10	1#10	3/4	SEWAGE LIFT PUMP		1.0 –		40	20	1	–	–	–	SPARE
41									1.0	42	–	–	–	–	–	SPACE
–						CONNECTED K.V.A. PER PHASE	32.6	30.9	28.5							
–						CONNECTED AMPS PER PHASE	–	–	–							

92 KVA x 1.2 D.F. = 110 KVA /1.73/.480 = 133 AMPS.

* NOTE: ASTERISK INDICATES HACR BREAKER

SURFACE MOUNTED
277/480V, 3PH, 4W.

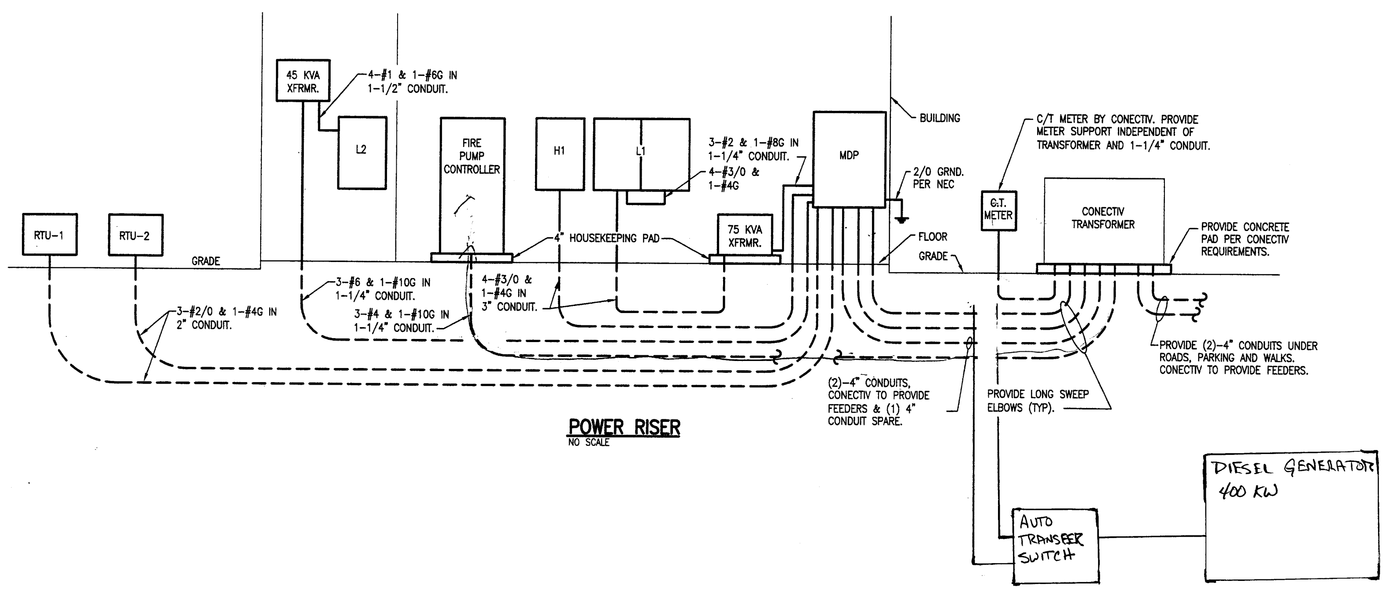
PANEL "MDP"

MAINS: 800A
MAIN CKT BKR: 600A

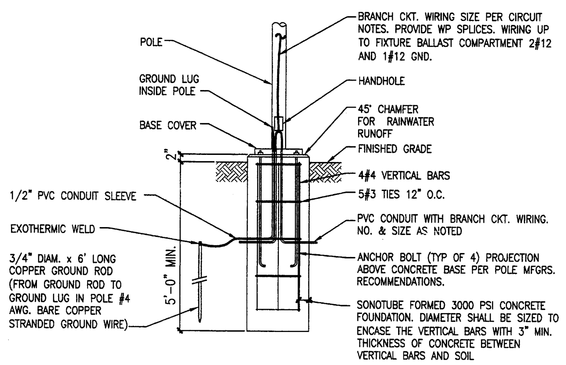
CKT NO.	EQUIPMENT SERVED	BREAKER FRAME	BREAKER TRIP	BREAKER POLE	FEEDER WIRE NO. AND SIZE	FEEDER WIRE GRND.	FEEDER WIRE COND.	LOAD KVA	REMARKS
1	PANEL–H1	225	200	3	4#3/0	1 #4	3"	110	–
2	PANEL–L1	125	125	3	3#2	1 #8	1–1/4"	54	VIA 75 KVA TRANSFORMER
3	PANEL–L2	125	100	3	3#6	1 #10	1–1/4"	30	VIA 45 KVA TRANSFORMER
4	RTU–1	225	125	3	3#2/0	1 #4	2"	102	–
5	RTU–2	225	150	3	3#2/0	1 #4	2"	108	–
6	SPARE	225	200	3					
7	SPACE	225	–						
8	SPACE	225	–						
9	SPACE	225	–						
							TOTAL	401 KVA	

DRY TYPE TRANSFORMER SCHEDULE

KVA	PRIMARY DELTA ø	PRIMARY DELTA VOLTS	SECONDARY "Y" VOLTS	SECONDARY "Y" WIRING NO.	SECONDARY "Y" WIRING SIZE	SECONDARY "Y" WIRING C.	SYSTEM GROUND NO.	SYSTEM GROUND SIZE	SYSTEM GROUND C.	MOUNTING
75	3	480	120/208	4 1	3/0 4G	3	1	4	3/4	FLOOR ON 4" PAD
45	3	480	120/208	4 1	1 6G	1–1/2	1	6	3/4	WALL BRACKET 6'–0" AFF

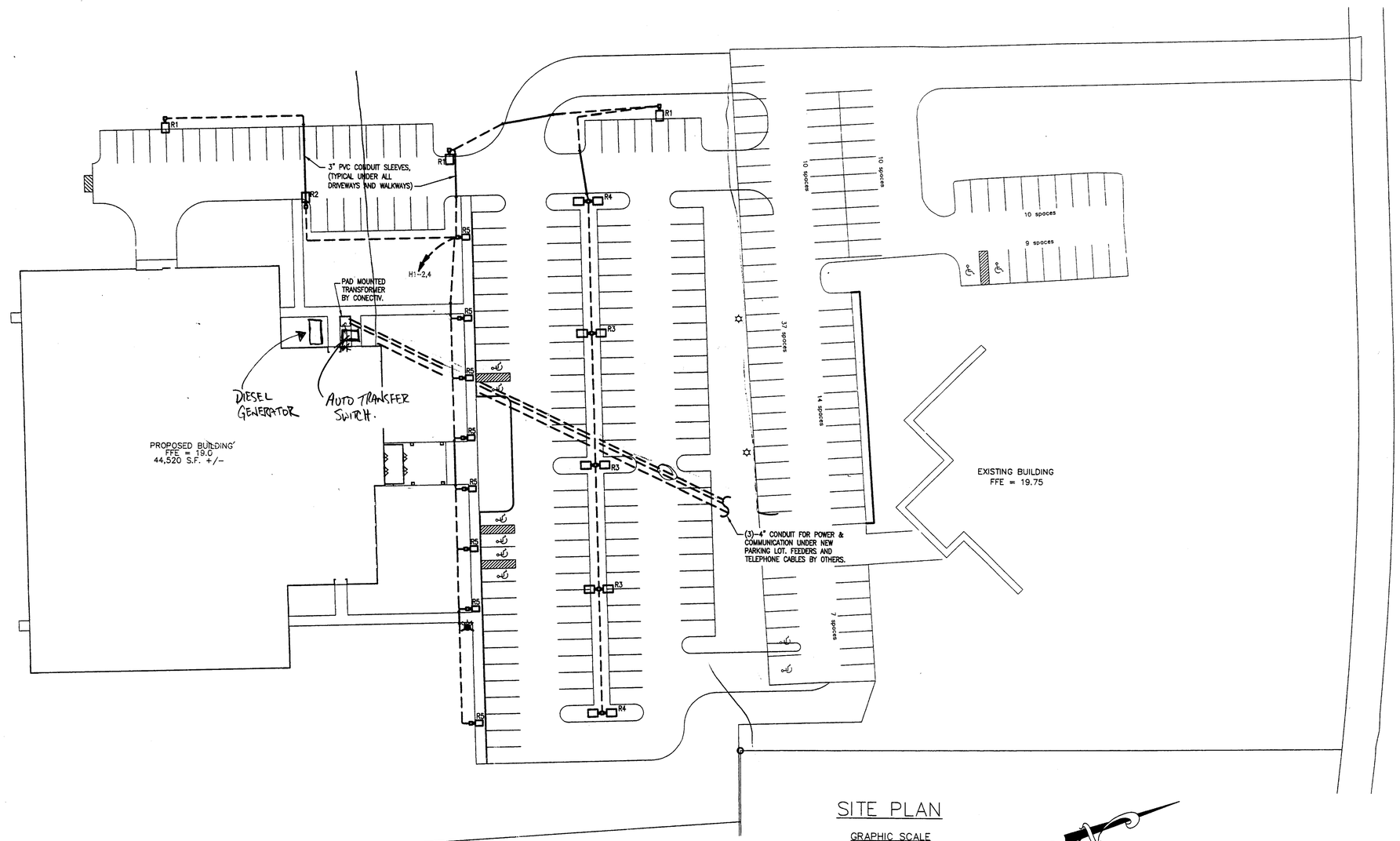


POWER RISER
NO SCALE



POLE BASE DETAIL
NO SCALE

NOTE:
1. DIESEL GENERATOR ADDED BY WORCESTER COUNTY MAINTENANCE AFTER ORIGINAL CONSTRUCTION.



SITE PLAN
GRAPHIC SCALE
40 0 10 20 30 40
Scale in Feet

REVISIONS

No	Date	Item	Ref

SEAL

SEAL

ADDED GENERATOR NOTES & SCHEMATIC 2/24/11 - WTB. FOR COUNTY DOCUMENTATION
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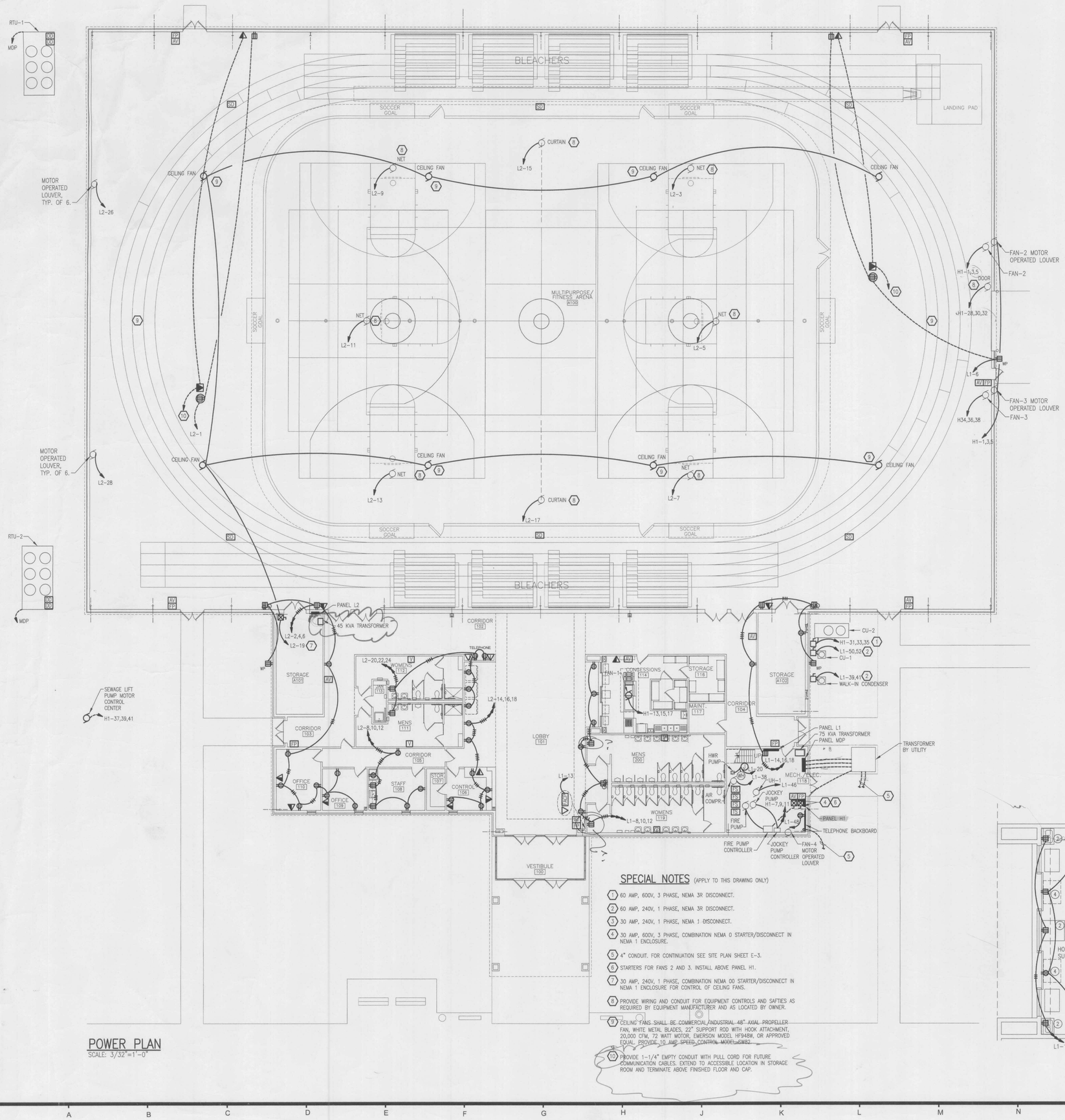


SPECIAL NOTES (APPLY TO THIS DRAWING ONLY)

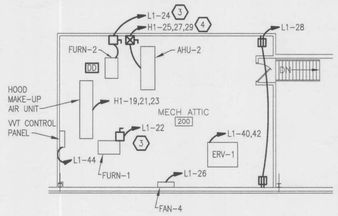
1. 60 AMP, 600V, 3 PHASE, NEMA 3R DISCONNECT.
2. 60 AMP, 240V, 1 PHASE, NEMA 3R DISCONNECT.
3. 30 AMP, 240V, 1 PHASE, NEMA 1 DISCONNECT.
4. 30 AMP, 600V, 3 PHASE, COMBINATION NEMA 0 STARTER/DISCONNECT IN NEMA 1 ENCLOSURE.
5. 4" CONDUIT. FOR CONTINUATION SEE SITE PLAN SHEET E-3.
6. STARTERS FOR FANS 2 AND 3. INSTALL ABOVE PANEL H1.
7. 30 AMP, 240V, 1 PHASE, COMBINATION NEMA 00 STARTER/DISCONNECT IN NEMA 1 ENCLOSURE FOR CONTROL OF CEILING FANS.
8. PROVIDE WIRING AND CONDUIT FOR EQUIPMENT CONTROLS AND SAFTIES AS REQUIRED BY EQUIPMENT MANUFACTURER AND AS LOCATED BY OWNER.
9. CEILING FANS SHALL BE COMMERCIAL/INDUSTRIAL 48" AXIAL PROPELLER FAN, WHITE METAL BLADES, 22" SUPPORT ROD WITH HOOK ATTACHMENT, 20,000 CFM, 72 WATT MOTOR, EMERSON MODEL HF948W, OR APPROVED EQUAL. PROVIDE 10 IMC SPEED CONTROL MODEL CM82.
10. PROVIDE 1-1/4" EMPTY CONDUIT WITH PULL CORD FOR FUTURE COMMUNICATION CABLES. EXTEND TO ACCESSIBLE LOCATION IN STORAGE ROOM AND TERMINATE ABOVE FINISHED FLOOR AND CAP.

POWER PLAN
SCALE: 3/32"=1'-0"

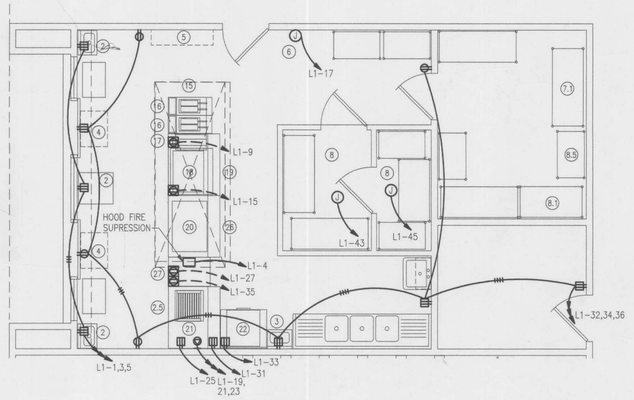
ELECTRICAL LEGEND

SYMBOL	DESCRIPTION AND/OR SPECIFICATION
	RECEPTACLE – 20A., 125V, DUPLEX, MH 1'-6", UON. TAMPERPROOF.
	RECEP., 20A, 277V, SIMPLEX., M.H. AT ROOF FRAMING, UON.
	SPECIAL PURPOSE OUTLET, M.H. 1'-6", UON
	RECEPTACLE – 20A., 125V. QUADRAPLEX, MH 1'-6", OR 6" ABOVE COUNTER TOP, UON, VERIFY COUNTER HEIGHT.
WP	RECEPTACLE – 20A., 125V. DUPLEX, GROUND FAULT INTERRUPTER TYPE (GFI), MH 4'-0", MH 6" ABOVE COUNTER TOP, UON. VERIFY COUNTER HEIGHT AND BACKSPLASH HEIGHT PRIOR TO START OF ROUGH IN WORK, TAMPERPROOF. WP DENOTES WEATHERPROOF.
	RECEPTACLE – 20A., 125V. DUPLEX, GROUND FAULT INTERRUPTER TYPE (GFI) W/ WETHERPROOF BOX, STUB ABOVE FLOOR.
	RECEPTACLE, SPECIAL PURPOSE, SINGLE BLACK, MOUNTED ON A 4" ROUND BOX COVER. SEE SPECIAL NOTE FOR SPECIFIC MOUNTING REQUIREMNTS ON SHEET WHERE USED.
	CONDUIT – ABOVE CEILING OR IN WALLS
	CONDUIT – IN OR UNDER SLAB FLOOR, OR BELOW GRADE
H	HOMERUN TO PANEL – LETTER AND NUMBER INDICATES PANEL AND BRANCH CIRCUIT NUMBER. NUMBER OF CROSSLINES INDICATES NUMBER OF CONDUCTORS PLUS GROUND CONDUCTOR (NOT SHOWN) 2#12, 1#12 GROUND IN 3/4"C, UON.
S S3 S4 S5 S7	SWITCH – SINGLE POLE, 3 WAY–SINGLE POLE, 3 WAY, DIMMER, TIMER 48" AFF UON.
SM	MANUAL MOTOR STARTER SWITCH
J	JUNCTION BOX
	DUPLEX MULTI PORT (NUMBER INDICATES QUANTITY) –TELEPHONE/DATA OUTLET – WALL MH 1'-6" UON, PROVIDE DEEP BOX AND 1" BUSHED CONDUIT UP TO ACCESSIBLE CEILING SPACE. PROVIDE ONE, EIGHT CONDUCTOR UTP, PLENUM RATED, CAT. 5E CABLE PER OUTLET. EXTEND WIRING TO RESPECTIVE COMPUTER OR TELEPHONE BOARD AND TERMINATE ON PUNCH PANEL.
	TELEPHONE OUTLET – WALL MH 1'-6" UON.
	DATA OUTLET – WALL MH 1'-6" UON.
	FAX OUTLET – WALL MH 1'-6" UON.
M	MOTOR – HVAC
	DISCONNECT SWITCH – UNFUSED, COMB. STARTER SWITCH/DISCONNECT, MH 4'-6" TO TOP
	PLYWOOD BACKBOARD FOR TELEPHONE, DATA, COMMUNICATIONS EQUIPMENT, SIZE VARIES, MINIMUM SIZE 2'x4'.
	PANEL BOARD – SURFACE MOUNTED, FLUSH MOUNTED, 5'-6" TO TOP
PC	PHOTO CELL
1 2	DRAWING NOTE, SPECIAL EQUIPMENT NO.
FP	FIRE ALARM PULL STATION MH 3'-6" WITH FLIP UP PROTECTIVE CLEAR POLYCARBONATE SHIELD AND FRAME THAT FITS OVER FULL STATION. WHEN LIFTED TO GAIN ACCESS TO PULL STATION IT SOUNDS A BUILT–IN 120DC WARNING HORN.
SM	FIRE ALARM SMOKE DETECTOR
FACP	FIRE ALARM CONTROL PANEL, FLUSH MOUNTED
DM	FIRE ALARM DUCT SMOKE DETECTOR
AV V	FIRE ALARM – AUDIO/VISUAL ALARM, VISUAL ALARM, MH 6" BELOW FINISHED CEILING.
DS US	FIRE ALARM FLOW SWITCH, TAMPER SWITCH
	DETAIL NO., DRAWING NO.
	NIGHT LIGHT FIXTURE

UON	UNLESS OTHERWISE NOTED	PNL.	PANELBOARD
MH	MOUNTING HEIGHT	CONT.	CONTINUED
WP	WEATHER PROOF	MCB	MAIN CIRCUIT BREAKER
DIST.	DISTRIBUTION	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR



ATTIC POWER PLAN
SCALE: 3/32"=1'-0"



CONCESSION POWER PLAN
SCALE: 1/4"=1'-0"

REVISIONS

No	Date	Item	Ref

SEAL

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Power Floor Plans, Electrical Legend & Notes

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ELECTRICAL SPECIFICATIONS

1. PRODUCTS AND INSTALLATION SHALL COMPLY WITH ALL APPLICABLE LAWS, CODES, GOVERNMENT REGULATIONS, UTILITY COMPANY REQUIREMENTS, ETC. OF ALL AUTHORITIES HAVING JURISDICTION. WORK SHALL COMPLY WITH THE FOLLOWING CODES, STANDARDS AND ORGANIZATIONS:
- 2011 NATIONAL ELECTRIC CODE
- 2012 INTERNATIONAL BUILDING CODE
- 2012 INTERNATIONAL MECHANICAL CODE
- 2012 NATIONAL STANDARD PLUMBING CODE
- 2012 INTERNATIONAL ENERGY CODE
- NFPA
- UNDERWRITERS LABORATORY (UL), IRI, FM
- IESNA

WHERE CONFLICTS EXIST BETWEEN CODES, STANDARDS OR THIS SPECIFICATION THE HIGHER REQUIREMENT SHALL APPLY. DEVIATIONS FROM THE CONTRACT DOCUMENTS REQUIRED BY THE ABOVE AUTHORITIES SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW. OBTAIN PERMITS AND PAY ALL FEES. ARRANGE FOR ALL REQUIRED INSPECTIONS AND APPROVALS. CONFIRM ALL UTILITY COMPANY REQUIREMENTS AND CONNECTION POINTS IN FIELD, PRIOR TO STARTING WORK.

2. ALL SPECIFICATIONS AND DRAWINGS, I.E., ARCHITECTURAL, MECHANICAL, PLUMBING, AND ELECTRICAL ARE COMPLIMENTARY AND MUST BE USED IN COMBINATION TO OBTAIN COMPLETE CONSTRUCTION INFORMATION. ANY INFORMATION CONFLICTS WITHIN THE SPECIFICATIONS AND DRAWINGS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC. THEY ARE INTENDED TO SHOW THE APPROXIMATE LOCATIONS OF EQUIPMENT AND CONDUIT. THE ELECTRICAL CONTRACTOR SHALL LAYOUT ALL EQUIPMENT ROOMS TO MAKE SURE THE EQUIPMENT FITS IN THE ROOM OR SPACE SHOWN AND HAS ALL CLEARANCES REQUIRED BY THE NEC, PRIOR TO ORDER. EXACT LOCATION OF ALL EQUIPMENT SHALL BE VERIFIED IN THE FIELD AND ROUTING OF CONDUITS SHALL SUIT FIELD CONDITIONS.

3. WORK SHALL BE EXECUTED IN A GOOD WORKMANLIKE MANNER USING MECHANICS SKILLED IN THEIR RESPECTIVE TRADES. ALL EQUIPMENT AND MATERIALS SHALL BE NEW, FREE OF DEFECTS. SYSTEMS ARE TO BE COMPLETE AND WORKABLE IN ALL RESPECTS, PLACED IN OPERATION AND PROPERLY ADJUSTED.

4. MAINTAIN THE CONSTRUCTION PREMISES IN A NEAT AND ORDERLY CONDITION AT THE END OF EACH WORKING DAY. CLEAN UP, REMOVE AND LEGALLY DISPOSE OF ALL RUBBISH DAILY. CONTRACTOR SHALL PROTECT THEIR WORK AND EXISTING OR ADJACENT PROPERTY AGAINST WEATHER, TO MAINTAIN THEIR WORK, MATERIALS, APPARATUS AND FIXTURES FREE FROM INJURY OR DAMAGE. ANY WORK DAMAGED BY FAILURE TO PROVIDE PROTECTION REQUIRED, SHALL BE REMOVED AND REPLACED WITH NEW WORK AT THE CONTRACTOR'S EXPENSE.

5. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE SAFETY OF HIS WORKERS, ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES FOR COORDINATING THE WORK UNDER THIS CONTRACT. CONFORM TO ALL GENERAL AND SPECIAL CONDITIONS OF CONTRACT AS SPECIFIED BY ARCHITECT AND/OR OWNER.

6. IN CASES OF DOUBT AS TO THE WORK INTENDED, OR IN THE EVENT OF NEED FOR EXPLANATION THEREOF, THE CONTRACTOR SHALL REQUEST SUPPLEMENTARY INSTRUCTIONS FROM THE ENGINEER. NO CHANGES ARE TO BE MADE TO THE WORK OF THIS CONTRACT WITHOUT PRIOR KNOWLEDGE AND APPROVAL OF THE ENGINEER. THE CONTRACTOR SHALL HOLD THE OWNER AND ITS CONSULTANTS HARMLESS AGAINST ALL CLAIMS AND JUDGMENTS ARISING OUT OF THE CONTRACTORS PERFORMANCE OF THE WORK OF THIS CONTRACT. THE CONTRACTOR SHALL NOT PROCEED WITH ANY WORK, WHICH HE EXPECTS ADDITIONAL COMPENSATION BEYOND THE CONTRACT AMOUNT, WITHOUT WRITTEN AUTHORIZATION FROM THE APPROPRIATE AUTHORITY. FAILURE TO OBTAIN SUCH AUTHORIZATION SHALL INVALIDATE ANY CLAIM FOR EXTRA COMPENSATION.

7. ALL PRODUCTS SHALL COMPLY WITH 25/50 FLAME AND SMOKE HAZARD RATINGS PER ASTM E-84, NFPA 255 AND UL 723.

8. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO INSTALL ALL ELECTRICAL FIXTURES AND EQUIPMENT AS TO INSURE QUIET OPERATION. NO VIBRATION OR SOUND SHALL BE TRANSMITTED TO THE BUILDING, STRUCTURE OR OCCUPIED AREAS. THE DECISION OF THE ENGINEER AS TO THE QUIETNESS OF THE SYSTEM AND EQUIPMENT SHALL BE FINAL. IT SHALL BE THIS CONTRACTORS RESPONSIBILITY TO CORRECT OR REPLACE ANY NOISY FIXTURES OR EQUIPMENT AS REQUIRED.

WORK IN EXISTING BUILDINGS

1. EXISTING BUILDING IS TO REMAIN OCCUPIED AND ACCESSIBLE AT ALL TIMES. PROTECT THE BUILDING PREMISES AND ALL OCCUPANTS ON THE PROJECT SITE. THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGES CAUSED BY IMPROPER PROTECTION AND SHALL MAKE ALL NECESSARY REPLACEMENTS OR REPAIRS AT NO ADDITIONAL COST. MAKE ALL ARRANGEMENTS, MAINTAIN AND PAY ALL COSTS FOR TEMPORARY WATER, PLUMBING, POWER, LIGHTING, AND HEATING OR VENTILATION AS REQUIRED TO PROPERLY CONDUCT THE WORK OF THIS CONTRACT AND MAINTAIN SERVICES. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN FOR THE ENTIRE LENGTH OF THIS CONTRACT ALL EXITS, EXIT LIGHTING, FIRE PROTECTION DEVICES AND ALARMS TO CONFORM TO LOCAL BUILDING CODE REQUIREMENTS.

2. VERIFY POINTS OF CONNECTION BEFORE COMMENCING WORK. COORDINATE WORK WITH EXISTING WORK AND OTHER TRADES. REMOVE WASTE MATERIALS, DEBRIS, AND RUBBISH FROM SITE AND LEGALLY DISPOSE OF IT. THE OWNER HAS THE RIGHT OF FIRST REFUSAL ON EQUIPMENT, FIXTURES, DEVICES, ETC., REMOVED AND NOT REINSTALLED. DELIVER TO THE OWNER, AT THE OWNER'S DESIGNATED LOCATION, ITEMS ACCEPTED BY THE OWNER. DISPOSE OF IN A LEGAL MANNER ITEMS REJECTED BY THE OWNER.

3. EXISTING EQUIPMENT TO REMAIN OR TO BE RELOCATED WITHIN OR SERVING THE RENOVATED SPACE, WHICH IS DAMAGED OR DOES NOT COMPLY WITH THE SPECIFICATIONS, SHALL BE RESTORED TO LIKE NEW CONDITION SUBJECT TO REVIEW BY THE ARCHITECT AND ENGINEER. EQUIPMENT THAT CANNOT BE REPAIRED SHALL BE REPLACED WITH NEW MATERIALS MEETING THE SPECIFICATION REQUIREMENTS. CLEAN, REPAIR, AND RE-LAMP LIGHT FIXTURES THAT ARE TO BE REUSED. THE CONTRACTOR SHALL NOT PROCEED WITH ANY WORK, WHICH HE EXPECTS ADDITIONAL COMPENSATION BEYOND THE CONTRACT AMOUNT, WITHOUT WRITTEN AUTHORIZATION FROM THE APPROPRIATE AUTHORITY. FAILURE TO OBTAIN SUCH AUTHORIZATION SHALL INVALIDATE ANY CLAIM FOR EXTRA COMPENSATION.

4. SOME WORK SHOWN MAY REQUIRE PREMIUM TIME INCLUDING NOISE PRODUCING ACTIVITIES, ACCESS INTO ADJOINING SPACES & ACTIVITIES DISRUPTING MEP SERVICES. CONFIRM THE REQUIREMENTS FOR PREMIUM TIME OR SPECIAL PROCEDURES WITH THE OWNER/LANDLORD AND INCLUDE THE COST IN BID PROPOSAL. WORK RELATED TO THE EXISTING BUILDING SHALL BE COORDINATED TO MINIMIZE INTERFERENCE OR INTERRUPTION OF NORMAL BUILDING USE BY OWNER. REFER TO ARCHITECTURAL PLANS FOR ANY PHASING REQUIREMENTS. ARRANGE FOR AND OBTAIN OWNER'S PERMISSION FOR ANY SERVICE SHUTDOWNS.

5. THE CONTRACTOR, BY SUBMITTING THEIR BID PROPOSAL AGREES TO ACCEPT ALL EXISTING SITE CONDITIONS NOT SPECIFICALLY EXPECTED. ALL EXCEPTIONS SHALL BE PROVIDED IN WRITING TO THE ARCHITECT AND ENGINEER.

6. WHERE EXISTING PANELBOARDS ARE INDICATED TO BE REUSED, PROVIDE NEW CB'S AS REQUIRED FOR NEW BRANCH CIRCUITING SHOWN. NEW PANELBOARDS SHALL MATCH EXISTING.

7. FIRE ALARM SYSTEM EQUIPMENT AND WIRING SHALL MATCH EXISTING FIRE ALARM SYSTEM. VERIFY EXISTING EQUIPMENT CAPACITY AND PROVIDE REQUIRED EXTENSIONS TO THE EXISTING SYSTEM. VERIFY EXISTING BATTERY CAPACITY FOR ADDITIONAL FIRE ALARM SIGNAL DEVICES. COORDINATE WITH SPRINKLER CONTRACTOR AND PROVIDE REQUIRED ALARM AND POWER CONNECTIONS.

8. COORDINATE ALL CONNECTIONS TO EXISTING SYSTEMS WITH BUILDING ENGINEER/LANDLORD AND PROVIDE COMPATIBLE EQUIPMENT AS REQUIRED FOR PROPER OPERATION.

DEMOLITION

1. DISCONNECT, DISASSEMBLE, CAP, PLUG AND REMOVE ALL MEP ELEMENTS (PIPING, DUCTS, ELECTRICAL DEVICES, WIRING, CONDUIT, EQUIPMENT, HANGERS, SUPPORTS, ETC) INDICATED ON THE DRAWINGS OR NOT OTHERWISE REQUIRED FOR COMPLETED PRODUCT. REROUTE AND RECONNECT ANY CIRCUITS THAT REMAIN IN USE OR ARE RELOCATED. NO MEP ELEMENTS ARE TO BE ABANDONED IN PLACE UNLESS SPECIFICALLY NOTED. NOT ALL ITEMS TO BE REMOVED ARE INDICATED ON DRAWING.

2. WIRING SHALL BE DISCONNECTED AT CIRCUIT BREAKERS AND REMOVED AND BREAKERS MARKED "SPARE." REMOVE ALL ABANDONED COMMUNICATION WIRING INCLUDING WIRING ABANDONED UNDER PREVIOUS PROJECTS.

3. ANY EQUIPMENT DESIGNATED BY OWNER TO BE SALVAGED SHALL BE PROTECTED AND DELIVERED TO AN OWNER DESIGNATED AREA ON SITE.

4. ALL ASBESTOS REMOVAL (IF REQUIRED) WILL BE HANDLED BY THE OWNER AND IS NOT A PART OF THIS WORK. IF MATERIALS SUSPECTED OF CONTAINING HAZARDOUS MATERIALS ARE ENCOUNTERED, DO NOT DISTURB; NOTIFY ARCHITECT AND OWNER IMMEDIATELY.

5. WHERE EXISTING ELECTRICAL WORK INTERFERES WITH NEW WORK AND WHERE SUCH INSTALLATIONS ARE TO REMAIN IN USE, THE INSTALLATIONS SHALL BE RELOCATED AND/OR RECONNECTED TO COORDINATE WITH THE WORK INDICATED ON THE CONTRACT DRAWINGS AND AS SPECIFIED. FOR EXISTING INSTALLATION WHICH INVOLVE BASE BUILDING SYSTEMS, OBTAIN APPROVAL OF OWNER'S REPRESENTATIVE PRIOR TO MAKING ANY MODIFICATIONS.

6. MAINTAIN CONTINUITY OF THOSE FEEDERS AND/OR BRANCH CIRCUITS SERVING MULTIPLE ITEMS OF WHICH ONE OR MORE ARE BEING REMOVED.

BASIS OF DESIGN AND SUBSTITUTIONS

1. MANUFACTURERS LISTED ARE BASIS OF DESIGN. SUBSTITUTIONS ARE SUBJECT TO THE APPROVAL OF THE OWNER, ARCHITECT & ENGINEER. IF SUBSTITUTION IS SUBMITTED, IT IS THE CONTRACTOR'S RESPONSIBILITY TO EVALUATE IT AND CERTIFY THAT THE SUBSTITUTION IS EQUIVALENT IN ALL RESPECTS TO THE BASIS OF DESIGN. WHERE SUBMITTALS VARY FROM THE CONTRACT REQUIREMENTS, THE CONTRACTOR SHALL CLEARLY INDICATE ON SUBMITTAL OR ACCOMPANYING DOCUMENTS THE NATURE AND REASON FOR VARIATIONS. IF SUBSTITUTIONS ARE APPROVED, NOTIFY ALL OTHER CONTRACTORS, SUBCONTRACTORS OR TRADES AFFECTED BY SUBSTITUTION AND FULLY COORDINATE. ANY COSTS RESULTING FROM SUBSTITUTION, WHETHER BY CONTRACTOR OR OTHERS, SHALL BE RESPONSIBILITY OF AND PAID FOR BY SUBSTITUTING CONTRACTOR. APPROVED SHOP DRAWINGS DOES NOT ABSOLVE THIS CONTRACTOR FROM THIS RESPONSIBILITY. APPROVAL OF SUBSTITUTIONS IS AT THE DISCRETION OF THE ARCHITECT & ENGINEER AND IF SUBMITTED AFTER THE BID, AT THE RISK OF THE CONTRACTOR.

SHOP DRAWING SUBMITTALS

1. COORDINATES, PREPARE AND SUBMIT SHOP DRAWINGS TO THE ARCHITECT AND ENGINEER FOR THEIR REVIEW. CONTRACTOR SHALL REVIEW AND INDICATE HIS APPROVAL OF EACH SHOP DRAWING PRIOR TO SUBMITTAL FOR REVIEW. DO NOT ORDER, START WORK OR FABRICATION UNTIL SHOP DRAWINGS HAVE BEEN REVIEWED BY THE ENGINEER AND RETURNED TO THE CONTRACTOR. SHOP DRAWINGS TO BE SUBMITTED INCLUDE, BUT NOT LIMITED TO:
- WIRING DEVICES
- SAFETY SWITCHES
- PANELBOARDS
- TRANSFORMERS
- LIGHT FIXTURES & CONTROLS
- FIRE ALARM SYSTEM AND DEVICES

2. CLEARLY IDENTIFY EACH ITEM ON THE SUBMITTAL AS TO MARK, LOCATION AND USE, USING SAME IDENTIFICATION AS PROVIDED ON DESIGN DRAWINGS. ELECTRONIC SUBMITTALS SHALL BE PRESENTED WITH ALL SHEETS IN ALPHANUMERIC ORDER AND ALL SHEETS ORIENTED WITH TOP OF SHEET UP.

3. SUBMITTALS WILL BE REVIEWED ONLY FOR GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS AND NOT FOR DIMENSIONS OR QUANTITIES. THE SUBMITTAL REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR PURCHASE OF ANY ITEM IN FULL COMPLIANCE WITH THE CONTRACT DOCUMENTS OR ITS COMPLETE AND PROPER INSTALLATION.

RECORD DRAWINGS

1. A SET OF MEP RECORD/COORDINATION DRAWINGS SHALL BE MAINTAINED IN THE GENERAL CONTRACTORS OFFICE AT THE JOB SITE. PRINTS SHALL INDICATE ADDITIONS, DELETIONS, VARIATIONS IN LOCATION, VARIATIONS IN NUMBERING ETC. ALTERATIONS SHALL BE MARKED IN RED AND DELETIONS ALL BE MARKED IN GREEN AND SHALL BE ON THE LATEST CONTRACT DRAWING ISSUED. RECORD DRAWINGS SHALL BE KEPT CLEAN AND UNDAMAGED AND SHALL NOT BE USED FOR ANY PURPOSE OTHER THAN RECORDING DEVIATIONS FROM WORKING DRAWINGS. AFTER THE PROJECT IS COMPLETED, THESE SETS OF DRAWINGS SHALL BE DELIVERED TO THE ARCHITECT IN GOOD CONDITION, AS A PERMANENT RECORD OF THE INSTALLATION AS ACTUALLY CONSTRUCTED.

IDENTIFICATION

1. FURNISH AND MOUNT ON EACH PANELBOARD, SWITCHBOARD (INCLUDING BRANCH SWITCHES), LARGE JUNCTION BOX, SAFETY SWITCH, STARTER, REMOTE CONTROL, PUSH BUTTON STATION, AND ALL SIMILAR CONTROLS, A NAMEPLATE DESCRIPTIVE OF THE EQUIPMENT OR EQUIPMENT CONTROLLED.

2. PROVIDE BLACK AND WHITE NAMEPLATES CONSTRUCTED FROM LAMINATED PHENOLIC WITH A WHITE CENTER CORE. LETTERS SHALL BE ENGRAVED IN THE PHENOLIC TO FORM WHITE LETTERS 3/8" HIGH.

CUTTING, PATCHING AND DRILLING

1. ALL CUTTING AND PATCHING OF THE BUILDING CONSTRUCTION REQUIRED FOR THIS WORK SHALL BE BY THIS CONTRACTOR UNLESS SHOWN ON ARCHITECTURAL DRAWINGS AND CONFIRMED AS TO SIZE AND LOCATION PRIOR TO NEW CONSTRUCTION. CUTTING SHALL BE IN A NEAT AND WORKMANLIKE MANNER.

2. DO NOT CORE DRILL OR CUT ANY CONCRETE SLABS OR OTHER STRUCTURAL COMPONENTS FOR ANY REASON WITHOUT THE KNOWLEDGE AND WRITTEN CONSENT OF THE STRUCTURAL ENGINEER, ARCHITECT AND THE OWNER.

3. PATCH AND FINISH TO MATCH ADJACENT AREAS THAT HAVE BEEN CUT, DAMAGED OR MODIFIED AS A RESULT OF THE INSTALLATION OF THE MECHANICAL OR ELECTRICAL EQUIPMENT.

MOUNTING ACCESSORIES

1. THIS CONTRACTOR SHALL FURNISH AND INSTALL ALL ANGLE IRON, CHANNEL IRON, RODS, SUPPORTS, HANGERS, CONCRETE OR PLYWOOD REQUIRED TO INSTALL, MOUNT AND SUPPORT ANY ELECTRICAL EQUIPMENT OR DEVICE CALLED FOR ON THE PLANS.

2. SUPPORTING MATERIAL SHALL BE COMPLETE WITH HANGERS, CONNECTORS, BOLTS, CLAMPS AND NECESSARY ACCESSORIES TO MAKE A COMPLETE INSTALLATION. SUPPORTING MATERIAL SHALL BE GALVANIZED, PAINTED OR OTHERWISE SUITABLY FINISHED.

3. RECESSED AND SEMI-RECESSED LIGHT FIXTURES SHALL BE INDEPENDENTLY SUPPORTED FROM THE BUILDING STRUCTURE WITH A MINIMUM OF TWO WIRES, STRAPS, OR RODS. LOCATED AT DIAGONAL CORNERS OF THE FIXTURE ENCLOSURE.

FIRESTOPPING/FIREDAMPERS

1. ALL PENETRATIONS OF SLAB-TO-SLAB PARTITIONS SHALL BE SEALED AIRTIGHT.

2. WHEREVER FIRE RATED PARTITIONS ARE PENETRATED FOR WIRE, DUCT, OR PIPE PASSAGE, SEAL PASSAGES WITH CODE APPROVED, LABORATORY TESTED AND LABELED SEALANT OF FIRE RESISTANCE RATING NOT LESS THAN THAT OF PENETRATED ASSEMBLY THAT WILL PREVENT PASSAGE OF FIRE AND SMOKE. ALL FIRE STOPPING SYSTEM SHALL MEET THE REQUIREMENTS OF ASTM E 814,UL 1479, AND BE FACTORY MUTUAL APPROVED. ALL FIRESTOPPING AND/OR SMOKE STOPPING MATERIAL AND INSTALLATION SHALL BE AS MANUFACTURED BY HILTI OR APPROVED EQUAL.

3. INSTALLATION OF LIGHT FIXTURES, AND OUTLETS IN RATED CEILINGS OR WALLS SHALL HAVE RATED BOXES OR BE PROVIDED WITH PREMANUFACTURED TENTS MATCHING THE RATING OF THE CEILING OR WALL ASSEMBLY.

ACCESS DOORS

1. ACCESS DOORS SHALL BE PROVIDED IN WALLS AND CEILINGS WHERE REQUIRED TO PERMIT PROPER ACCESS TO EQUIPMENT AND OTHER DEVICES WHICH REQUIRE MAINTENANCE OR SERVICE. DOORS PLACED IN WALLS, PARTITIONS OR OTHER FIRE-RATED CONSTRUCTION SHALL HAVE A LABEL SIGNIFYING THAT THE DOOR HAS THE SAME FIRE RATING AS THE FIRE-RATED CONSTRUCTION.

2. ACCESS PANELS SHALL BE CONSTRUCTED OF 14 GAUGE STEEL, WITH 16 GAUGE STEEL FRAMES. DOORS SHALL FINISH FLUSH WITH THE SURROUNDING SURFACE. FRAMES SHALL HAVE 3 " WIDE EXPANDED METAL FOR PLASTERED SURFACES AND PLAIN FLANGED TYPE FRAME FOR TILE, MASONRY OR GYPSUM BOARD SURFACES. DOORS AND FRAMES SHALL BE FURNISHED PRIME COATED. DOORS INSTALLED IN CERAMIC TILE OR OTHER NON-PAINTED SURFACES SHALL BE STAINLESS STEEL. HINGES SHALL BE CONCEALED SPRING TYPE, TO ALLOW DOORS TO BE OPENED 175 DEGREES. LOCKS SHALL BE FLUSH SCREWDRIVER TYPE WITH STEEL CAMS. ACCESS PANELS SHALL BE 16" X 16" OR LARGER AS MAY BE REQUIRED FOR PROPER ACCESS TO THE DEVICE BEING SERVED.

3. ACCESS PANELS ARE NOT REQUIRED IN COMPLETELY ACCESSIBLE LIFT OUT TILE CEILINGS. CONTRACTOR SHALL REVIEW THE ROOM FINISH SCHEDULE ON THE ARCHITECTURAL DRAWINGS IN ORDER TO VERIFY THE NEED FOR ACCESS PANELS. PROVIDE ACCESS PANELS TO GENERAL CONTRACTOR FOR INSTALLATION.

RACEWAYS

1. ALL WIRE SHALL BE RUN IN ACCORDANCE WITH CODE IN INTERMEDIATE METAL CONDUIT (IMC) OR ELECTRICAL METALLIC TUBING (EMT) OR METAL CLAD (MC) CABLING UNLESS OTHERWISE SPECIFICALLY STATED HEREIN. CONDUIT SIZE SHALL BE 3/4" MINIMUM UNLESS NOTED OTHERWISE.

2. CONDUIT IN EXTERIOR WALLS, EXPOSED TO THE WEATHER OR OTHER DAMP/WET LOCATIONS SHALL BE RIGID, THREADED, GALVANIZED, HEAVY WALL TYPE.

3. CONDUIT UNDERGROUND SHALL BE SCHEDULE 40 PVC CONDUIT WITH GROUND WIRE. PVC CONDUIT SHALL NOT BE RUN IN OR ABOVE FLOOR SLAB. PVC CONDUIT SHALL TERMINATE BELOW FLOOR SLAB WITH RIGID, THREADED METAL CONDUIT ADAPTER. CONDUIT ABOVE SLAB SHALL BE METAL.

4. ALL CONDUIT SHALL BE CONCEALED IN WALLS, FLOORS AND CEILINGS WHEREVER POSSIBLE. EXPOSED CONDUIT IN FINISHED AREAS WILL NOT BE PERMITTED. EXPOSED CONDUIT WILL BE PERMITTED IN UNFINISHED AREAS WITH THE SPECIFIC APPROVAL OF THE ARCHITECT.

5. USE FLEXIBLE CONDUIT FOR THE CONNECTION TO THE RECESSED OR SEMI-RECESSED LIGHTING FIXTURES (6' LENGTH MAXIMUM). USE LIQUID TIGHT METAL CONDUIT FOR ALL CONNECTIONS TO MOTORS AND OTHER EQUIPMENT SUBJECT TO VIBRATION AND IN AREAS SUBJECT TO MOISTURE.

6. USE WATERTIGHT JOINTS WITH BURIED AND CONCRETE ENCASED CONDUIT. ALL BURIED CONDUITS OUTSIDE OF BUILDINGS SHALL HAVE A MINIMUM OF 24" OF COVER. METAL CONDUITS BURIED IN EARTH SHALL BE PAINTED WITH TWO COATS OF HEAVY ASPHALTUM PAINT.

7. CONDUIT SHALL BE SECURELY FASTENED IN PLACE. SUPPORT RUNS OF CONDUIT AS DETAILED IN THE APPROPRIATE TABLE OF THE NATIONAL ELECTRICAL CODE.

8. INSTALL EXPOSED RUNS OF CONDUIT AND CONDUIT ABOVE LAY-IN CEILINGS PARALLEL OR PERPENDICULAR TO THE WALLS, STRUCTURAL MEMBERS OF INTERSECTIONS OF VERTICAL PLANES AND CEILINGS. PROVIDE RIGHT ANGLE TURNS USING FITTINGS OR SYMMETRICAL BENDS. SUPPORT CONDUITS WITHIN 1' OF ALL CHANGES INDIRECTION.

9. IF A CONDUIT IS SUSPENDED, IT SHALL BE SUPPORTED ON TRAPEZE HANGERS, WHICH USE "ALL-THREAD" RODS FROM THE STRUCTURAL STEEL. THE USE OF CEILING SUPPORT WIRE OR SIMILAR MATERIAL WILL NOT BE ACCEPTED.

10. INSTALL EMPTY CONDUIT FOR FUTURE USE AS INDICATED ON THE DRAWINGS. CONDUIT SHALL BE COMPLETE WITH JETLINE OR PULL ROPE, JUNCTION/OUTLET BOXES, TILE RINGS AND APPROPRIATE COVER PLATES.

11. PROVIDE PITCHPOCKETS WHERE CONDUITS PENETRATE THE ROOF. HORIZONTAL PORTIONS OF CONDUIT EXPOSED ON THE ROOF AND FEEDING EQUIPMENT SHALL NOT BE MORE THAN 5'-0" UNLESS THE WRITTEN APPROVAL FROM ARCHITECT OR ENGINEER IS OBTAINED.

12. THREAD LUBRICATION/SEALANT IS REQUIRED ON OUTDOOR AND UNDERGROUND THREADED METAL JOINTS.

13. COORDINATE CONDUIT RUNS WITH OTHER TRADES AND ADJUST ROUTING TO AVOID INTERFERENCE.

14. RACEWAYS SHALL BE PROVIDED WITH EXPANSION FITTINGS WHERE NECESSARY TO COMPENSATE FOR THERMAL EXPANSION AND CONTRACTION.

15. SURFACE RACEWAYS SHALL BE AS INDICATED ON DRAWINGS AND INSTALLED AS A COMPLETE SYSTEM WITH ALL REQUIRED FITTINGS AND APPURTENANCES. RECEPTACLES/OUTLETS AS INDICATED ON PLAN. INSTALL RACEWAYS PARALLEL AND PERPENDICULAR TO BUILDING ELEMENTS.

16. THE USE OF METAL CLAD (MC) CABLING SHALL BE ALLOWED WHERE CONCEALED WITHIN WALLS. WHERE CONDUCTORS EXIT THE WALL CAVITY THE USE OF CONDUIT RACEWAYS ARE REQUIRED.

BOXES

1. INSTALL PULL AND JUNCTION BOXES WHERE SHOWN ON THE DRAWINGS, AND WHERE REQUIRED FOR CHANGES IN DIRECTION, AT JUNCTION POINTS AND TO FACILITATE WIRE PULLING. FURNISH BOX SIZES IN ACCORDANCE WITH NEC UNLESS LARGER BOXES ARE INDICATED ON THE DRAWINGS.

2. INTERIOR CONCEALED - USE SHEET STEEL BOXES, ZINC COATED OR CADMIUM PLATED.

3. IN FLOOR LOCATIONS - PROVIDE CAST IRON, CONCRETE-TITE FLOOR BOXES WITH ADJUSTABLE COVERS SET FLUSH AND LEVEL WITH THE FINISHED FLOOR, WITH OUTLETS AS INDICATED ON THE DRAWINGS. PROVIDE BOXES WITH LEVELING SCREWS. FLUSH TYPE BRASS COVERS AND OPENINGS TO SERVE OUTLETS USED. FURNISH FLUSH CAPS FOR CLOSING OFF BOX WHEN NOT IN USE.

4. ALL OTHER LOCATIONS EXCEPT BELOW GRADE - USE CAST BOXES, ZINC-CADMIUM FINISH MALLEABLE IRON. FURNISH WEATHERPROOF BOXES WHEN INSTALLED OUTSIDE OR IN DAMP/WET LOCATIONS.

5. PROVIDE REMOVABLE COVERS OF CODE GAUGE, HOT ROLLED SHEET STEEL, HOT DIPPED GALVANIZED FOR ALL BOXES, UNO.

6. EXTERIOR BELOW GRADE - COMPOSITE WATERPROOF ASSEMBLIES SUITABLE FOR INGROUND INSTALLATIONS.

7. WALL BOX SIZES SHALL BE MINIMUM 4" SQUARE X 2-1/2" DEEP WHERE WALL CONSTRUCTION PERMITS. FIXTURE OUTLETS IN CEILING SHALL BE MINIMUM 4" OCTAGONAL X 1-1/2" DEEP (4-11/16 OCTAGONAL X 2-1/2" DEEP WHERE REQUIRED TO ACCOMMODATE LARGER CONDUIT OR LARGER NUMBER OF WIRES). GANG BOXES SHALL BE ONE PIECE MINIMUM 2-1/8" DEEP.

8. FLUSH MOUNT BOXES IN ALL FINISHED WALLS, INSTALL THE PLASTER RINGS IN DRYWALLED PLASTERED WALLS AND RAISED COVERS AS REQUIRED IN WALLS WITH OTHER FINISHES SO THAT THE COVER PLATES FIT TIGHTLY AGAINST BOXES OR RINGS. 3/16" MAXIMUM GAPS ARE ALLOWED FOR NONCOMBUSTIBLE WALLS. SUPPORT ALL BOXES TO MAINTAIN PROPER ALIGNMENT AND RIGIDITY. CLEAN BOXES OF ALL FOREIGN MATTER PRIOR TO THE INSTALLATION OR WIRING OR DEVICES.

9. MOUNTING HEIGHTS ON THE DRAWING ARE TO THE CENTERLINE OF THE BOXES UNLESS OTHERWISE NOTED. ADJUST LOCATIONS OF OUTLETS IN MASONRY OR TILE CONSTRUCTION TO OCCUR IN THE NEAREST JOINT TO THE HEIGHT SPECIFIED. HEIGHTS SHALL MEET ADA REQUIREMENTS.

CONDUCTORS

1. COLOR CODE CONDUCTORS (EXCEPT CONTROL AND INSTRUMENTATION CONDUCTORS) AS FOLLOWS:

	208/120 VOLT SYSTEM	480/277 VOLT SYSTEM
PHASE A	BLACK	BROWN
PHASE B	RED	ORANGE
PHASE C	BLUE	YELLOW
NEUTRAL	WHITE	GRAY
GROUND	GREEN	GREEN

- #12 AND #10 CONDUCTORS SHALL HAVE CONTINUOUS INSULATION COLOR, AS LISTED ABOVE.
- COLOR CODE CONDUCTORS LARGER THAN ABOVE, WHICH DO NOT HAVE CONTINUOUS INSULATION COLOR BY APPLICATION OF AT LEAST TWO LAPS OF COLORED TAPE ON EACH CONDUCTOR AT ALL POINTS OF ACCESS INCLUDING JUNCTION BOXES.
- CONDUCTORS SHALL BE SOFT ANNEALED COPPER INSULATED FOR 600 VOLTS UNLESS SPECIFICALLY INDICATED OTHERWISE.
- DRAWINGS INDICATE SIZES BASED ON COPPER CONDUCTORS.

2. INSULATION TYPE SHALL BE TYPE THHW FOR WIRE SIZES #8 AWG AND LARGER AND THWN FOR #10 AWG AND SMALLER. THHN SHALL NOT BE USED IN WET OR DAMP LOCATIONS.

3. FLEXIBLE CORD SHALL BE HEAVY DUTY TYPE SO WITH AN EQUIPMENT GROUND CONDUCTOR IN ADDITION TO THE CURRENT CARRYING CONDUCTORS.

4. PROVIDE #12 CONDUCTORS, UNLESS OTHERWISE INDICATED. CONTROL CONDUCTORS SHALL BE #14 MINIMUM FOR NEC CLASS I AND #16 FOR NEC CLASS II. CONDUCTORS #8 AWG AND LARGER SHALL BE STRANDED. CONDUCTORS #10 AWG AND SMALLER SHALL BE SOLID.

5. CONNECT #10 AND SMALLER WIRES WITH CONSTANT PRESSURE EXPANDABLE SPRING TYPE CONNECTORS. CONNECT #8 AND LARGER WIRES WITH COMPRESSION CONNECTORS OR SPLICES.

6. INSTALL WIRING IN CONDUIT. PULL CONDUCTORS USING RECOGNIZED METHODS AND EQUIPMENT LEAVING AT LEAST 6" WIRE AT ALL JUNCTION BOXES FOR CONNECTIONS. CLEANOUT EACH CONDUIT SYSTEM TO ELIMINATE OBSTRUCTIONS OVER FULL LENGTH BEFORE PULLING WIRE.

7. FORM AND TIE ALL WIRING IN PANELBOARDS. THERE SHALL BE NO WIRENUT JOINTS OR SPLICES MADE INSIDE SWITCHBOARDS/PANELBOARDS.

8. BRANCH CIRCUIT WIRE SIZES (AND CONDUITS) SHALL BE INCREASED FROM THOSE INDICATED ON THE PLANS TO PREVENT EXCESSIVE VOLTAGE DROP. BRANCH CIRCUITS SHALL BE INSTALLED WITH WIRES OF SUFFICIENT SIZE SO THAT VOLTAGE DROP BETWEEN THE PANEL AND THE LOADS DOES NOT EXCEED LIMIT OF 2%.

9. WIRE SIZES SHALL BE BASED ON THE 60°C. AMPACITIES FOR WIRE SIZES #14-1 AWG AND 75°C AMPACITIES FOR WIRE SIZES #1/0 AWG AND LARGER.

10. CIRCUITS MAY BE MULTI-PLEXED IN CONDUIT PROVIDED WIRE IS PROPERLY DERATED AND CONDUIT SIZED PER NEC. UNDER NO CIRCUMSTANCES SHALL MORE THAN NINE (9) CURRENT CARRYING CONDUCTORS BE RUN IN A SINGLE CONDUIT. WIREMOLD SERVED BY MULTIPLE CIRCUITS SHALL BE WIRED WITH INDIVIDUAL SEPARATE NEUTRALS FOR EACH CIRCUIT.

11. METAL-CLAD (MC) OR ARMORED CABLE (AC) MAY BE USED FOR BRANCH CIRCUITS WHERE ALLOWED BY CODE. ARMORED CABLE SHALL NOT BE USED IN ASSEMBLY AREAS OR WHERE PROHIBITED BY CODE. CABLES SHALL BE CONCEALED IN FINISHED SPACES. TEST CABLES FOR CONTINUITY AND GROUNDS. INSTALL CABLES PARALLEL AND PERPENDICULAR TO BUILDING SURFACES. COORDINATE CABLE RUNS WITH OTHER TRADES AND ADJUST ROUTING TO AVOID INTERFERENCE. LOW VOLTAGE WIRING INSTALLED ABOVE CEILINGS SHALL BE BUNDLED AND SUPPORTED FROM THE BUILDING STRUCTURE. DO NOT LAY CABLE ON CEILINGS.

12. COMMUNICATION CABLE SHALL BE PLENUM RATED.

DEVICES

1. WIRING DEVICE COLOR SHALL BE IVORY OR AS SELECTED BY OWNER/ARCHITECT, UNLESS OTHERWISE INDICATED.

2. PROVIDE TOTALLY ENCLOSED, SPECIFICATION GRADE, 20 AMPERE, 120/277 VOLT QUIET A/C GENERAL USE SNAP SWITCHES MANUFACTURED BY HUBBELL, P&S OR LEVITON.

3. PROVIDE SPECIFICATION GRADE NEMA CONFIGURATION 5-20R DUPLEX 125-VOLT GROUNDING TYPE RECEPTACLES UNLESS OTHERWISE NOTED ON THE DRAWINGS. MANUFACTURED BY HUBBELL, P&S OR LEVITON.

4. RECEPTACLES REQUIRING AMPERAGES, VOLTAGES OR CONFIGURATIONS DIFFERENT FROM THE DUPLEX CONVENIENCE RECEPTACLES ABOVE SHALL BE AS INDICATED ON THE DRAWINGS AND OF A QUALITY, MATERIAL AND CONSTRUCTION EQUAL TO THAT SPECIFIED FOR DUPLEX CONVENIENCE RECEPTACLES.

5. PROVIDE COVER OR DEVICE PLATES FOR OUTLET BOXES AS FOLLOWS UNLESS OTHERWISE NOTED:

- FINISHED AREAS: TYPE 302 STAINLESS STEEL
- UNFINISHED AREAS: ZINC COATED SHEET METAL, ALUMINUM, OR CAST METAL AS APPROPRIATE FOR THE TYPE OF BOX.
- EXTERIOR AREAS: COPPER FREE ALUMINUM WITH GRAY, POWDER EPOXY FINISH, GASKETED, WEATHERPROOF.
- TELEPHONE, COMMUNICATION, AND SIGNAL OUTLET PLATES, SHALL MATCH THOSE USED FOR RECEPTACLES AND SWITCHES.
- ALL OUTLET AND/OR JUNCTION BOXES SHALL BE COMPLETE WITH A COVER PLATE BY THIS CONTRACTOR. WHERE DEVICES ARE GANGED, THEY SHALL BE INSTALLED UNDER A COMMON COVERPLATE.
- LOCATE THE SWITCHES APPROXIMATELY 4'-0" ABOVE THE FINISHED FLOOR ELEVATION OR NEAREST BLOCK COURSE (WITH IN ADA REQUIREMENTS) UNLESS OTHERWISE NOTED. THE LONG DIMENSION OF THE SWITCHES SHALL BE VERTICAL.

6. LOCATE RECEPTACLES APPROXIMATELY 1'-6" ABOVE THE FINISHED FLOOR ELEVATION OR NEAREST BLOCK COURSE (WITH IN ADA REQUIREMENTS), UNLESS OTHERWISE NOTED. THE LONG DIMENSION OF THE RECEPTACLE SHALL BE VERTICAL. ALL DEVICES SHALL BE FLUSH MOUNTED U.N.O.

7. RECEPTACLES WITHIN 6' OF SINKS SHALL BE GFCI TYPE. ALL DEVICES INSTALLED OUTDOORS SHALL BE WEATHERPROOF AND GFCI PROTECTED.

8. RECEPTACLE IN KITCHEN AREA OR BATHROOM TO BE GFCI PROTECTED.

SAFETY SWITCHES

1. PROVIDE DISCONNECT SWITCHES FOR ALL EQUIPMENT, WHERE REQUIRED BY CODE. MANUFACTURER SHALL BE SQUARE D, SIEMENS, G.E., OR CUTLER-HAMMER. ALL SAFETY SWITCHES SHALL BE BY ONE MANUFACTURER.

2. SAFETY SWITCHES SHALL BE THE ENCLOSED HEAVY-DUTY TYPE (TYPE HD) WITH QUICK-MAKE, QUICK-BREAK MECHANISM AND EXTERNAL PAD LOCKABLE OPERATING HANDLE.

3. SAFETY SWITCHES SHALL BE RATED FOR 240 OR 600 VOLTS AS APPLICABLE. THEY SHALL BE HORSEPOWER RATED WHEN USED IN MOTOR CIRCUITS. SAFETY SWITCHES SHALL BE FUSIBLE OR NONFUSIBLE 2, 3 OR 4 POLE AS INDICATED ON THE DRAWINGS. SAFETY SWITCHES SHALL BE SINGLE THROW, UNO. ENCLOSURES SHALL BE NEMA 1 INDOORS AND NEMA 3R OUTDOORS UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
4. MOUNT THE SAFETY SWITCHES SECURELY BETWEEN 3' X 6' LEVELS ABOVE THE FLOOR UNLESS OTHERWISE NOTED IN THE DRAWINGS. SWITCHES ON BLOCK WALLS SHALL BE MOUNTED ON A 3/4" PLYWOOD BACKBOARD, WHERE LOCATED INDOORS.

5. THE CONTRACTOR SHALL FURNISH A COMPLETE SET OF FUSES FOR ALL FUSIBLE SWITCHES, PLUS FUSIBLE EQUIPMENT FURNISHED BY OTHER TRADES. UNLESS OTHERWISE INDICATED ON THE DRAWINGS, THE FUSES SHALL BE OF THE FOLLOWING TYPE:
- FUSES 601 TO 6000 AMPS SHALL BE UL CLASS RK5. TRADE TYPE SHALL BE KRP-C AS MANUFACTURED BY THE BUSSMANN COMPANY.
- FUSES 1/10 TO 600 AMPS SHALL BE UL CLASS RK1. TRADE TYPE SHALL BE LOW PEAK LPS-RK (600V) AND LPN-RK (250C) AS MANUFACTURED BY BUSSMANN COMPANY.
- ALL OTHER FUSES SHALL BE DUAL ELEMENT CURRENT LIMITING TYPE WITH 200,000 AMPERES SYMMETRICAL INTERRUPTING CAPACITY.

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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER: 30756
EXPIRATION DATE: 06/28/2016

PROJECT TITLE

RECREATION & PARKS WORCESTER COUNTY

WORCESTER COUNTY RECREATION CENTER ADDITION
6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

ELECTRICAL SPECIFICATIONS

ISSUE BLOCK

MARK	DATE	DESCRIPTION
5	09.18.14	ISSUED FOR CONSTRUCTION
⚠	07.21.14	ADDENDUM #1
4	06.04.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	NONE
DRAWN BY: SM	PROJ MGR: DC

E001

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$DATE$ $FILE$

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PANELBOARDS

1. PANELBOARDS SHALL BE ENCLOSED DEAD FRONT SAFETY TYPE WITH FEATURES AND RATINGS AS SCHEDULED ON DRAWINGS. ALL BUS BARS SHALL BE RECTANSULAR SOLID COPPER. SPACE, WHERE SHOWN IN PANEL SCHEDULES, DESIGNATES SPACE FOR FUTURE PROTECTIVE DEVICES AND SHALL INCLUDE BUS AND SUPPORT. PANELS KNOWN AS "LOAD CENTERS" ARE UNACCEPTABLE. MANUFACTURER SHALL BE SQUARE D, SIEMENS, GE OR CUTLER-HAMMER.

2. MOLDED CASE CIRCUIT BREAKERS SHALL BE AS SCHEDULED ON THE DRAWINGS AND SPECIFIED IN THIS DIVISION. ALL BREAKERS SHALL BE BOLT ON TYPE. ALL BOLTED CONNECTIONS SHALL BE TORQUED IN ACCORDANCE WITH MANUFACTURERS STANDARDS. RETORQUE ALL CONNECTIONS ONE MONTH AFTER INITIAL TORQUE.

3. INSTALL CABINETS SO THAT CENTER OF THE TOP BREAKER DOES NOT EXCEED 6'-6" ABOVE THE FINISHED FLOOR. PROVIDE (3) SPARE 1" CONDUITS INTO ACCESSIBLE CEILING WHERE PANELS ARE FLUSH MOUNTED.

4. ELECTRICAL CONTRACTOR SHALL ARRANGE CIRCUITS AS NEAR AS POSSIBLE TO CIRCUIT NUMBERS ON THE DRAWINGS. AT COMPLETION OF JOB, ELECTRICAL CONTRACTOR SHALL TAKE CURRENT READING CHECKS OF RESPECTIVE PHASES. A MINIMUM OF CIRCUIT CONNECTIONS SHALL BE REARRANGED TO BALANCE, AS CLOSELY AS POSSIBLE, THE LOAD IN THE PANEL. ENTRIES ON DIRECTORY CARDS SHALL BE TYPED, COMPLETE AND ACCURATE. FINAL ROOM NAMES/NUMBERS MAY BE DIFFERENT FROM THOSE USED ON PLANS AND SHOULD BE USED TO CREATE DIRECTORIES.

TRANSFORMERS

1. TRANSFORMERS SHALL BE CONTINUOUSLY RATED ISOLATING TYPE FOR 60-HERTZ SERVICE UNLESS OTHERWISE INDICATED. TRANSFORMERS SHALL BE DRY TYPE, GENERAL PURPOSE, COPPER WINDINGS. PROVIDE CLASS 220 INSULATION (80°C RISE).

2. ENCLOSURES FOR TRANSFORMERS SHALL BE METALLIC, SUITABLE FOR INDOOR AND OUTDOOR INSTALLATION AS APPLICABLE AND RODENT PROOF. MANUFACTURER SHALL BE EATON/CUTLER-HAMMER, SQUARE "D", GENERAL ELECTRIC OR SIEMENS. FRACTIONAL KVA TRANSFORMERS SHALL BE MANUFACTURED BY EDWARDS OR THE SPECIAL EQUIPMENT MANUFACTURER IN WHICH THE TRANSFORMERS ARE USED.

GROUNDING

1. GROUND ALL EQUIPMENT PER NEC. GROUND ALL DRY TYPE TRANSFORMERS AS PER DRAWINGS AND NEC SECTION #450, AND #250.

2. ALL CONDUITS SHALL CONTAIN A CODE SIZED GROUND WIRE SIZE PER NEC IN ADDITION TO THE CONDUCTORS SHOWN ON THE PLANS. WHERE CIRCUIT CONDUCTORS ARE INCREASED IN SIZE THE GROUND WIRE SIZE SHALL BE INCREASED PROPORTIONALLY.

COMMUNICATION SYSTEMS

1. THIS CONTRACTOR SHALL PROVIDE AND INSTALL ALL CABLES, CONDUITS, OUTLET BOXES, METAL CABINETS AND PULL BOXES AS INDICATED. PROVIDE A COMPLETE CONDUIT SYSTEMS WITH PULL WIRES WHERE INDICATED ON THE DRAWINGS. ALL CONDUIT RUN SHALL HAVE NOT MORE THAN THREE (3) BENDS IN A RUN BETWEEN OUTLET BOXES OR BETWEEN OUTLET BOX AND A METAL CABINET OR PULL BOX. WHEN A RUN REQUIRES MORE THAN THREE (3) BENDS, A PULL BOX OF SUITABLE SIZE SHALL BE PLACED IN A SUITABLE LOCATION TO MEET THE ABOVE CONDITIONS.

2. COORDINATE TELEPHONE AND DATA OUTLET LOCATIONS AND QUANTITIES WITH OWNER. PROVIDE OUTLET BOX AND RACEWAY WITH PULL WIRE IN INSULATED OR SOLID OR INACCESSIBLE AREAS. ALL PLATES SHALL BE STANDARD TELEPHONE OR DATA TYPE WITH JACK. PROVIDE PLATES OF SAME MATERIAL AND FINISH AS SPECIFIED FOR RECEPTACLES. WALL PHONE PLATES SHALL HAVE MOUNTING STUDS.

FIRE ALARM AND DETECTION SYSTEMS

1. MAKE ADDITIONS AND ALTERATIONS TO EXISTING SIMPLEX FIRE ALARM SYSTEM PER FIRE ALARM PLANS.

2. ALL DEVICES, COMBINATIONS OF DEVICES, APPLIANCES AND EQUIPMENT SHALL BE UL LISTED FOR THE PURPOSE, WHICH THEY ARE USED AND SHALL BE INSTALLED IN ACCORDANCE WITH NFPA 72, AS WELL AS ALL APPLICABLE LOCAL CODES, AUTHORITIES HAVING JURISDICTION AND MANUFACTURER'S REQUIREMENTS.

3. THE INSTALLATION OF THIS SYSTEM SHALL BE BY A COMPANY THAT SPECIALIZES IN INSTALLATION OF THIS EQUIPMENT AND HAS A SUCCESSFUL RECORD OF SYSTEM INSTALLATIONS DATING BACK A MINIMUM OF 5 YEARS ON SIMILAR TYPES OF INSTALLATIONS.

4. THE CONTRACTOR SHALL MAINTAIN AN UP-TO-DATE SET OF DESIGN DOCUMENTS, APPROVED PERMIT DOCUMENTS AND SHOP DRAWINGS ON-SITE AND SHALL TURN THESE DOCUMENTS OVER TO THE OWNER UPON PROJECT COMPLETION AND APPROVAL BY THE LOCAL AUTHORITY.

5. RECORD DRAWINGS SHALL INCLUDE A CAD GENERATED SET OF DOCUMENTS, WHICH INDICATE LOCATION OF ALL DEVICES, CONTROL PANELS, ANNUNCIATORS, INTERFACE ADDRESSABLE MODULES, AND END-OF-LINE DEVICES.

6. SUBMIT BATTERY CALCULATIONS TO SUBSTANTIATE COMPLIANCE WITH REQUIREMENTS.

7. DEVICES TO BE PROVIDED FOR THIS PROJECT INCLUDE; NFPA 72 AND ADA COMPLIANT FLASHING STROBE LIGHTS (MINIMUM 15/75 CANDELA, UNO) AND COMBINATION STROBE / HORNS. WALL AND CEILING MOUNT TYPE AS INDICATED.

8. WHERE MULTIPLE STROBE DEVICES ARE INSTALLED IN A COMMON AREA, PROVIDE SYNCHRONIZED STROBES TO ALLOW FLASH TO OCCUR SIMULTANEOUSLY.

9. ALL FIRE ALARM WIRING SHALL BE INSTALLED IN MINIMUM OF 3/4" CONDUIT, EXCEPT USE UL RATED "MC" FIRE ALARM CABLE FROM JUNCTION BOX LOCATED ABOVE CEILING SPACE OVER THE STROBE, DOWN INSIDE THE WALL TO STROBE JUNCTION BOX. FIRE ALARM JUNCTION BOX COVERS SHALL BE PAINTED RED. WHERE ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION (AHJ), THE CONTRACTOR MAY USE UL LISTED, MC FIRE ALARM CABLE.

10. ALL WIRING TO DEVICES SHALL BE SIZED AND INSTALLED PER MANUFACTURERS REQUIREMENTS.

11. FIRE ALARM WIRING SHALL NOT BE INSTALLED IN THE SAME CONDUIT OR JUNCTION BOXES AS POWER AND LIGHTING WIRING.

12. ALL WIRE SPLICING SHALL BE PERFORMED IN JUNCTION BOXES SIZED TO ACCOMMODATE TERMINAL BLOCKS (NUMBER AS REQUIRED). ALL CONNECTIONS SHALL BE MADE WITH APPROVED CRIMP-ON TERMINAL SPADE LUGS, PRESSURE-TYPE TERMINAL BLOCKS OR PLUG CONNECTORS. CABLE TAPS OR T-TAPS WILL NOT BE PERMITTED.

13. THE COMPLETED FIRE ALARM SYSTEM SHALL BE FULLY TESTED IN ACCORDANCE WITH NFPA 72, AND LOCAL FIRE DEPARTMENT REQUIREMENTS, BY THE INSTALLER, AND IN THE PRESENCE OF THE OWNERS REPRESENTATIVE AND THE LOCAL FIRE MARSHALL. UPON COMPLETION OF A SUCCESSFUL TEST, THE INSTALLER SHALL SO CERTIFY IN WRITING TO THE OWNER AND GENERAL CONTRACTOR.

14. TEST CONDUCTORS FOR SHORT CIRCUITS USING AN INSULATION-TESTING DEVICE, INDICATING AND INITIATING CIRCUITS FOR PROPER SIGNAL TRANSMISSION UNDER OPEN CIRCUIT CONDITIONS, INDICATING AND INITIATING CIRCUITS FOR PROPER ALARM OPERATION AND RESPONSE AND ANNUNCIATION AT THE MAIN FIRE ALARM CONTROL PANEL, AND NEW SYSTEMS FOR SPECIFIED FUNCTIONS ACCORDING TO THIS SPECIFICATION AND THE FIRE ALARM MATRIX INDICATED ON THE DRAWINGS.

15. CORRECT DEFICIENCIES INDICATED BY TESTING AND COMPLETELY RETEST WORK AFFECTED BY SUCH DEFICIENCIES. VERIFY BY THE SYSTEM TEST THAT THE TOTAL SYSTEM MEETS THE EXISTING BASE BUILDING SYSTEM OPERATION STANDARD.

16. PROVIDE INTERFACE WITH SECURITY SYSTEM, IF PROVIDED, TO UNLOCK ALL EGRESS DOORS IN THE EVENT OF AN ALARM BY AN INITIATING DEVICE. ACTIVATION OF FLOOR FIRE ALARM PULL STATION, SMOKE DETECTORS, HEAT DETECTORS AND WATERFLOW SWITCH AND ETC., SHALL CAUSE THE RELEASE OF ALL SECURITY DOOR LOCKS/ELECTRIC DOOR STRIKE. (1)

17. INCLUDE ON-SITE SERVICES OF A CERTIFIED FACTORY TECHNICIAN TO PROVIDE TECHNICAL INSTALLATION SUPPORT FOR PANEL START UP, PROGRAMMING AND PROGRAM EDITING BASED ON LOCAL AUTHORITY COMMENTS, ASSIST CONTRACTORS WITH TROUBLESHOOTING AND ASSIST INSTALLER FOR ONE COMPLETE FINAL SYSTEM CHECKOUT.

18. THE CONTRACTOR SHALL WARRANTY THE INSTALLATION OF THIS SYSTEM FOR A PERIOD OF NOT LESS THAN 18 MONTHS, AND THAT SHALL INCLUDE ALL DEFECTIVE PARTS, TROUBLESHOOTING OF NUISANCE ALARMS DUE TO SHORTS OR OTHER ANOMALIES. THE STANDARD MANUFACTURER WARRANTY SHALL APPLY TO ALL DEVICES, POWER SUPPLIES AND EQUIPMENT.

19. GET APPROVAL FROM FIRE MARSHAL AND INCORPORATE ALL COMMENTS.

START UP AND INSTRUCTIONS

1. AFTER INSTALLATION, CHECK ALL EQUIPMENT, AND PERFORM START UP IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. PLACE ALL SYSTEMS INTO OPERATION.

2. TESTS SHALL INCLUDE THE FOLLOWING:
- MEASURE THE LOAD ON EACH PHASE OF THE MAIN SERVICE AND EACH PHASE OF EVERY FEEDER UNDER FULL LOAD CONDITIONS
- MEASURE THE NO-LOAD AND FULL-LOAD VOLTAGES (PHASE TO PHASE, PHASE TO NEUTRAL AND PHASE TO GROUND FOR EACH PHASE OF EACH SERVICE, OF EACH SEPARATELY DERIVED SYSTEM, AND AT EACH PANELBOARD OR TRANSFORMER).
- MEASURE THE GROUND RESISTANCE OF THE MAIN SERVICE GROUNDING ELECTRODE AND THE GROUND RESISTANCE OF EACH SEPARATELY DERIVED SYSTEM'S GROUNDING ELECTRODE.

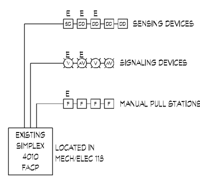
3. CLEAN ALL ELECTRICAL EQUIPMENT AND FIXTURES OF ALL CONSTRUCTION DUST AT PROJECT COMPLETION.

4. PROVIDE OWNER TRAINING AND DEMONSTRATION OF ALL ELECTRICAL SYSTEMS AND EQUIPMENT. INSTRUCT OWNER ON PROPER OPERATION AND PREVENTATIVE MAINTENANCE OF SYSTEM. SUBMIT OPERATING AND MAINTENANCE MANUAL ON ALL EQUIPMENT AND SYSTEMS.

WARRANTY

1. FULLY WARRANT ALL MATERIALS, EQUIPMENT AND WORKMANSHIP FOR ONE (1) YEAR FROM DATE OF ACCEPTANCE. EXTEND ALL MANUFACTURER'S WARRANTIES TO OWNER, INCLUDING ALL EXTENDED WARRANTIES.

2. REPAIR OR REPLACE WITHOUT CHARGE TO THE OWNER ALL ITEMS FOUND DEFECTIVE DURING THE WARRANTY PERIOD. IN THE CASE OF REPLACEMENT OR REPAIR DUE TO FAILURE WITHIN THE WARRANTY PERIOD, THE WARRANTY ON THAT PORTION OF THE WORK SHALL BE EXTENDED FOR A MINIMUM PERIOD OF ONE (1) YEAR FROM THE DATE OF SUCH REPLACEMENT OR REPAIR.

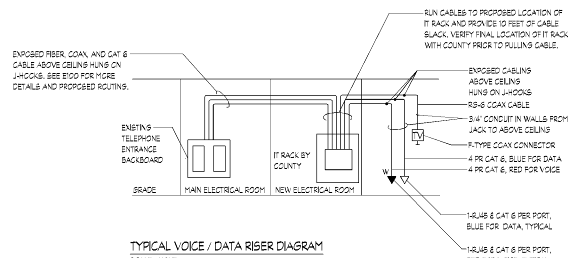


PARTIAL FIRE ALARM RISER
NOT TO SCALE

NOTES:
1. SEE FLOOR PLAN FOR DEVICE QUANTITIES AND LOCATIONS. FIELD VERIFY EXISTING NOTIFYING AND INITIATING CIRCUIT LOCATIONS.
2. FIRE ALARM SYSTEM SHALL BE IN ACCORDANCE WITH THE FIRE MARSHAL'S REQUIREMENTS.
3. EXISTING SYSTEM IS NOTIFIER. NEW DEVICES SHALL BE COMPATIBLE WITH EXISTING SYSTEM.
4. EQUIPMENT AND COMPONENTS SHALL BE U.L. LISTED, MEET ALL APPLICABLE CODES, MEET THE REQUIREMENTS OF NFPA72, NFPA 101 AND THE REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.
5. SUBMIT FOUR SETS OF PRODUCT DATA FOR EACH FIRE ALARM SYSTEM COMPONENT AND SUBMIT FOUR SETS OF SHOP DRAWINGS FOR WIRING DIAGRAMS, BATTERY SIZING CALCULATIONS, DEVICE ADDRESS LIST AND SYSTEM OPERATIONS DESCRIPTION. SUBMIT FIELD QUALITY CONTROL TEST REPORTS, AND OPERATION AND MAINTENANCE DATA. SUBMIT 3 SETS OF SHOP DRAWINGS TO FIRE MARSHALL FOR APPROVAL.
6. TEST THE SYSTEM AS OUTLINED IN NFPA 72. PROVIDE CERTIFICATION TO THE OWNER THAT SYSTEM COMPONENTS HAVE BEEN TESTED AND THAT SYSTEM IS OPERATIVE.
7. INSTRUCT THE OWNERS REPRESENTATIVE IN THE PROPER OPERATION AND MAINTENANCE OF THE SYSTEM.
8. PROVIDE BATTERY CALCULATIONS AND ADDITIONAL BATTERIES IF REQUIRED.
9. PROVIDE 1 YEAR WARRANTY AND 1 YEAR MAINTENANCE BY MANUFACTURERS U.L. AUTHORIZED REPAIR OR REPAIR BY U.L. CERTIFIED CONTRACTOR.
10. SOUND LEVELS ON AUDIO DEVICES SHALL MEET FIRE MARSHAL'S REQUIREMENTS.
11. NEW VISUAL DEVICES SHOULD BE ABLE TO BE SYNCHRONIZED WITH EXISTING VISUAL DEVICES.
12. SMOKE DETECTORS SHALL BE BAGGED DURING CONSTRUCTION.
13. WIRING SHALL BE IN CONDUIT WHERE EXPOSED OR WHERE BURIED IN NON-ACCESSIBLE CEILINGS OR WALLS. WIRING MAY BE OPEN PLENUM RATED ABOVE ACCESSIBLE CEILINGS.

DIVISION OF MECHANICAL/ELECTRICAL WORK

ITEM	MECH DIV 15	ELEC DIV 16
AUTOMATIC TEMPERATURE CONTROLS	FURNISH, INSTALL, & WIRE	POWER WIRING
CONTROL PANELS FOR MECHANICAL EQUIPMENT	FURNISH & INSTALL	POWER WIRING
LOW & LINE VOLTAGE CONTROL WIRING FOR MECH. EQUIPMENT	FURNISH & INSTALL	
MECHANICAL FLOW SWITCHES	FURNISH, INSTALL, & WIRE	
THERMOSTATS/SENSORS	FURNISH, INSTALL, & WIRE	
P/E & E/P SWITCHES	FURNISH, INSTALL, & WIRE	
DISCONNECT SWITCHES FOR MECHANICAL EQUIPMENT		FURNISH, INSTALL, & WIRE
MECHANICAL EQUIPMENT MOTORS	FURNISH & INSTALL	POWER WIRING
MANUAL STARTERS FOR MECHANICAL EQUIPMENT	FURNISH	INSTALL & POWER WIRE
MAGNETIC STARTERS FOR MECHANICAL EQUIPMENT	FURNISH	INSTALL & POWER WIRE
MOTOR CONTROL CENTERS	CONTROL WIRING	FURNISH, INSTALL, & WIRE
VARIABLE SPEED CONTROLLERS	FURNISH & INSTALL	POWER WIRING
MOTORIZED DAMPERS & VALVES	FURNISH, INSTALL, & WIRE	
DUCT SMOKE DETECTORS	INSTALL	FURNISH & WIRE
HEAT TRACE CABLE FOR PIPING	FURNISH & INSTALL	POWER WIRING
FIRE SMOKE DAMPERS	FURNISH & INSTALL	POWER AND FIRE ALARM WIRING



TYPICAL VOICE / DATA RISER DIAGRAM
SCALE: NONE

NOTES:
1. REFER TO FLOOR PLAN FOR LOCATIONS OF DEVICES. ELECTRICAL CONTRACTOR TO COORDINATE FINAL TERMINATION LOCATIONS, QUANTITIES, AND TYPES WITH COUNTY'S IT DEPARTMENT
2. CABLE INSTALL BETWEEN EXISTING TELEPHONE ENTRANCE BACKBOARD AND NEW IT RACK SHALL BE BY ELECTRICAL CONTRACTOR. SEE PLANS AND RISER FOR DETAILS ON WHO FURNISHES CABLES.
3. ALL CABLING SHALL BE SUSPENDED BY J-HOOKS WHERE ABOVE ACCESSIBLE CEILINGS. WHERE CEILING ARE NOT ACCESSIBLE PROVIDE CONDUITS AND BOXES AS NECESSARY.
4. ALL CABLING SHALL BE PLENUM RATED. CABLING SHALL BE RUN IN 3/4" CONDUIT WITH-IN WALL CAVITIES.
5. ELECTRICAL CONTRACTOR SHALL PULL ALL CABLING FROM JACK TO DATA RACK, WITH A MINIMUM OF 6'-0" WHIP AT RACK. CABLE PUNCH DOWN BY COUNTY. CONTRACTOR SHALL TEST CABLE FROM EACH OUTLET TO DATA RACK. PERFORM THE FOLLOWING TESTS ACCORDING TO TIA/EIA-568-B.1 AND TIA/EIA-568-B.2 AND SUPPLY REPORT OF RESULTS TO OWNER IN HARD COPY AND CD FORMAT: WIRE MAP, LENGTH, INSERTION LOSS, NEAR-END CROSSTALK (NEXT) LOSS, POWER SUM NEAR-END CROSSTALK (PSNEXT) LOSS, EQUAL-LEVEL FAR-END CROSSTALK (ELFEXT), POWER SUM EQUAL-LEVEL FAR-END CROSSTALK (PSELFEXT), RETURN LOSS, PROPAGATION DELAY, AND DELAY SKEW.

ELECTRICAL ABBREVIATIONS

ABRV.	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
CLG	CEILING
UNO	UNLESS NOTED OTHERWISE
ADA	AMERICANS WITH DISABILITIES ACT COMPLIANCE
P	POLES
Ø	PHASE
G, GRD	GROUND
C	CONDUIT
WP	WEATHER PROOF
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
ENCL	ENCLOSURE
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOC.
F&I	FURNISH AND INSTALL
ATS	AUTOMATIC TRANSFER SWITCH
C/B	CIRCUIT BREAKER
N/O	NORMALLY OPEN
N/C	NORMALLY CLOSED

ELECTRICAL LEGEND

SYMBOL	ABRV.	DESCRIPTION	ABRV.	SYMBOL
	PNL.	ELECTRICAL PANEL 208Y/120V, 480Y/277V		
		EXIT SIGN SINGLE FACE, DOUBLE FACE, DIRECTIONAL		
\$ \$2 \$3 \$4		SWITCH 1 POLE, 2 POLE, 3 WAY, 4 WAY	48" AFF UNO	
\$O	SO	PASSIVE INFRARED SINGLE POLE WALL SWITCH SENSOR, LINE VOLTAGE, WHITE MANUAL ON	48" AFF UNO	SENSOR SWITCH# nWSD-WH OR EQUAL
\$O2	SO2	PASSIVE DUAL TECHNOLOGY SINGLE POLE WALL SWITCH SENSOR, LINE VOLTAGE, WHITE, LOW TEMP, MANUAL ON	48" AFF UNO	SENSOR SWITCH# nWSD-PDT-WH-LT OR EQUAL
\$N	SN	PUSH BUTTON SWITCH, SINGLE POLE WITH MANUAL ON/OFF AND RAISE/LOWER CONTROLS, LOW VOLTAGE	48" AFF UNO	SENSOR SWITCH# nPODM-DX OR EQUAL
O1	O1	PASSIVE DUAL TECHNOLOGY CEILING MOUNTED OCCUPANCY SENSOR, LINE VOLTAGE, WHITE, EXTENDED RANGE		SENSOR SWITCH# nCMR-PDT-10 OR EQUAL
O2	O2	PASSIVE DUAL TECHNOLOGY CEILING MOUNTED OCCUPANCY SENSOR, LOW VOLTAGE, WHITE, EXTENDED RANGE		SENSOR SWITCH# nCM-PDT-10 OR EQUAL
O3	O3	PASSIVE INFRARED CEILING MOUNTED OCCUPANCY SENSOR, LOW VOLTAGE, WHITE, EXTENDED RANGE		SENSOR SWITCH# nCM-10 OR EQUAL
PP	PP	120/277V SWITCHING POWER PACK		SENSOR SWITCH# nPP-16 OR EQUAL
DP	DP	120/277V DIMMING/SWITCHING POWER PACK		SENSOR SWITCH# nEPP5 OR EQUAL
PS	PS	120/277V POWER SUPPLY		SENSOR SWITCH# nPS-80 OR EQUAL
IO	IO	INPUT/OUTPUT INTERFACE DEVICE, LOW VOLTAGE		SENSOR SWITCH# nIO-1S-KO OR EQUAL
PT PR	PR PT	PARTITION SENSOR, PROVIDED WITH (1) TRANSMITTER & (1) RECEIVER, PROVIDE WITH POWER SUPPLY LUTRON #GRX-12VDC		LUTRON# GRX-IRPS- WH OR EQUAL
PC	PC	SWIVEL NIPPLE 277V RATED PHOTOCELL		
		DUPLEX OR QUADRAPLEX RECEPTACLE	18" AFF UNO	
		GFCI DUPLEX RECEPTACLE	18" AFF UNO	
C C		DUPLEX OR GFCI RECEPTACLE MOUNTED 6" ABOVE COUNTER		
TP TP		TAMPERPROOF DUPLEX OR GFCI RECEPTACLE	18" AFF UNO	
FB	FB	4 COMPARTMENT FLUSH FLOOR BOX W/TWO 20A SIMPLEX RECEPTACLES, 4 PORT TELE/DATA, & HDMI/VGA PORTS AS REQUIRED BY OWNER. PROVIDE (1) 3/4" C FOR POWER, (1) 1" C FOR TELE/DATA AND (1) 1 1/4" C FOR HDMI/VGA. COORDINATE FINISH WITH ARCHITECT/OWNER		WIREMOLD# RFB4E-OG-6CTXX SERIES OR EQUAL
SP	SP	NOMINAL 8" DIAMETER RECESSED CEILING PA SYSTEM SPEAKER LOCATION. SPEAKER FURNISHED BY OWNER AND INSTALLED BY CONTRACTOR. CENTER SPEAKER IN CEILING TILE.		
▽		DATA OUTLET - F&I DOUBLE GANG BOX WITH PLASTER RING. PROVIDE 3/4" EMT TO ABOVE ACCESSIBLE CEILING. VERIFY QUANTITY OF PORTS WITH OWNER.	18" AFF UNO	SEE VOICE/DATA RISER FOR MORE INFO.
▼ W		WALL PHONE OUTLET - F&I DOUBLE GANG BOX WITH PLASTER RING. PROVIDE 3/4" EMT WITH PULLCORD TO ABOVE ACCESSIBLE CEILING	54" AFF UNO	SEE VOICE/DATA RISER FOR MORE INFO.
TV		TV OUTLET - F&I DOUBLE GANG BOX WITH PLASTER RING. PROVIDE 3/4" EMT TO ABOVE ACCESSIBLE CEILING. MOUNT ADJACENT QUAD RECEPTACLE AT SAME HEIGHT.	90" AFF UNO	SEE VOICE/DATA RISER FOR MORE INFO.
---F.S.D.		FIRE SMOKE DAMPER		
F	PS	FIRE ALARM INITIATING DEVICE - PULL STATION		COMPLY WITH ADA REQUIREMENTS
V #	V	FIRE ALARM VISUAL SIGNALING DEVICE, ADJUSTABLE INTENSITY STROBE	80" AFF UNO	NO. INDICATES MIN. CANDELA
AV #	AV	FIRE ALARM AUBILE/VISUAL SIGNALING DEVICE. ADJUSTABLE INTENSITY STROBE.	80" AFF UNO	NO. INDICATES MIN. CANDELA
J		JUNCTION BOX		
T		TRANSFORMER		
F	FSS NFSS	DISCONNECT SWITCH FUSED, NON FUSED.		

TYPICAL DEVICE: PANEL — L3-# — CIRCUIT NUMBER

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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER: 30756
EXPIRATION DATE: 06/28/2016

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

ELECTRICAL SPECIFICATIONS

ISSUE BLOCK

MARK	DATE	DESCRIPTION
5	09.18.14	ISSUED FOR CONSTRUCTION
1 (triangle)	07.21.14	ADDENDUM #1
4	06.04.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW

PROJECT NO: 2013.182.00
DATE: 02.07.2014
SCALE: NONE
DRAWN BY: SM PROJ MGR: DC

E002

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GENERAL NOTES:

1. EACH ROOM SHALL BE CONTROLLED BY ONLY THE DEVICES WITHIN THAT ROOM UNLESS OTHERWISE NOTED.
2. CONTRACTOR SHALL PROVIDE IN HIS BID PRICING, COMMISSIONING OF THE SYSTEM AND ALL PROGRAMMING REQUIRED FOR A FULLY FUNCTIONING SYSTEM BY A MANUFACTURER APPROVED REPRESENTATIVE.
3. ALL DIMMING OUTPUTS AND WIRING ARE NOT SHOWN ON DIAGRAM.
4. REFERENCE LIGHTING PLAN FOR SENSOR AND SWITCH QUANTITIES AND LOCATIONS.
5. POWER SUPPLIES, RELAY RACKS, INTERFACE DEVICES, BACKBOX, AND OTHER BACKBONE DEVICES SHALL BE LOCATED ABOVE ACCESSIBLE CEILING AND TO BEST SUIT FIELD CONDITIONS & MINIMIZE CABLE WIRE RUNS.

WIRE LEGEND	
A	CAT 5 (LOW VOLTAGE)
B	CLASS 1 (LINE VOLTAGE)
C	CLASS 2 (LOW VOLTAGE)
D	ETHERNET LAN (LOW VOLTAGE)

8 DRAWING NOTES:

1. CONTRACTOR TO COORDINATE WITH LIGHTING CONTROLS VENDOR AND PROVIDE ALL REQUIRED COMPONENTS TO FULLY INTERFACE PARTITION SENSORS WITH LIGHTING CONTROLS IN ORDER FOR SYSTEM TO FUNCTION AS DESCRIBED IN THE LIGHTING CONTROLS SCHEDULE.

LIGHTING CONTROLS SCHEDULE

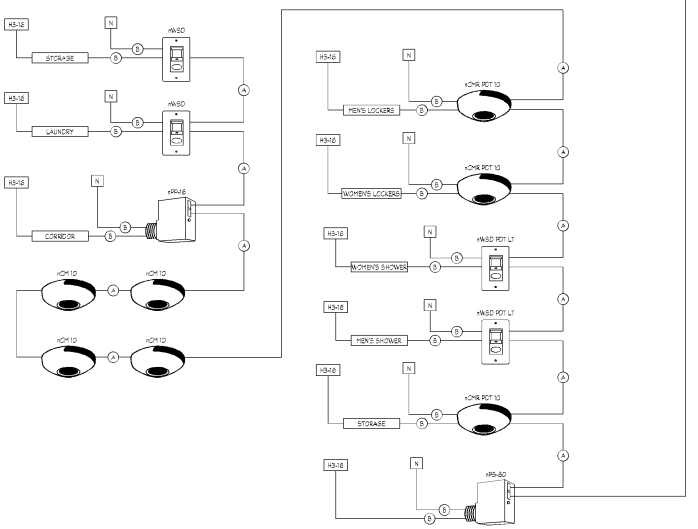
ROOM NAME	ZONE CONTROL DEVICES	ZONE OPERATION
SMALL STORAGE	LINE VOLTAGE PASSIVE INFRARED WALL SWITCH VACANCY SENSOR.	MANUAL ON, MANUAL OFF BY PUSH BUTTON OR AUTOMATIC OFF AFTER 10 MINUTES OF NON-OCCUPANCY.
LAUNDRY	LINE VOLTAGE PASSIVE INFRARED WALL SWITCH VACANCY SENSOR.	MANUAL ON, MANUAL OFF BY PUSH BUTTON OR AUTOMATIC OFF AFTER 10 MINUTES OF NON-OCCUPANCY.
CORRIDOR	LOW VOLTAGE PASSIVE INFRARED CEILING MOUNTED OCCUPANCY SENSORS AND RELAY RACK	AUTOMATIC ON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
MENS LOCKER	LINE VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSOR	AUTOMATIC ON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
MENS SHOWER	LINE VOLTAGE PASSIVE INFRARED/ULTRASONIC WALL SWITCH VACANCY SENSOR.	MANUAL ON, MANUAL OFF BY PUSH BUTTON OR AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
WOMENS LOCKER	LINE VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSOR	AUTOMATIC ON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
WOMENS SHOWER	LINE VOLTAGE PASSIVE INFRARED/ULTRASONIC WALL SWITCH VACANCY SENSOR.	MANUAL ON, MANUAL OFF BY PUSH BUTTON OR AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
LARGE STORAGE	LINE VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSOR	AUTOMATIC ON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
AEROBICS	LOW VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSORS, LOW VOLTAGE ON/OFF-RAISE/LOWER DIMMER SWITCH, ON/OFF PUSHBUTTON, AND DIMMING RELAY PACK.	WHEN PARTITION IS CLOSED; LIGHTS IN AEROBICS & EXERCISE CONTROLLED SEPARATELY, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA xPODM DX IN RESPECTIVE ROOM, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY. WHEN PARTITION IS OPEN; LIGHTS IN AEROBICS & EXERCISE CONTROLLED TOGETHER, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA EITHER xPODM DX IN AEROBICS OR EXERCISE, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
EXERCISE/ WEIGHTS	LOW VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSORS, LOW VOLTAGE ON/OFF-RAISE/LOWER DIMMER SWITCH, ON/OFF PUSHBUTTON, AND DIMMING RELAY PACK.	WHEN PARTITION IS CLOSED; LIGHTS IN AEROBICS & EXERCISE CONTROLLED SEPARATELY, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA xPODM DX IN RESPECTIVE ROOM, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY. WHEN PARTITION IS OPEN; LIGHTS IN AEROBICS & EXERCISE CONTROLLED TOGETHER, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA EITHER xPODM DX IN AEROBICS OR EXERCISE, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
MULTI-PURPOSE/ CONFERENCE	LOW VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSOR, LOW VOLTAGE ON/OFF-RAISE/LOWER DIMMER SWITCH, ON/OFF PUSHBUTTON, AND DIMMING RELAY PACK.	WHEN PARTITION IS CLOSED; LIGHTS IN MULTI-PURPOSE & AFTER SCHOOL CARE CONTROLLED SEPARATELY, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA xPODM DX IN RESPECTIVE ROOM, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY. WHEN PARTITION IS OPEN; LIGHTS IN MULTI-PURPOSE & AFTER SCHOOL CARE CONTROLLED TOGETHER, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA EITHER xPODM DX IN AEROBICS OR EXERCISE, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.
AFTER SCHOOL CARE	LOW VOLTAGE PASSIVE INFRARED/ULTRASONIC CEILING MOUNTED OCCUPANCY SENSORS, LOW VOLTAGE ON/OFF-RAISE/LOWER DIMMER SWITCH, ON/OFF PUSHBUTTON, AND DIMMING RELAY PACK.	WHEN PARTITION IS CLOSED; LIGHTS IN MULTI-PURPOSE & AFTER SCHOOL CARE CONTROLLED SEPARATELY, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA xPODM DX IN RESPECTIVE ROOM, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY. WHEN PARTITION IS OPEN; LIGHTS IN MULTI-PURPOSE & AFTER SCHOOL CARE CONTROLLED TOGETHER, MANUAL ON TO 50% OF FULL LIGHT OUTPUT VIA EITHER xPODM DX IN AEROBICS OR EXERCISE, MANUAL DIMMER OVERRIDE AND MANUAL OFF BY PUSHBUTTON, AUTOMATIC OFF AFTER 20 MINUTES OF NON-OCCUPANCY.

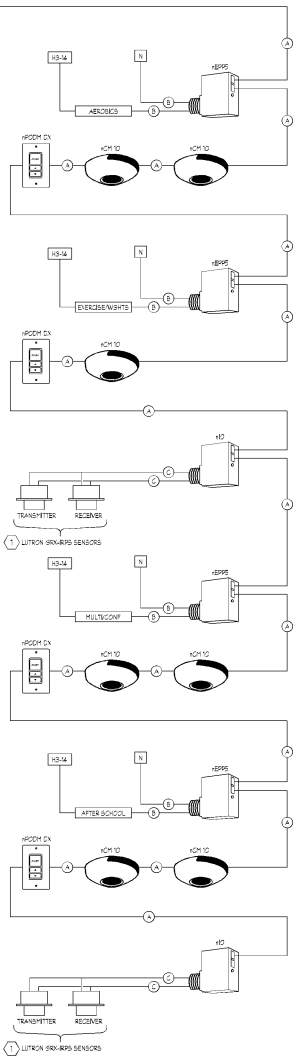
LIGHTING FIXTURE SCHEDULE

TYPE		DESCRIPTION	MANUFACTURER	CATALOG NUMBER	LAMPS QTY	LAMPS TYPE	MOUNTING	VOLTAGE	REMARKS
○	A	2'X4' LED LAY-IN TROFFER, ACRYLIC LENS, 120/277V UNIVERSAL 0-10V DIMMING DRIVER	METALUX	2SNA-LD1-48-A12S-UNV-L835-CD1	1	48W LED 3500K	RECESSED	120/277V	1, 2, 4, 5
○	B	2'X4' LED LAY-IN TROFFER, ACRYLIC LENS, 120/277V UNIVERSAL 0-10V DIMMING DRIVER	METALUX	2SNA-LD1-64-A12S-UNV-L835-CD1	1	65W LED 3500K	RECESSED	120/277V	1, 2, 4, 5, 6
⟷	C	4' INDUSTRIAL FLUORESCENT STRIP WITH WIREGUARD, 120/277V UNIVERSAL PROGRAM START BALLAST	METALUX	ICT-232-UNV-E4S1-MVS/ICT-4-FT-U	2	F32T8 T8 3500K	PENDANT @ 8'-0" AFF	120/277V	1, 2, 3, 4, 5
○	D	6" LED DOWNLIGHT FIXTURE, SEMI-SPECULAR REFLECTOR, WHITE FLANGE, 120/277V UNIVERSAL 0-10V DIMMING DRIVER	PORTFOLIO	LD6410D010TR-ERM-A40835-ZLHTMWF	1	14W LED 3500K	RECESSED	120/277V	1, 2, 4, 5
○	D1	6" LED DOWNLIGHT FIXTURE, SEMI-SPECULAR REFLECTOR, WHITE FLANGE, 120/277V UNIVERSAL 0-10V DIMMING DRIVER, WET LISTED	PORTFOLIO	LD6410D010TR-ERM-A40835-ZLHTMWF-L950ATDRD8	1	14W LED 3500K	RECESSED	120/277V	1, 2, 4, 5
⬅	EM	EMERGENCY LIGHTING UNIT, THERMOPLASTIC HOUSING, WHITE FINISH, LEAD-CALCIUM BATTERY, 120/277V	SURE-LITES	CCM-MRT	2	MR16 5W INC	WALL MOUNT @ 8'-0" AFF	120/277V	1, 2, 4, 5
	F	CONTINUOUS RECESSED LINEAR FLUORESCENT, WHITE FINISH, ALUMINUM BAFFLE, SEE PLANS FOR CONTINUOUS FIXTURE LENGTHS, 120/277V UNIVERSAL PROGRAM START BALLAST	NEO-RAY	T8-2T8-48-R-2EB-C-S12	2	F32T8 T8 3500K	RECESSED	277V	1, 2, 3, 4, 5
▭	G	METAL HALIDE EVERBRITE WALL PACK, BLACK FINISH, BUILT-IN 277V PHOTOCELL, 277V MAGNETIC BALLAST, WET LISTED, LAMP INCLUDED	LITHONIA	TWA175M-G7T-PE-DBLK-FI	1	175W MH 3200K	WALL MOUNT TO MATCH EXISTING HGT	277V	1, 2, 3, 4, 5
D	H	2'X4' LED LAY-IN TROFFER, ACRYLIC LENS, 120/277V UNIVERSAL 0-10V DIMMING DRIVER	METALUX	2SNA-LD1-32-A12S-UNV-L835-CD1	1	32W LED 3500K	RECESSED	120/277V	1, 2, 4, 5
◀●	X2	UNIVERSAL MOUNT EXIT LIGHT COMBO, WITH DIRECTIONAL ARROWS AS INDICATED, PLASTIC HOUSING, RED LETTERS, 120/277V	SURE-LITES	LPXTCH	1 2	RED LED 5.4W INC	MOUNT ON CLG OR WALL MOUNT @ 8'	120/277V	1, 2, 4, 5
◀●	X3	UNIVERSAL MOUNT EXIT LIGHT COMBO, WITH DIRECTIONAL ARROWS AS INDICATED, PLASTIC HOUSING, RED LETTERS, LEAD-CALCIUM BATTERY, 120/277V, REMOTE HEAD CAPABLE	SURE-LITES	LPXHCH	1 2	RED LED 5.4W INC	MOUNT ON CLG OR WALL MOUNT @ 8'	120/277V	1, 2, 4, 5
◀●	X6	SINGLE REMOTE EMERGENCY LAMP HEAD, WEATHERPROOF, SV BLACK FINISH, WIRE TO CLOSEST TYPE X3 EMERGENCY LIGHTING UNIT	SURE-LITES	SVWS4WBK	1	5.4W INC	MOUNT ON CLG OR WALL MOUNT @ 8'	6V	1, 2, 4, 5

TYPICAL FIXTURE: FIXTURE TYPE (A) — LIGHTING CONTROL ZONE (2E) — PANEL & CIRCUIT NUMBER (H3-8)

REMARKS:
1. COORDINATE WITH ARCHITECT/OWNER FOR FIXTURES MAKE, MODEL, FINISHES, MOUNTING HEIGHTS AND FINAL LOCATION.
2. ALL CEILING/WALL TYPES SHALL BE VERIFIED PRIOR TO FIXTURES BEING ORDERED.
3. ALL FLUORESCENT FIXTURES SHALL BE PROVIDED WITH HIGH POWER FACTOR ELECTRONIC BALLAST. ALL HID FIXTURES SHALL BE PROVIDED WITH HIGH POWER FACTOR BALLAST.
4. ALL FIXTURES SHOWN ESTABLISH THE BASIS OF DESIGN OR LEVEL OF QUALITY EXPECTED. IF ALTERNATE FIXTURES ARE SUBSTITUTED DURING THE SUBMITTAL PROCESS, THE ENGINEER AND ARCHITECT RESERVE THE RIGHT TO REJECT THE SUBSTITUTED FIXTURE BASED UPON OUR PROFESSIONAL JUDGEMENT.
5. ALL FIXTURES PROVIDED ARE EXPECTED TO HAVE ALL APPURTENANCES, MOUNTING HARDWARE AND ETC. PROVIDED IN ORDER TO PROVIDE A PROPER INSTALLATION.
6. COORDINATE DIMMER CONTROLS WITH DIMMING BALLAST/DRIVER.





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I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER 30790
EXPIRATION DATE 9/29/2014

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

LIGHTING SCHEDULE & CONTROL DIAGRAM

ISSUE BLOCK:		
6	09.10.14	ISSUED FOR CONSTRUCTION
5	07.21.14	ADDENDUM #1
4	06.06.14	ISSUED FOR BIDS/PERMIT
3	12.18.13	PLANNING COMMISSION
2	10.25.13	DD REVIEW
1	09.25.13	DD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	NONE
DRAWN BY: SM	PROJ MGR: DC

E003

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⑦⑫EXISTING PANEL MDP

3 PHASE, 4 WIRE, 480Y/277 VOLT, 600 AMP, MCB TYPE, 18,000 MIN AIC

CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT	LOAD kVA	LOAD Ø	LOAD kVA	CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT
1	SPACE				0.00	a	0.00	2	SPACE			
3	SPACE				0.00	b	0.00	4	SPACE			
5	SPACE				0.00	c	0.00	6	SPACE			
7	SPACE				0.00	a	0.00	8	SPACE			
9	SPACE				0.00	b	0.00	10	SPACE			
11	SPACE				0.00	c	0.00	12	SPACE			
13	SPACE				0.00	a	0.00	14	SPACE			
15	SPACE				0.00	b	0.00	16	SPACE			
17	SPACE				0.00	c	0.00	18	SPACE			
⑨⑩ 19	PANEL H3	3	250	480	166.89	a	0.88	20	PANEL H4	3	125	480
21	-	-	-	-	48.48	b	0.93	22	-	-	-	-
23	-	-	-	-	120.89	c	0.93	24	-	-	-	-
⑨⑩ 25	PANEL MPZ	2	30	480	4.04	a	0.00	26	SPARE	3	200	480
27	-	-	-	-	3.84	b	0.00	28	-	-	-	-
29	SPACE				0.00	c	0.00	30		-	-	-
31	RTU-1	3	125	480	34.00	a	3.20	32	PNL L2 VIA 45 kVA XFMR	3	100	480
33	-	-	-	-	34.00	b	3.10	34	-	-	-	-
35	-	-	-	-	34.00	c	1.30	36	-	-	-	-
37	RTU-2	3	150	480	36.00	a	13.70	38	PNL L1 VIA 75 kVA XFMR	3	125	480
39	-	-	-	-	36.00	b	13.70	40	-	-	-	-
41	-	-	-	-	56.00	c	14.70	42	-	-	-	-
43	SPARE	3	200	480	0.00	a	31.80	44	PANEL H1	3	200	480
45	-	-	-	-	0.00	b	28.80	46	-	-	-	-
47	-	-	-	-	0.00	c	27.80	48	-	-	-	-

NOTES:
1. ALL BREAKERS ARE EXISTING UNO.
2. EXISTING LOADS BASED OFF AS-BUILTS.
3. PROVIDE NEW BREAKER AS INDICATED.
4. PROVIDE WITH HANDLE MOTOR OPERATOR.
5. FEED WITH 2 #6 + #8S, 1"C.

a 184.88 ±TOTAL PHASE LOAD
b 179.30 ±TOTAL PHASE LOAD
c 168.88 ±TOTAL PHASE LOAD
532.8 ±TOTAL PANEL CONNECTED LOAD

PANEL H3

3 PHASE, 4 WIRE, 480Y/277 VOLT, 250 AMP, MLO TYPE, 18,000 MIN AIC

CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT	LOAD kVA	LOAD Ø	LOAD kVA	CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT
② 1	VAV-1	3	30	480	5.85	c	13.82	2	RTU-1	3	70	480 ⑤
3	-	-	-	-	5.85	b	13.82	4	-	-	-	-
③ 5	-	-	-	-	5.85	c	13.82	6	-	-	-	-
③ 7	VAV-2	3	40	480	9.33	c	0.83	8	ERV-1	3	20	480 ⑥
9	-	-	-	-	9.33	b	0.83	10	-	-	-	-
11	-	-	-	-	9.33	c	0.83	12	-	-	-	-
② 13	VAV-4	3	30	480	5.42	c	2.22	14	LTS, EXER LIGHTS, CONF	1	20	277
15	-	-	-	-	5.42	b	1.66	16	LTS, CORRIDOR/BATH	1	20	277
17	-	-	-	-	5.42	c	3.20	15	SUH-1	1	20	277
① 19	VAV-3	1	20	277	5.83	c	0.00	20	SPARE	1	20	277
21	VAV-5	1	20	277	5.11	b	0.00	22	SPARE	1	20	277
23	VAV-6	1	20	277	5.11	c	0.00	24	SPARE	1	20	277
25	VAV-8	1	20	277	5.11	c	0.00	26	SPARE			
27	VAV-7	1	40	277	9.90	c	0.00	28	SPARE			
29	SPACE				0.00	b	0.00	30	SPACE			
31	SPACE				0.00	c	0.00	32	SPACE			
33	SPACE				0.00	b	0.00	34	SPACE			
35	SPACE				0.00	c	0.00	36	SPACE			
37	SPACE				0.00	c	0.00	38	SPACE			
39	SPACE				0.00	b	0.00	40	SPACE			
41	SPACE				0.00	c	2.80	42	-	-	-	-

NOTES:
1. FEED WITH 2 #10 + #10S, 3/4"C.
2. FEED WITH 3 #10 + #10S, 3/4"C.
3. FEED WITH 3 #8 + #10S, 3/4"C.
4. FEED WITH 3 #12 + #12S, 3/4"C.
5. FEED WITH 3 #4 + #8S, 1"C.

a 56.89 ±TOTAL PHASE LOAD
b 48.18 ±TOTAL PHASE LOAD
c 50.35 ±TOTAL PHASE LOAD
156.66 ±TOTAL PANEL CONNECTED LOAD

PANEL L3

3 PHASE, 4 WIRE, 208Y/120 VOLT, 150 AMP, MLO TYPE, 10,000 MIN AIC

CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT	LOAD kVA	LOAD Ø	LOAD kVA	CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT
① 1	DRYER	2	30	208	4.75	a	0.72	2	REC, AFTER SCHOOL	1	20	120
3					4.75	b	0.54	4	REC, AFTER SCHOOL	1	20	120
5	WASHER/REC, LAUN, RM	1	20	120	1.80	c	0.54	6	REC, MULTI/CONF	1	20	120
7	REC, CORRIDOR	1	20	120	0.72	a	0.54	8	REC, MULTI/CONF	1	20	120
9	SPARE	1	20	120	0.00	b	0.90	10	REC, AERO, STUDIO/EVER	1	20	120
11	REC, MEN'S RESTRM	1	20	120	0.36	c	0.54	12	REC, AERO, STUDIO/EVER	1	20	120
13	REC, WOMEN'S RESTRM	1	20	120	0.36	a	0.18	14	REC, EXERCISE/WEIGHTS	1	20	120
15	REC, STUDIO/TECH, HVAC	1	20	120	0.72	b	0.18	16	REC, EXERCISE/WEIGHTS	1	20	120
17	REC, EXERCISE FLR/BOX #1	1	20	120	1.44	c	0.36	18	REC, EXERCISE/WEIGHTS	1	20	120
19	REC, EXERCISE FLR/BOX #2	1	20	120	1.44	a	0.36	20	REC, EXERCISE/WEIGHTS	1	20	120
21	REC, EXERCISE FLR/BOX #3	1	20	120	1.44	b	0.18	22	REC, EXERCISE/WEIGHTS	1	20	120
23	REC, EXERCISE FLR/BOX #4	1	20	120	1.44	c	0.18	24	REC, EXERCISE/WEIGHTS	1	20	120
25	REC, EXERCISE FLR/BOX #5	1	20	120	1.44	a	0.18	26	REC, EXERCISE/WEIGHTS	1	20	120
27	REC, EXERCISE FLR/BOX #6	1	20	120	1.44	b	0.18	28	REC, EXERCISE/WEIGHTS	1	20	120
29	REC, EXERCISE FLR/BOX #7	1	20	120	1.44	c	0.72	30	REC, AFTR SCHOOL/CNF TVS	1	20	120
31	REC, EXERCISE FLR/BOX #8	1	20	120	1.44	c	0.00	32	SPARE	1	20	120
② 33	ELECTRIC WATER COOLER	1	20	120	0.68	a	0.00	34	SPARE	1	20	120
35	AUTOMATIC FAUCETS	1	20	120	0.72	b	0.00	36	SPARE	1	20	120
37	REC, EXERCISE TVS	1	20	120	0.72	c	0.00	38	SPARE	1	20	120
39	SPARE	1	20	120	0.00	a	0.00	40	SPARE	1	20	120
41	SPARE	1	20	120	0.00	c	0.00	42	SPARE	1	20	120

NOTES:
1. FEED WITH 3 #10 + #10S, 3/4"C.
2. PROVIDE SPCI BREAKER.

a 10.88 ±TOTAL PHASE LOAD
b 8.88 ±TOTAL PHASE LOAD
c 8.80 ±TOTAL PHASE LOAD
28.23 ±TOTAL PANEL CONNECTED LOAD

①PANEL MPZ

1PHASE, 3 WIRE, 240/120 VOLT, 60 AMP, MCB TYPE, 10,000 MIN AIC

CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT	LOAD kVA	LOAD Ø	LOAD kVA	CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT
① 1	DUPLEX PUMP PANEL	2	40	240	2.40	a	0.00	2	SPACE			
3	-	-	-	-	2.40	b	0.00	4	SPACE			
② 5	SIMPLEX PUMP PANEL	2	30	240	1.44	a	0.00	6	SPACE			
7	-	-	-	-	1.44	b	0.00	8	SPACE			
9	RECEPTACLE	1	20	120	0.18	c	0.00	10	SPACE			

NOTES:
1. PROVIDE A SQUARE D MPZB1064GP SEALED, 10 kVA MINI POWER-ZONE UNIT SUBSTATION WITH 480V Ø PRIMARY & 30A O/B, AND 120/240V 1Ø SECONDARY & 60A C/B, UNIT TO HAVE 10 SPACE PANEL SECTION.
2. FEED WITH 3 #10 + #10S, 3/4"C.
3. FEED WITH 3 #8 + #10S, 3/4"C.

a 4.02 ±TOTAL PHASE LOAD
b 3.84 ±TOTAL PHASE LOAD
7.86 ±TOTAL PANEL CONNECTED LOAD

PANEL H4

3 PHASE, 4 WIRE, 480Y/277 VOLT, 125 AMP, MLO TYPE, 18,000 MIN AIC

CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT	LOAD kVA	LOAD Ø	LOAD kVA	CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT
1	SPARE	1	20	277	0.00	c	0.00	2	SPARE	1	20	277
3	SPARE	1	20	277	0.00	b	0.00	4	SPARE	1	20	277
5	SPARE	1	20	277	0.00	c	0.00	6	SPARE	1	20	277
7	SPACE				0.00	c	0.00	8	SPACE			
9	SPACE				0.00	b	0.00	10	SPACE			
11	SPACE				0.00	c	0.00	12	SPACE			
13	SPACE				0.00	a	0.00	14	SPACE			
15	SPACE				0.00	b	0.00	16	SPACE			
17	SPACE				0.00	c	0.00	18	SPACE			
19	SPACE				0.00	a	0.00	20	SPACE			
21	SPACE				0.00	b	0.00	22	SPACE			
23	SPACE				0.00	c	0.00	24	SPACE			
25	SPACE				0.00	a	0.88	26	PNL L4 VIA 30 kVA XFMR	3	50	480
27	SPACE				0.00	b	0.88	28	-	-	-	-
29	SPACE				0.00	c	0.80	30	-	-	-	-

NOTES:
1.

a 0.88 ±TOTAL PHASE LOAD
b 0.88 ±TOTAL PHASE LOAD
c 0.80 ±TOTAL PHASE LOAD
2.08 ±TOTAL PANEL CONNECTED LOAD

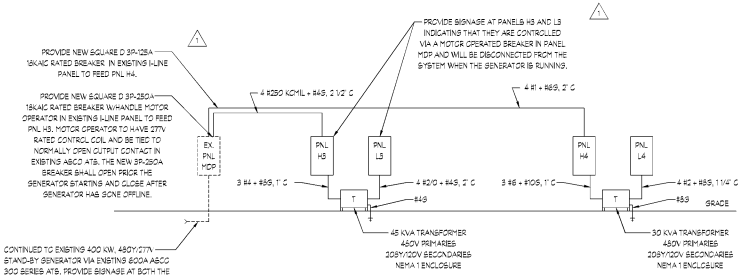
PANEL L4

3 PHASE, 4 WIRE, 208Y/120 VOLT, 100 AMP, MCB TYPE, 10,000 MIN AIC

CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT	LOAD kVA	LOAD Ø	LOAD kVA	CKT	FOR	CKT BKR P	CKT BKR AMP	CKT BKR VOLT
1	TELECOM BACKBOARD	1	20	120	0.18	a	0.90	2	FIRE SMOKE DAMPERS	1	20	120
3	TELECOM BACKBOARD	1	20	120	0.18	b	0.90	4	FIRE SMOKE DAMPERS	1	20	120
5	EXHAUST FAN, EF-1	1	20	120	0.90	c	0.18	6	HVAC PANEL B	1	20	120
7	SPARE	1	20	120	0.00	a	0.00	8	SPARE	1	20	120
9	SPACE				0.00	b	0.00	10	SPACE			
11	SPACE				0.00	c	0.00	12	SPACE			
13	SPACE				0.00	a	0.00	14	SPACE			
15	SPACE				0.00	b	0.00	16	SPACE			
17	SPACE				0.00	c	0.00	18	SPACE			
19	SPACE				0.00	a	0.00	20	SPACE			
21	SPACE				0.00	b	0.00	22	SPACE			
23	SPACE				0.00	c	0.00	24	SPACE			
25	SPACE				0.00	a	0.00	26	SPACE			
27	SPACE				0.00	b	0.00	28	SPACE			
29	SPACE				0.00	c	0.00	30	SPACE			

NOTES:
1. PROVIDE BREAKER LOCK.

a 0.88 ±TOTAL PHASE LOAD
b 0.88 ±TOTAL PHASE LOAD
c 0.80 ±TOTAL PHASE LOAD
2.08 ±TOTAL PANEL CONNECTED LOAD



PARTIAL POWER RISER

NOT TO SCALE

NOTES:

1. FEEDERS & EQUIPMENT SHOWN AS A LIGHT LINE WEIGHT AND DASHED ARE EXISTING TO REMAIN.
2. FEEDERS & EQUIPMENT SHOWN AS A DARK LINE WEIGHT AND SOLID ARE NEW TO BE FURNISHED AND INSTALL.

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I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER 30790
EXPIRATION DATE 10/09/2015

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

PANEL SCHEDULES AND POWER RISER

MARK	DATE	DESCRIPTION
6	07.10.14	ISSUED FOR CONSTRUCTION
5	07.21.14	ADDENDUM #1
4	06.06.14	ISSUED FOR BIDDING/PERMIT
3	10.30.13	PLANNING COMMISSION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW

PROJECT NO: 2013.182.00
DATE: 02.07.2014
SCALE: NONE
DRAWN BY: SM PROJ MGR: DC

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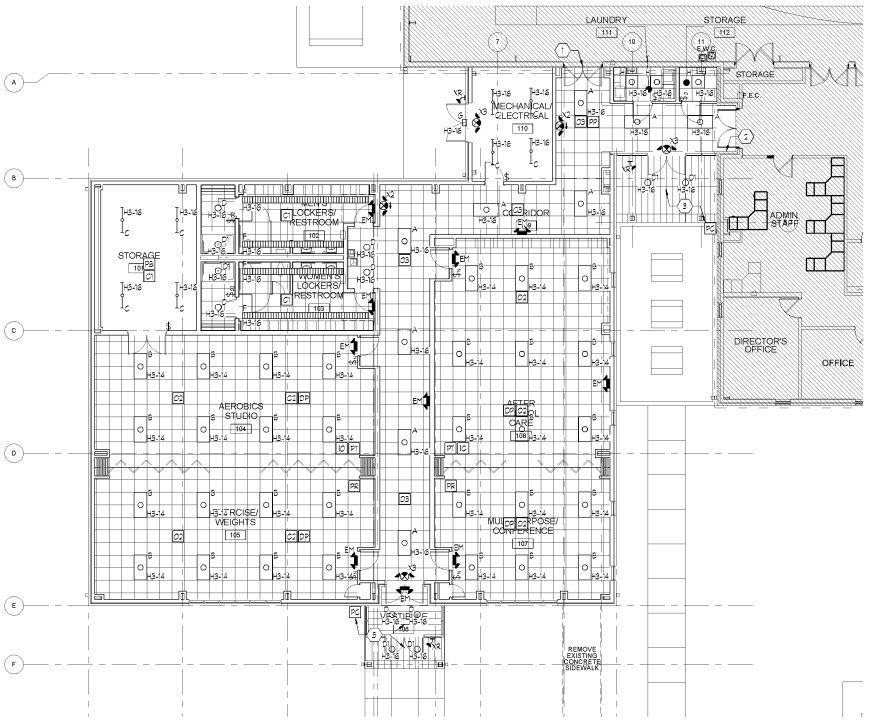
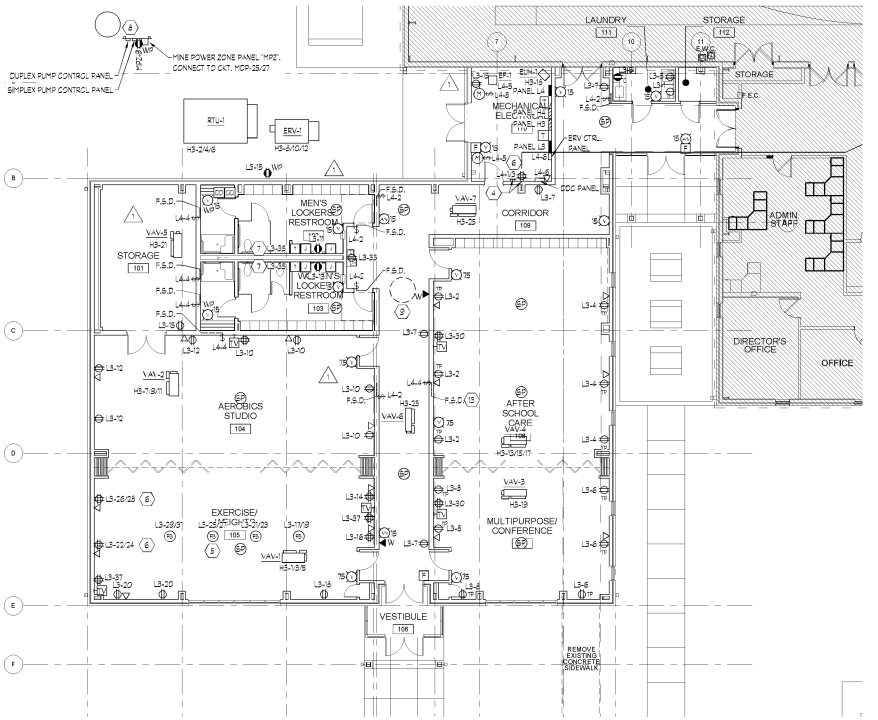


LIGHTING FLOOR PLAN

SCALE: 1/8" = 1' - 0"



POWER FLOOR PLAN

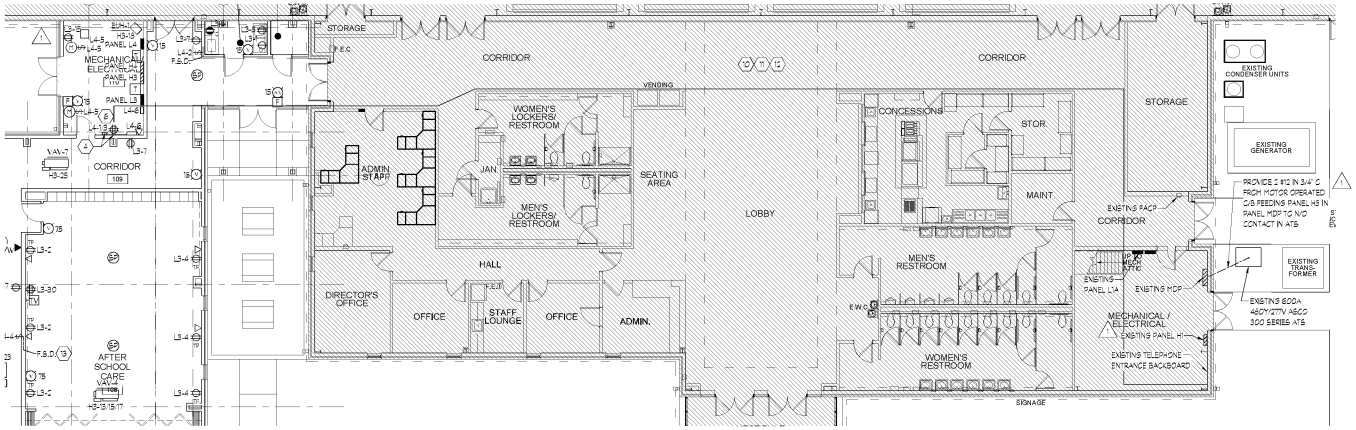
SCALE: 1/8" = 1' - 0"

GENERAL NOTES:

1. EXIT SIGNS AND EMERGENCY LIGHTING UNITS SHALL BE WIRED TO THE UNSWITCHED SIDE OF THE LOCAL LIGHTING CIRCUIT. CARRY EXTRA HOT WIRE AS REQUIRED.
2. CONTRACTOR TO VERIFY LOCATIONS AND MOUNTING HEIGHTS OF ALL POWER AND TELECOM DEVICES WITH OWNER AND OWNER PROVIDED EQUIPMENT PRIOR TO ROUGH-IN.
3. ALL MECHANICAL EQUIPMENT IS FACTORY FURNISHED WITH A DISCONNECTING MEANS UNO. ELECTRICAL CONTRACTOR TO PROVIDE CONNECTION OF EQUIPMENT.
4. CONTRACTOR TO COORDINATE WORK WITH OWNER SELECTED SECURITY VENDOR AND CABLE VENDOR. WHERE DISCREPANCIES OCCUR THE CONTRACTOR SHALL BRING IT TO THE ARCHITECT OR ENGINEER'S ATTENTION BEFORE COMMENCING WORK.

(E) DRAWING NOTES:

1. ELECTRICAL CONTRACTOR TO REMOVE EXISTING EXTERIOR WALL PACK AT THIS LOCATION.
2. ELECTRICAL CONTRACTOR TO REMOVE EXISTING EMERGENCY REMOTE HEAD AT THIS LOCATION.
3. TYPE 'D' AND/OR 'DI' FIXTURES AT THIS LOCATION TO BE WIRED THRU ADJACENT PHOTOCELL. PHOTOCELL TO BE LOCATED AS HIGH AS POSSIBLE AND IN A LOCATION TO AVOID SHADOWS.
4. ELECTRICAL CONTRACTOR TO PROVIDE 4'-W X 8'-H X 3/4" THICK FIRE RETARDANT PLYWOOD FOR OWNER PROVIDED TELECOM EQUIPMENT. PROVIDE COPPER 3-LINE BRITEBAR OR EQUAL TELECOM GROUNDING BUSBAR AND BOND PER NEC ARTICLE 250. PROVIDE TWO DEDICATED CIRCUITS FOR TELECOM EQUIPMENT POWER.
5. TYPICAL FLOORBOX WITH TWO DEDICATED SIMPLEX RECEPTACLES. PROVIDE 2#12 + #12G TO EACH DEVICE. PROVIDE CONDUITS IN OR BELOW SLAB AS INDICATED IN LEGEND FROM FLOOR BOX TO NEAREST WALL AND STUB UP TO ABOVE ACCESSIBLE CEILING.
6. QUAD WITH TWO DEDICATED DUPLEX RECEPTACLES. PROVIDE 2#12 + #12G TO EACH DEVICE.
7. JUNCTION BOX FOR MOUNTING TRANSFORMER FEEDING AUTOMATIC FAUCETS. MOUNT JUNCTION BOX TIGHT TO UNDERSIDE OF COUNTER. TRANSFORMER TO BE PROVIDED BY PLUMBING CONTRACTOR WITH INSTALLATION AND HOOK-UP BY ELECTRICAL CONTRACTOR.
8. LIFT STATION PUMP CONTROL PANELS TO BE WIRED TO PANEL MDP. PROVIDE A 3P-30A C/B IN PANEL MDP, FEED WITH 3 #10 + #10G IN 3/4" C. PROVIDE CONNECTION OF CORD FROM CONTROL PANEL TO PUMPS. CORD PROVIDED BY OTHERS.
9. ELECTRICAL CONTRACTOR TO SAFELY DISCONNECT POWER TO EXISTING LIFT STATION TO BE DEMOLISHED. CONDUIT AND WIRE BELOW GRADE MAY BE ABANDONED IN PLACE. CONDUIT AND WIRE INSIDE THE BUILDING MUST BE REMOVED BACK FROM THE APPROPRIATE PANELBOARD TO THE POINT WHERE IT ENTS THE BUILDING.
10. ELECTRICAL CONTRACTOR TO FURNISH AND INSTALL (4) - 4 PAIR RED CAT6 CABLES ROUTED ABOVE ACCESSIBLE CEILING ALONG CORRIDOR AND ACROSS LOBBY CEILING FROM EXISTING TELEPHONE ENTRANCE BACKBOARD TO LOCATION OF NEW IT RACK. MOUNT CABLES ON J-HOOKS. PROVIDE 10 FEET OF CABLE SLACK AT EACH END.
11. ELECTRICAL CONTRACTOR TO INSTALL FIBER OPTIC CABLE FURNISHED BY OWNER. CABLE IS TO BE ROUTED ABOVE ACCESSIBLE CEILING ALONG CORRIDOR AND ACROSS LOBBY CEILING FROM EXISTING TELEPHONE ENTRANCE BACKBOARD TO LOCATION OF NEW IT RACK. MOUNT CABLE ON SEPARATE J-HOOKS. VERIFY CABLE SLACK AT BOTH ENDS WITH OWNER.
12. ELECTRICAL CONTRACTOR TO FURNISH AND INSTALL (3) - COAX CABLES ROUTED ABOVE ACCESSIBLE CEILING ALONG CORRIDOR AND ACROSS LOBBY CEILING FROM EXISTING TELEPHONE ENTRANCE BACKBOARD TO LOCATION OF NEW IT RACK. MOUNT CABLES ON J-HOOKS. PROVIDE 10 FEET OF CABLE SLACK AT EACH END.
13. TYPICAL FIRE SMOKE DAMPER, PROVIDED BY OTHERS. FACTORY FURNISHED WITH SMOKE DETECTOR AND INSTALLED BY MECHANICAL CONTRACTOR. ELECTRICAL CONTRACTOR TO PROVIDE POWER CONNECTION. FIRE ALARM CONTRACTOR TO TIE INTO BUILDING FIRE ALARM SYSTEM.



EXISTING BUILDING FLOOR PLAN

SCALE: 1/8" = 1' - 0"

GRAPHIC SCALE 1/8" = 1'-0"

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LICENSE NUMBER 30790
EXPIRATION DATE 10/09/2015

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

ELECTRICAL PLANS

ISSUE BLOCK		
5	05.10.14	ISSUED FOR CONSTRUCTION
4	04.21.14	ADDENDUM #1
3	10.08.13	ISSUED FOR BIDDING/PERMIT
2	10.30.13	PLANNING COMMISSION
1	09.26.13	DD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	1/4" = 1' - 0"
DRAWN BY: SM	PROJ MGR: DC

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MECHANICAL SPECIFICATIONS

1. PRODUCTS AND INSTALLATION SHALL COMPLY WITH ALL APPLICABLE LAWS, CODES, GOVERNMENT REGULATIONS, UTILITY COMPANY REQUIREMENTS, ETC. OF ALL AUTHORITIES HAVING JURISDICTION. WORK SHALL COMPLY WITH THE FOLLOWING CODES, STANDARDS AND ORGANIZATIONS:
   - 2012 INTERNATIONAL MECHANICAL CODE
   - 2012 NATIONAL STANDARD PLUMBING CODE
   - 2012 INTERNATIONAL ENERGY CONSERVATION CODE
   - 2011 NATIONAL ELECTRIC CODE
   - NFPA
   - UNDERWRITERS LABORATORY (UL), IRI, FM
   - SMACNA "HVAC DUCT CONSTRUCTION STANDARDS" GUIDELINES, DETAILS, & MODEL SPECIFICATION
   - ASHRAE

   WHERE CONFLICTS EXIST BETWEEN CODES, STANDARDS OR THIS SPECIFICATION THE HIGHER REQUIREMENT SHALL APPLY. DEVIATIONS FROM THE CONTRACT DOCUMENTS REQUIRED BY THE ABOVE AUTHORITIES SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW. OBTAIN PERMITS AND PAY ALL FEES. ARRANGE FOR ALL REQUIRED INSPECTIONS AND APPROVALS. CONFIRM ALL UTILITY COMPANY REQUIREMENTS AND CONNECTION POINTS IN FIELD, PRIOR TO STARTING WORK.

2. ALL SPECIFICATIONS AND DRAWINGS, I.E., ARCHITECTURAL, MECHANICAL, PLUMBING, AND ELECTRICAL ARE COMPLIMENTARY AND MUST BE USED IN COMBINATION TO OBTAIN COMPLETE CONSTRUCTION INFORMATION. ANY INFORMATION CONFLICTS WITHIN THE SPECIFICATIONS AND DRAWINGS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION. DRAWINGS ARE DIAGRAMMATIC. CONFIRM ALL DIMENSIONS BY FIELD MEASUREMENT. THE EXACT LOCATIONS FOR APPARATUS, FIXTURES, EQUIPMENT AND PIPING WHICH IS NOT COVERED BY DRAWINGS, SHALL BE OBTAINED FROM THE ARCHITECT OR HIS REPRESENTATIVE IN THE FIELD, AND THE WORK SHALL BE LAID OUT ACCORDINGLY.

3. WORK SHALL BE EXECUTED IN A GOOD WORKMANLIKE MANNER USING MECHANICS SKILLED IN THEIR RESPECTIVE TRADES. ALL EQUIPMENT AND MATERIALS SHALL BE NEW, FREE OF DEFECTS. SYSTEMS ARE TO BE COMPLETE AND WORKABLE IN ALL RESPECTS, PLACED IN OPERATION AND PROPERLY ADJUSTED.

4. MAINTAIN THE CONSTRUCTION PREMISES IN A NEAT AND ORDERLY CONDITION AT THE END OF EACH WORKING DAY. CLEAN-UP, REMOVE AND LEGALLY DISPOSE OF ALL RUBBISH DAILY. CONTRACTOR SHALL PROTECT THEIR WORK AND EXISTING OR ADJACENT PROPERTY AGAINST WEATHER, TO MAINTAIN THEIR WORK, MATERIALS, APPARATUS AND FIXTURES FREE FROM INJURY OR DAMAGE. ANY WORK DAMAGED BY FAILURE TO PROVIDE PROTECTION REQUIRED, SHALL BE REMOVED AND REPLACED WITH NEW WORK AT THE CONTRACTOR'S EXPENSE.

5. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE SAFETY OF HIS WORKERS, ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES FOR COORDINATING THE WORK UNDER THIS CONTRACT. CONFORM TO ALL GENERAL AND SPECIAL CONDITIONS OF CONTRACT AS SPECIFIED BY ARCHITECT AND/OR OWNER.

6. IN CASES OF DOUBT AS TO THE WORK INTENDED, OR IN THE EVENT OF NEED FOR EXPLANATION THEREOF, THE CONTRACTOR SHALL REQUEST SUPPLEMENTARY INSTRUCTIONS FROM THE ENGINEER. NO CHANGES ARE TO BE MADE TO THE WORK OF THIS CONTRACT WITHOUT PRIOR KNOWLEDGE AND APPROVAL OF THE ENGINEER. THE CONTRACTOR SHALL HOLD THE OWNER AND ITS CONSULTANTS HARMLESS AGAINST ALL CLAIMS AND JUDGMENTS ARISING OUT OF THE CONTRACTORS PERFORMANCE OF THE WORK OF THIS CONTRACT. THE CONTRACTOR SHALL NOT PROCEED WITH ANY WORK, WHICH HE EXPECTS ADDITIONAL COMPENSATION BEYOND THE CONTRACT AMOUNT, WITHOUT WRITTEN AUTHORIZATION FROM THE APPROPRIATE AUTHORITY. FAILURE TO OBTAIN SUCH AUTHORIZATION SHALL INVALIDATE ANY CLAIM FOR EXTRA COMPENSATION.

7. ALL PRODUCTS SHALL COMPLY WITH 25/50 FLAME AND SMOKE HAZARD RATINGS PER ASTM E-84, NFPA 255 AND UL 723.

8. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO INSTALL THE HEATING, VENTILATION AND AIR CONDITIONING SYSTEM SO AS TO INSURE QUIET OPERATION. NO VIBRATION OR SOUND SHALL BE TRANSMITTED TO THE BUILDING, STRUCTURE OR OCCUPIED AREAS. THE DECISION OF THE ENGINEER AS TO THE QUIETNESS OF THE SYSTEM AND EQUIPMENT SHALL BE FINAL. IT SHALL BE THIS CONTRACTORS RESPONSIBILITY TO CORRECT OR REPLACE ANY NOISY SYSTEM OR EQUIPMENT AS REQUIRED.

WORK IN EXISTING BUILDINGS

1. EXISTING BUILDING IS TO REMAIN OCCUPIED AND ACCESSIBLE AT ALL TIMES. PROTECT THE BUILDING PREMISES AND ALL OCCUPANTS ON THE PROJECT SITE. THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGES CAUSED BY IMPROPER PROTECTION AND SHALL MAKE ALL NECESSARY REPLACEMENTS OR REPAIRS WITHOUT ANY ADDITIONAL COST. MAKE ALL ARRANGEMENTS, MAINTAIN AND PAY ALL COSTS FOR TEMPORARY WATER, PLUMBING, POWER, LIGHTING, AND HEATING OR VENTILATION AS REQUIRED TO PROPERLY CONDUCT THE WORK OF THIS CONTRACT AND MAINTAIN SERVICES. PROVIDE AND MAINTAIN FOR THE ENTIRE LENGTH OF THIS CONTRACT ALL EXITS, EXIT LIGHTING, FIRE PROTECTION DEVICES AND ALARMS TO CONFORM TO LOCAL BUILDING CODE REQUIREMENTS.

2. CONFORM WITH THE CURRENT EDITION OF THE SMACNA "IAQ GUIDELINES FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION."

3. CONTRACTOR SHALL VERIFY ALL POINTS OF CONNECTION BEFORE COMMENCING WORK. CONTRACTOR SHALL COORDINATE WORK WITH EXISTING WORK AND OTHER TRADES. ALL UNUSED EQUIPMENT SERVING THIS AREA SHALL BE REMOVED AND RETURNED TO THE OWNER.

4. EXISTING EQUIPMENT TO REMAIN, BE REUSED, OR RELOCATED WITHIN OR SERVING THE SPACE, WHICH IS DAMAGED OR DOES NOT COMPLY WITH THE SPECIFICATIONS, SHALL BE RESTORED TO LIKE NEW CONDITION SUBJECT TO REVIEW BY THE ARCHITECT AND ENGINEER, OR SHALL BE REPLACED WITH NEW MATERIALS MEETING THE SPECIFICATION REQUIREMENTS.

5. SOME WORK SHOWN MAY REQUIRE PREMIUM TIME INCLUDING NOISE PRODUCING ACTIVITIES, ACCESS INTO ADJOINING SPACES & ACTIVITIES DISRUPTING MEP SERVICES. CONFIRM THE REQUIREMENTS FOR PREMIUM TIME OR SPECIAL PROCEDURES WITH THE OWNER/LANDLORD AND INCLUDE THE COST IN BID PROPOSAL. WORK RELATED TO THE EXISTING BUILDING SHALL BE COORDINATED TO MINIMIZE INTERFERENCE OR INTERRUPTION OF NORMAL BUILDING USE BY OWNER. REFER TO ARCHITECTURAL PLANS FOR ANY PHASING REQUIREMENTS. ARRANGE FOR AND OBTAIN OWNER'S PERMISSION FOR ANY SERVICE SHUTDOWNS.

6. THE CONTRACTOR, BY SUBMITTING HIS BID PROPOSAL AGREES TO ACCEPT ALL EXISTING SITE CONDITIONS NOT SPECIFICALLY EXCEPTED. ALL EXCEPTIONS SHALL BE PROVIDED IN WRITING TO THE ARCHITECT AND ENGINEER.

BASIS OF DESIGN AND SUBSTITUTIONS

1. MANUFACTURERS LISTED ARE BASIS OF DESIGN. SUBSTITUTIONS ARE SUBJECT TO THE APPROVAL OF THE OWNER, ARCHITECT & ENGINEER. IF SUBSTITUTION IS SUBMITTED, IT IS THE CONTRACTOR'S RESPONSIBILITY TO EVALUATE IT AND CERTIFY THAT THE SUBSTITUTION IS EQUIVALENT IN ALL RESPECTS TO THE BASIS OF DESIGN. WHERE SUBMITTALS VARY FROM THE CONTRACT REQUIREMENTS, THE CONTRACTOR SHALL CLEARLY INDICATE ON SUBMITTAL OR ACCOMPANYING DOCUMENTS THE NATURE AND REASON FOR VARIATIONS. IF SUBSTITUTIONS ARE APPROVED, NOTIFY ALL OTHER CONTRACTORS, SUBCONTRACTORS OR TRADES AFFECTED BY SUBSTITUTION AND FULLY COORDINATE. ANY COSTS RESULTING FROM SUBSTITUTION, WHETHER BY CONTRACTOR OR OTHERS, SHALL BE RESPONSIBILITY OF AND PAID FOR BY SUBSTITUTING CONTRACTOR. APPROVED SHOP DRAWINGS DOES NOT ABSOLVE THIS CONTRACTOR FROM THIS RESPONSIBILITY. APPROVAL OF SUBSTITUTIONS IS AT THE DISCRETION OF THE ARCHITECT & ENGINEER AND IF SUBMITTED AFTER THE BID, AT THE RISK OF THE CONTRACTOR.

SHOP DRAWING SUBMITTALS

1. COORDINATE, PREPARE AND SUBMIT SHOP DRAWINGS TO THE ARCHITECT AND ENGINEER FOR THEIR REVIEW. CONTRACTOR SHALL REVIEW AND INDICATE HIS APPROVAL OF EACH SHOP DRAWING PRIOR TO SUBMITTAL FOR REVIEW. DO NOT ORDER, START WORK OR FABRICATION UNTIL SHOP DRAWINGS HAVE BEEN REVIEWED BY THE ENGINEER AND RETURNED TO THE CONTRACTOR. SHOP DRAWINGS TO BE SUBMITTED INCLUDE BUT NOT LIMITED TO:
   - SHEETMETAL
   - DIFFUSERS, GRILLES & REGISTERS
   - FIRE DAMPERS
   - ALL EQUIPMENT

2. INDICATE THE OPERATING CHARACTERISTICS FOR EACH REQUIRED ITEM. PROVIDE ADEQUATE DETAILS AND SCALES TO CLEARLY SHOW CONSTRUCTION. CLEARLY IDENTIFY EACH ITEM ON THE SUBMITTAL AS TO MARK, LOCATION AND USE, USING SAME IDENTIFICATION AS PROVIDED ON DESIGN DRAWINGS. ELECTRONIC SUBMITTALS SHALL BE PRESENTED WITH ALL SHEETS IN ALPHANUMERIC ORDER AND ALL SHEETS ORIENTED WITH TOP OF SHEET UP.

3. SHEETMETAL SHOP DRAWINGS SHALL BE FULLY DIMENSIONED BASED ON FIELD VERIFIED DIMENSIONS AND ARCHITECTURAL CEILING LAYOUTS. DRAWINGS SHALL BE COORDINATED WITH ALL DISCIPLINES AND SHOW DUCT ELEVATIONS. INDICATE STRUCTURAL, LIGHTING, DUCTWORK AND PIPING AT ALL CRITICAL LOCATIONS. PROVIDE RISES, DROPS AND OFFSETS AS REQUIRED. BRING AREAS OF POTENTIAL CONFLICT TO THE ENGINEERS ATTENTION.

4. SUBMITTALS WILL BE REVIEWED ONLY FOR GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS AND NOT FOR DIMENSIONS OR QUANTITIES. THE SUBMITTAL REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR PURCHASE OF ANY ITEM IN FULL COMPLIANCE WITH THE CONTRACT DOCUMENTS OR ITS COMPLETE AND PROPER INSTALLATION.

RECORD DRAWINGS

1. A SET OF MEP RECORD/COORDINATION DRAWINGS SHALL BE MAINTAINED IN THE GENERAL CONTRACTORS OFFICE AT THE JOB SITE. PRINTS SHALL INDICATE ADDITIONS, DELETIONS, VARIATIONS IN LOCATION, VARIATIONS IN NUMBERING ETC. ALTERATIONS SHALL BE MARKED IN RED AND DELETIONS ALL BE MARKED IN GREEN AND SHALL BE ON THE LATEST CONTRACT DRAWING ISSUED. RECORD DRAWINGS SHALL BE KEPT CLEAN AND UNDAMAGED AND SHALL NOT BE USED FOR ANY PURPOSE OTHER THAN RECORDING DEVIATIONS FROM WORKING DRAWINGS. AFTER THE PROJECT IS COMPLETED, THESE SETS OF DRAWINGS SHALL BE DELIVERED TO THE ARCHITECT IN GOOD CONDITION, AS A PERMANENT RECORD OF THE INSTALLATION AS ACTUALLY CONSTRUCTED

DUCTWORK

1. ALL NEW (INTERIOR) RECTANGULAR DUCTWORK SHALL BE 1 " W.G. CONSTRUCTION, CONSTRUCTED OF LOCK FORMING No. 1 GALVANIZED STEEL. VOLUME DAMPERS SHALL BE PROVIDED IN ALL BRANCH TAKE OFFS, SPIN-INS OR OTHER CONNECTIONS TO INDIVIDUAL AIR DISTRIBUTION DEVICES. ALL 90 DEGREE ELBOWS SHALL BE RADIUS, OR RECTANGULAR WITH TURNING VANES. DUCTWORK SHALL BE HUNG FROM THE BUILDING STRUCTURE WITH HANGER ASSEMBLIES IN ACCORDANCE WITH "SMACNA" REQUIREMENTS. ALL DUCTWORK SHALL BE SEALED USING HARDCAST TAPE AND ADHESIVE (2 PART SYSTEM). IRON GRIP MAY BE USED AS AN ALTERNATE FOR SEALING INDOOR DUCTWORK. TAPES AND MASTICS FOR DUCT SEALING SHALL BE UL-181A RATED AND LABELED AS SUCH. WHERE FLEXIBLE DUCT OR PORTIONS OF SHEET METAL DUCT ARE SHOWN TO BE REMOVED, BUT ADJACENT SHEET METAL DUCT REMAINS, PATCH REMAINING SHEET METAL AIRTIGHT. DUCTWORK SHALL MEET SMACNA LOW PRESSURE CONSTRUCTION 2" STATIC PRESSURE RATING AND SEALED PER SMACNA CLASS "B" REQUIREMENTS. DUCTWORK UPSTREAM OF VAV AND FPVAV TERMINALS SHALL BE SMACNA MEDIUM PRESSURE CONSTRUCTION 3" STATIC PRESSURE RATING AND BE SEALED PER SMACNA CLASS "A" REQUIREMENTS. ALL BRANCH CONNECTION FITTINGS IN RECTANGULAR DUCTWORK SHALL BE 45 DEGREE TRANSITION TYPE, CONICAL FITTINGS OR SPIN-IN FITTINGS WITH INTEGRAL AIR SCOOPS. BUTT FITTINGS ARE NOT ACCEPTABLE.

2. ALL FLEXIBLE DUCTWORK SHALL BEAR THE UL 181 LABEL (CLASS 1 AIR DUCT) AND SHALL BE FACTORY INSULATED (1-1/2 ", 0.6 LB., FIBERGLASS) ATCO UPC #076 I OR EQUAL. FLEXIBLE DUCTWORK SHALL COMPLY W/ NFPA 90A, AND NFPA 90B. ALL FLEXIBLE DUCTWORK CONNECTED TO DIFFUSERS SHALL NOT BE LESS THAN THE NECK SIZE OF THE DIFFUSER. MINIMUM FLEXIBLE DUCT BEND RADIUS OF CURVATURE SHALL BE 3 DUCT DIAMETERS, MAXIMUM LENGTH SHALL BE 5' - 0", NO MORE THAN THE EQUIVALENT OF TWO (2) 90 DEGREE BENDS WILL BE ACCEPTABLE. FLEXIBLE DUCTS SHALL BE INDEPENDENTLY SUPPORTED FROM THE STRUCTURE AND CONNECTED WITH PLASTIC DRAW BANDS TIGHTENED WITH MANUFACTURER'S TOOL. FLEXIBLE DUCTS ARE NOT PERMITTED IN ROOMS WITHOUT CEILINGS.

3. ALL NEW ROUND SHEET METAL DUCTWORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH FIGURES 3-1 THROUGH 3-56 AND TABLE 3-2 OF THE "SMACNA" MANUAL. SNAP LOCK LONGITUDINAL SEAMS AND DRAW BAND JOINT CONNECTIONS ARE NOT ACCEPTABLE.

4. DRYER VENT ROUND DUCTWORK SHALL BE 22 GAUGE (MINIMUM) ALUMINUM CONSTRUCTION WITH DIESTAMPED OR FABRICATED FITTINGS. DUCTS SHALL BE CONSTRUCTED FOR LOW PRESSURE OPERATION WITH LONGITUDINAL SEAM UP. FABRICATED ELBOWS SHALL BE THE MULTI-PIECE TYPE WITH EACH SEGMENT NOT EXCEEDING 22-1/2 DEGREES. THROAT RADIUM OF ALL ELBOWS SHALL BE EQUAL TO THE DUCT DIAMETER. TEES SHALL BE THE CONCEALED TYPE. JOINTS SHALL BE THE SLIP OF FLANGED TYPE. DO NOT USE DRIVE SLIP COUPLING BANDS. MAKE-UP SLIP JOINTS WITH DUCT SEALER. DUCTS FOR EXHAUSTING CLOTHES DRYERS SHALL NOT BE ASSEMBLED WITH SCREWS OR OTHER FASTENING MEANS THAT EXTEND INTO THE DUCT AND THAT WOULD CATCH LINT. PROVIDE NFPA 90 A APPROVED FLEXIBLE DUCT SECTION AT CONNECTION OF DRYER TO DUCTWORK. PROVIDE AND INSTALL EXTRUDED ALUMINUM DRYER FLAPPER VENT AT TERMINATION OF EACH DRYER VENT. WHERE CLOTHES DRYER VENT DUCTS PASS THROUGH WALLS, FLOORS, OR PARTITIONS, THAT SPACE AROUND THE DUCT SHALL BE SEALED WITH NON-COMBUSTIBLE MATERIAL AND FIRESTOPPED. SIGNAGE INDICATING EQUIVALENT LENGTH SHALL BE POSTED WITHIN 6' OF THE DRYER CONNECTION IN ACCORDANCE WITH IMC 504.6.5 2009.

5. INCLUDE ALL ACOUSTIC; AIRFOIL SHAPED PERFORATED ALUMINUM TURNING VANES, MANUAL DAMPERS, FLEXIBLE CONNECTORS, GRILLES AND DIFFUSERS, ACOUSTIC LINING, AND OTHER SHEET METAL ACCESSORIES FOR THE PROJECT. VOLUME DAMPERS TO BE OF OPPOSED BLADE TYPE CONSTRUCTED IN ACCORDANCE WITH "SMACNA" STANDARDS.

6. EXTERIOR DUCTWORK SHALL BE ALUMINUM CONSTRUCTION. ALUMINUM SHEETS SHALL BE ASTM B 209, ALLOY 3003, TEMPER H14, WITH MILL FINISH. TOP SHALL BE FABRICATED TO PROVIDE A ¼" PER FOOT SLOPE FROM CENTERLINE TO EDGE. RECTANGULAR DUCT REQUIREMENTS COVERED IN DUCTWORK SPECIFICATION NO. 1 SHALL APPLY.

EQUIPMENT

1. ALL PACKAGED EQUIPMENT SHALL BE INDEPENDENTLY THIRD PARTY LABELED AS A SYSTEM FOR ITS INTENDED USE BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) IN ACCORDANCE WITH OSHA FEDERAL REGULATIONS 29CFR1910.303 AND .399, AS WELL AS NFPA PAMPHLET NO. 70, AND THE NATIONAL ELECTRICAL CODE (NEC), ARTICLE 90-7.

2. MAKE ALL FINAL EQUIPMENT CONNECTIONS AND PROVIDE THE NECESSARY ADAPTORS, FITTINGS, VALVES, DEVICES, ETC. FOR A COMPLETE AND OPERABLE SYSTEM. PROVIDE COMPLETE WITH BASES, ISOLATORS, SUPPORTS AND OTHER REQUIRED ACCESSORIES.

3. EQUIPMENT SHALL BE INSTALLED IN FULL ACCORDANCE WITH THE MANUFACTURER'S DATA AND INSTALLATION INSTRUCTIONS, INCLUDING CLEARANCES; LUBRICATE AND ADJUST AS REQUIRED. IT IS THIS CONTRACTOR'S RESPONSIBILITY TO CHECK AND CONFORM TO THESE REQUIREMENTS PRIOR TO STARTING WORK. FURNISH AND INSTALL CLEAN SET OF FILTERS PRIOR TO BALANCING.

4. THE CONTRACTOR SHALL COORDINATE ELECTRICAL CHARACTERISTICS OF ALL MECHANICAL EQUIPMENT PRIOR TO ORDERING OF EQUIPMENT. COORDINATE REQUIREMENT FOR PROVISION OF MOTOR STARTERS, DISCONNECTS, CONTACTORS, CONTROL WIRING, ETC. AS REQUIRED FOR PROPER FUNCTIONING SYSTEM WITH ELECTRICAL CONTRACTOR. NO ADDITIONAL PAYMENT WILL BE MADE FOR LACK OF CONTRACTOR COORDINATION OF ELECTRICAL CHARACTERISTICS.

5. ALL GROUND MOUNTED EQUIPMENT SHALL BE INSTALLED ON CONCRETE PADS. MINIMUM PAD THICKNESS SHALL BE NOMINAL 6". PAD SHALL EXTEND BEYOND THE EQUIPMENT A MINIMUM OF 4" ON EACH SIDE. CONCRETE PADS SHALL BE PROVIDED BY THIS CONTRACTOR. IT SHALL BE THE RESPONSIBILITY OF THE THIS CONTRACTOR TO COORDINATE THE SIZE AND LOCATION OF THE CONCRETE PADS WITH THE GENERAL CONTRACTOR.

6. ALL EQUIPMENT SHALL BE MOUNTED ON VIBRATION ISOLATORS TO PREVENT THE TRANSMISSION OF VIBRATION AND MECHANICALLY TRANSMITTED SOUND TO THE BUILDING STRUCTURE.

7. ISOLATION EQUIPMENT SHALL BE THE PRODUCT OF A SINGLE MANUFACTURER, AND SHALL BE DESIGNED SPECIFICALLY FOR THE APPLICATION REQUIRED. THIS INCLUDES, BUT IS NOT LIMITED TO, PIPING DUCTWORK, PUMPS, COMPRESSORS. VIBRATION ISOLATORS SHALL BE RATED FOR THE WEIGHT AND SPACING REQUIRED FOR THE EQUIPMENT REQUIRING ISOLATION.

8. ALL CONDENSATE DRAINS SHALL BE TRAPPED PER THE COOLING COIL TRAP DETAIL. VERIFY DETAIL MEETS OR EXCEEDS EQUIPMENT MANUFACTURER'S REQUIREMENTS. PROVIDE CLEANOUT. PROVIDE AUXILIARY DRAIN PANS AT ALL EQUIPMENT WHERE DAMAGE TO ANY BUILDING COMPONENT COULD OCCUR AS A RESULT OF OVERFLOW OR STOPPAGE OF THE PRIMARY SYSTEM. WATER LEVEL DETECTION SHALL BE PROVIDED IN AUXILIARY PAN TO PROVIDE SHUT DOWN OF EQUIPMENT.

9. PROVIDE CURBS FOR ALL ROOF OPENINGS FOR DUCTS, FLUES, PIPING AND EQUIPMENT. CURBS SHALL BE FURNISHED AS ACCESSORIES TO THE EQUIPMENT OR 8" HIGH PATE OR EQUAL EQUIPMENT SUPPORTS SPANNING STRUCTURE AND FLASHED INTO ROOFING. ALL CUTTING, FLASHING, AND PATCHING OF ROOF SHALL BE BY OWNER'S ROOFING CONTRACTOR AND PAID FOR BY MECHANICAL CONTRACTOR.

INSULATION

1. ALL RIGID SUPPLY, RETURN, EXHAUST, AND OUTSIDE AIR DUCTWORK WITHIN THE INSULATED BUILDING ENVELOPE SHALL BE INSULATED WITH 2" THICK (3/4 TO 1 1/2LB/FT3) FIBERGLASS DUCT WRAP (MINIMUM R-6 INSTALLED). ALL RIGID SUPPLY, RETURN, EXHAUST AND OUTSIDE AIR DUCTWORK OUTSIDE THE INSULATED BUILDING ENVELOPE (CRAWL SPACE, UNINSULATED ATTIC OR SIMILAR) SHALL BE INSULATED WITH 3" THICK (3/4 TO 1 1/2LB/FT3) FIBERGLASS DUCT WRAP (MINIMUM R-8 INSTALLED).

2. FIBERGLASS DUCT WRAP SHALL HAVE FACTORY FOIL JACKET. SEAL ALL SEAMS AND JOINTS WITH PRESSURE SENSITIVE TAPE MATCHING THE FACING, CLOTH DUCT TAPE IS NOT ACCEPTABLE. WHERE RECTANGULAR DUCTS ARE 24" IN WIDTH OR GREATER, DUCT WRAP SHALL BE ADDITIONALLY SECURED TO THE BOTTOM OF THE DUCT WITH PUSH PINS AND SPEED WASHERS, SPACED ON 18" CENTERS. EXTERNAL INSULATION IS NOT REQUIRED WHERE DUCTWORK IS INTERNALLY LINED.

3. THE FIRST 15 FEET OF SUPPLY, EXHAUST, AND RETURN DUCTWORK DOWN & UP STREAM FROM AIR HANDLING EQUIPMENT SHALL BE INTERNALLY LINED. THE FIRST 10 FEET DOWNSTREAM OF VAV BOXES SHALLL BE INTERNALLY LINED. ALL EXTERIOR SUPPLY, EXHAUST, AND RETURN DUCTWORK SHALL BE LINED. ALL DUCTORK EXPOSED IN FINISH SPACES SHALL BE INTERNALLY LINED. LINER SHALL BE NON-FLAKING COATED FIBERGLASS. DUCT DIMENSIONS INDICATED ON THE DRAWINGS ARE CLEAR INSIDE DIMENSIONS.

4. DUCTLINER WITHIN THE INSULATED BUILDING ENVELOPE SHALL BE 1-1/2" THICK, 2LB/FT3 DENSITY OR 1" THICK, 3LB/FT3 DENSITY (MINIMUM R-6 INSTALLED). DUCTLINER OUTSIDE THE INSULATED BUILDING ENVELOPE (CRAWLSPACE, UNINSULATED ATTIC, EXTERIOR OR SIMILAR) SHALL BE 2" THICK, 2LB/FT3 DENSITY (MINIMUM R-8 INSTALLED).

IDENTIFICATION

1. ALL DUCT SYSTEMS, DAMPERS AND EQUIPMENT SHALL BE PROPERLY IDENTIFIED. ALL DAMPERS SHALL HAVE THEIR NORMAL (IN OPERATION) POSITION IDENTIFIED, SUCH AS "NORMALLY OPEN" OR "NORMALLY CLOSED".

2. IDENTIFICATION SHALL BE IN ACCORDANCE WITH ANSI STANDARD A13.1. PRESSURE SENSITIVE MARKERS SHALL BE MANUFACTURED BY THE BRADY CO., OR APPROVED EQUAL. MARKERS SHALL BE MANUFACTURER'S STANDARD PRODUCT.

CONTROLS

1. PROVIDE COMPLETE TEMPERATURE CONTROLS FOR ALL HVAC SYSTEMS. PROVIDE NEW CONTROL DEVICES INCLUDING DAMPER OPERATORS, TEMPERATURE SENSORS, STAGING RELAYS AND OTHER REQUIRED DEVICES TO PROVIDE A COMPLETE OPERATIONAL SYSTEM PER THE FOLLOWING OPERATING SEQUENCE. MOUNT ALL CONTROLS FURNISHED AS ACCESSORIES TO EQUIPMENT AND PROVIDE ALL CONTROL WIRING REQUIRED FOR PROPER OPERATION WHERE NOT SPECIFICALLY SHOWN ON ELECTRICAL PLANS. ALL WIRING SHALL BE IN CONDUIT PER N.E.C. AND LOCAL CODE REQUIREMENTS. STANDARD MOUNTING HEIGHT TO TOP OF THERMOSTAT IS 48" ABOVE FINISHED FLOOR OR AS INDICATED ON THE ARCHITECTURAL DRAWINGS. DO NOT INSTALL THERMOSTATS NEAR DIMMER SWITCHES. WIRING OF ALL MOTORIZED OPERATORS AND THERMOSTATS (REGARDLESS OF VOLTAGE) ARE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. SEE DRAWING M004 FOR ADDITIONAL INFORMATION.

2. PROVIDE RETURN AND SUPPLY DUCT SMOKE DETECTOR AT EACH HVAC UNIT 2000 CFM AND HIGHER TO PROVIDE IMMEDIATE SHUT DOWN OF FAN UPON ACTIVATION. DETECTOR SHALL BE MOUNTED PRIOR TO ANY BRANCH CONNECTIONS. PROVIDE LOCAL VISUAL INDICATOR AND RESET FOR EACH DETECTOR IF CENTRAL FIRE ALARM IS NOT INCLUDED IN PROJECT.

3. PROVIDE ONE YEAR SERVICE. SERVICE SHALL INCLUDE SOFTWARE UPGRADES, REPROGRAMMING, SETPOINT ADJUSTMENTS, REVISIONS TO SEQUENCE OF OPERATION (NOT REQUIRING NEW CONTROL POINTS) AND REGULAR MAINTENANCE. ANY SYSTEMS WITH LOGINS WILL BE PROVIDED WITH A MINIMUM OF 2 LOGIN GROUPS; ONE SHALL PERMIT REGULAR DAY TO DAY ACCESS TO TYPICAL SETPOINTS; THE SECOND SHALL PERMIT 100% UNRESTRICTED ACCESS TO ALL PROGRAMMING POINTS AND SEQUENCES FOR CURRENT AND FUTURE SERVICE PERSONNEL DESIGNATED BY THE OWNER. NO ACCESS SHALL BE RESTRICTED FROM OWNER DESIGNATED SERVICE PERSONNEL OR CONTRACTORS BY INSTALLER OR SUPPLIER.

CUTTING, PATCHING AND DRILLING

1. ALL CUTTING AND PATCHING OF THE BUILDING CONSTRUCTION REQUIRED FOR THIS WORK SHALL BE BY THIS CONTRACTOR UNLESS SHOWN ON ARCHITECTURAL DRAWINGS AND CONFIRMED AS TO SIZE AND LOCATION PRIOR TO NEW CONSTRUCTION. CUTTING SHALL BE IN A NEAT AND WORKMANLIKE MANNER.

2. NEATLY SAW CUT ALL RECTANGULAR OPENINGS, SET SLEEVE THROUGH OPENING, AND FINISH PATCH OR PROVIDE TRIM FLANGE AROUND OPENING. CORE DRILL AND SLEEVE ALL ROUND OPENINGS.

3. DO NOT CORE DRILL OR CUT ANY CONCRETE SLABS OR OTHER STRUCTURAL COMPONENTS FOR ANY REASON WITHOUT THE KNOWLEDGE AND WRITTEN CONSENT OF THE STRUCTURAL ENGINEER, ARCHITECT AND THE OWNER.

4. PATCH AND FINISH TO MATCH ADJACENT AREAS THAT HAVE BEEN CUT, DAMAGED OR MODIFIED AS A RESULT OF THE INSTALLATION OF THE MECHANICAL OR ELECTRICAL EQUIPMENT.

FIRESTOPPING/FIREDAMPERS

1. THE GENERAL CONTRACTOR SHALL BRING TO THE ATTENTION OF THE MECHANICAL CONTRACTOR ANY SLAB-TO-SLAB PARTITIONS IN ORDER TO PRESERVE RETURN AIR PATHWAYS. ALL PENETRATIONS OF SLAB-TO-SLAB PARTITIONS SHALL BE SEALED AIRTIGHT. CONTRACTOR SHALL VERIFY PARTITION RATING AND PROVIDE FIRE DAMPER AND ACCESS DOOR AS REQUIRED. INSTALL FIRE DAMPERS WITH ACCESS DOORS AT ALL FIRE RATED WALLS, PARTITIONS AND CEILINGS. DAMPERS SHALL HAVE RATING EQUIVALENT TO BARRIER. CURTAIN TYPE DAMPERS SHALL BE W/ THE CURTAIN OUT OF THE AIR STREAM.

2. WHEREVER FIRE RATED PARTITIONS ARE PENETRATED FOR WIRE, DUCT, OR PIPE PASSAGE, SEAL PASSAGES WITH CODE APPROVED, LABORATORY TESTED AND LABELED SEALANT OF FIRE RESISTANCE RATING NOT LESS THAN THAT OF PENETRATED ASSEMBLY THAT WILL PREVENT PASSAGE OF FIRE AND SMOKE. ALL FIRE STOPPING SYSTEM SHALL MEET THE REQUIREMENTS OF ASTM E 814,UL 1479, AND BE FACTORY MUTUAL APPROVED. ALL FIRESTOPPING AND/OR SMOKE STOPPING MATERIAL AND INSTALLATION SHALL BE AS MANUFACTURED BY HILTI OR APPROVED EQUAL.

ACCESS DOORS

1. ACCESS DOORS SHALL BE PROVIDED IN WALLS AND CEILINGS WHERE REQUIRED TO PERMIT PROPER ACCESS TO VALVES AND ANY OTHER SUCH DEVICES WHICH REQUIRE MAINTENANCE OR SERVICE. DOORS PLACED IN WALLS, PARTITIONS OR OTHER FIRE-RATED CONSTRUCTION SHALL HAVE A LABEL SIGNIFYING THAT THE DOOR HAS THE SAME FIRE RATING AS THE FIRE-RATED CONSTRUCTION.

2. ACCESS PANELS SHALL BE CONSTRUCTED OF 14 GAUGE STEEL, WITH 16 GAUGE STEEL FRAMES. DOORS SHALL FINISH FLUSH WITH THE SURROUNDING SURFACE. FRAMES SHALL HAVE 3" WIDE EXPANDED METAL FOR PLASTERED SURFACES AND PLAIN FLANGED TYPE FRAME FOR TILE, MASONRY OR GYPSUM BOARD SURFACES. DOORS AND FRAMES SHALL BE FURNISHED PRIME COATED. DOORS INSTALLED IN CERAMIC TILE OR OTHER NON-PAINTED SURFACES SHALL BE STAINLESS STEEL. HINGES SHALL BE CONCEALED SPRING TYPE, TO ALLOW DOORS TO BE OPENED 175 DEGREES. LOCKS SHALL BE FLUSH SCREWDRIVER TYPE WITH STEEL CAMS. ACCESS PANELS SHALL BE 16" X 16" OR LARGER AS MAY BE REQUIRED FOR PROPER ACCESS TO THE DEVICE BEING SERVED.

3. ACCESS PANELS ARE NOT REQUIRED IN COMPLETELY ACCESSIBLE LIFT OUT TILE CEILINGS. CONTRACTOR SHALL REVIEW THE ROOM FINISH SCHEDULE ON THE ARCHITECTURAL DRAWINGS IN ORDER TO VERIFY THE NEED FOR ACCESS PANELS. PROVIDE ACCESS PANELS TO GENERAL CONTRACTOR FOR INSTALLATION.

BALANCING, START UP AND INSTRUCTIONS

1. AFTER INSTALLATION, CHECK ALL EQUIPMENT, AND PERFORM START UP IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. PLACE ALL SYSTEMS INTO OPERATION.

2. AIR BALANCING SHALL BE PERFORMED BY AN AABC CERTIFIED CONTRACTOR. THIS CONTRACTOR SHALL BE ACCEPTABLE UPON APPROVAL OF THE ENGINEER. ADJUST AND BALANCE THE AIR SYSTEMS BEFORE REFRIGERANT SYSTEMS. TESTING AND BALANCING SHALL BE DONE IN ACCORDANCE WITH THE MOST RECENT AABC NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE. AFTER ALL AIR SYSTEMS ARE INSTALLED, EACH SUPPLY AIR OUTLET SHALL BE AIR BALANCED TO WITHIN 10% OF THE CFM SHOWN WITH AIR PATTERNS SET AS INDICATED ON DRAWINGS (OR WITHIN 10 CFM WHEN BELOW 100 CFM). FAN RPMS AND ZONE DAMPERS SHALL BE ADJUSTED AND SHEAVES SHALL BE REPLACED AS REQUIRED TO ACHIEVE AIR BALANCE. ALL ZONES OR PORTIONS THEREOF SERVING OTHER SPACES AND WHICH MAY BE AFFECTED BY THE PROJECT SHALL BE TRAVERSED PRIOR TO CONSTRUCTION. THE FINAL AIR BALANCE SHALL RESTORE THESE AIR QUANTITIES. BEFORE AND AFTER AIR QUANTITIES SHALL BE LISTED IN THE AIR BALANCE REPORT

3. SHOULD THE AIR BALANCE REPORT INDICATE UNACCEPTABLE DUCT LEAKAGE, AS DETERMINED BY THE ENGINEER, THEN DUCT LEAKAGE TEST SHALL BE PERFORMED IN ACCORDANCE WITH AABC STANDARDS. DUCT SHALL BE RESEALED AND/OR REPAIRED AS REQUIRED TO MEET DESIGN REQUIREMENTS. ALL, OR PORTIONS OF THE SYSTEM SHALL BE REBALANCED AS REQUIRED UNTIL ALL SYSTEMS ARE WITHIN THE PERFORMANCE STANDARDS LISTED ABOVE.

4. CLEAN ALL MECHANICAL EQUIPMENT AND DUCTWORK OF ALL CONSTRUCTION DUST AT PROJECT COMPLETION. REPLACE ALL FILTERS PRIOR TO AIR BALANCING. PROVIDE ONE SPARE SET OF FILTERS FOR EACH PIECE OF EQUIPMENT TO THE OWNER.

5. PROVIDE OWNER TRAININGS AND DEMONSTRATION OF ALL MECHANICAL SYSTEMS AND EQUIPMENT. INSTRUCT OWNER ON PROPER OPERATION AND PREVENTATIVE MAINTENANCE OF SYSTEM. SUBMIT OPERATING AND MAINTENANCE MANUAL ON ALL EQUIPMENT AND SYSTEMS.

WARRANTY

1. FULLY WARRANT ALL MATERIALS, EQUIPMENT AND WORKMANSHIP FOR ONE (1) YEAR FROM DATE OF ACCEPTANCE. EXTEND ALL MANUFACTURER'S WARRANTIES TO OWNER, INCLUDING ALL EXTENDED WARRANTIES.

2. REPAIR OR REPLACE WITHOUT CHARGE TO THE OWNER ALL ITEMS FOUND DEFECTIVE DURING THE WARRANTY PERIOD. IN THE CASE OF REPLACEMENT OR REPAIR DUE TO FAILURE WITHIN THE WARRANTY PERIOD, THE WARRANTY ON THAT PORTION OF THE WORK SHALL BE EXTENDED FOR A MINIMUM PERIOD OF ONE (1) YEAR FROM THE DATE OF SUCH REPLACEMENT OR REPAIR.

MISCELLANEOUS EQUIPMENT SPECIFICATIONS:

PERFORATED FACE DIFFUSER - TITUS MODEL PSS OR APPROVED EQUAL. 24" X 24" FACE, STEEL CONSTRUCTION, WHITE FINISH, FLUSH FACE, LAY IN BORDER, STAR PATTERN. PROVIDE FACTORY INSTALLED MOLDED INSULATION BLANKET. PROVIDE SURFACE MOUNT BOARDER FOR INSTALLATION IN DRYWALL CEILING. ROUND NECK. SEE SCHEDULE FOR NECK AND FLEX DUCT SIZE.

PERFORATED FACE RETURN/ EXHAUST/ TRANSFER AIR GRILLES AND REGISTERS - TITUS MODEL PAR OR APPROVED EQUAL. 24" X 24" FACE, STEEL CONSTRUCTION, WHITE FINISH, FLUSH FACE, LAY-IN BORDER (TYPICAL). PROVIDE FACTORY INSTALLED MOLDED INSULATION BLANKET. PROVIDE SURFACE MOUNT BORDER FOR INSTALLATION IN DRYWALL CEILING. SQUARE NECK. SEE SCHEDULE FOR REQUIRED NECK SIZES.

PLENUM SLOT DIFFUSER - TITUS MODEL TBDI - 80 OR APPROVED EQUAL. STEEL CONSTRUCTION, INSULATED PLENUM, PATTERN CONTROLLER WITH ADJUSTABLE GASKETED BLADE.

SUPPLY AIR REGISTERS - TITUS MODEL 300 FS OR APPROVED EQUAL. ALUMINUM CONSTRUCTION, DOUBLE DEFLECTION BLADES SHALL HAVE 3/4" SPACING, FRONT BLADES PARALLEL TO SHORT DIMENSION. ALL BLADES INDIVIDUALLY ADJUSTABLE. PROVIDE REGISTER WITH OPPOSED BLADE DAMPER FOR REGISTERS INSTALLED INSIDE OF DUCT. DAMPER SHALL BE ADJUSTABLE FROM FACE OF AIR DEVICE. SEE SCHEDULE FOR NECK SIZES.

OUTSIDE AIR INTAKE & EXHAUST AIR LOUVERS - GREENHECK MODEL ESD-403 OR APPROVED EQUAL. STATIONARY, EXTRUDED ALUMINUM CONSTRUCTION, 4" FRAME, DRAINABLE BLADES, WITH BIRDSCREEN (MODEL ESD-603 FOR 6" FRAME).

COMBINATION FIRE/ SMOKE DAMPERS - GREENHECK MODEL FSD-211 OR APPROVED EQUAL. UL RATED FOR FIRE AND SMOKE. LEAKAGE CLASS 1. ACTUATOR VOLTAGE 120V. DAMPER MOUNTED IN SLEEVE WITH ACTUATOR EXERNALLY MOUNTED FROM THE FACTORY. TWO POSITION ACTUATOR, OPEN CLOSED BLADE INDICATION, MOMENTARY SWITCH TESTING DEVICE, AND A NO FLOW TYPE SMOKE DETECTOR FACTORY MOUNTED INTERNALLY TO THE DAMPER SLEEVE WITH A BUILT-IN TEST SWITCH. FIRE DAMPER SHALL BE RATED FOR 1 - 1/2 HOURS MINIMUM WITH REUSABLE RESETTABLE LINK (RRL). PROVIDE DUCT ACCESS DOOR. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.

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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER: 30756
EXPIRATION DATE: 06/28/2016

PROJECT TITLE

RECREATION & PARKS WORCESTER COUNTY

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

MECHANICAL SPECIFICATIONS

ISSUE BLOCK

MARK	DATE	DESCRIPTION
5	09.18.14	ISSUED FOR CONSTRUCTION
△	07.21.14	ADDENDUM #1
4	06.04.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW

PROJECT NO: 2013.182.00
DATE: 02.07.2014
SCALE: NONE
DRAWN BY: JH PROJ MGR: DC

M001

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$FILES $DATES

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VAV BOX SCHEDULE

DESIGNATION	PRIMARY AIR			ELECTRIC HEATER			VOLTS/ PHASE	BASIS OF DESIGN TRANE MODEL NUMBER	REMARKS
	MIN. CFM	MAX. CFM	INLET Ø	CFM	kW	STEPS			
VAV-1	700	1320	14	1255	14	3	480 / 3	VCEF-14	1 THRU 7
VAV-2	520	1110	14	1105	20	3	480 / 3	VCEF-14	1 THRU 7
VAV-3	310	900	8	330	4.5	2	277 / 1	VCEF-08	1 THRU 7
VAV-4	455	1195	12	1155	13	3	480 / 3	VCEF-12	1 THRU 7
VAV-5	155	410	8	210	2.5	1	277 / 1	VCEF-08	1 THRU 7
VAV-6	205	515	8	210	2.5	1	277 / 1	VCEF-08	1 THRU 7
VAV-7	185	475	8	210	2	1	277 / 1	VCEF-08	1 THRU 7

REMARKS:

1. PROVIDE WITH DDC CONTROLS, INTERLOCKED WITH BUILDING CENTRAL CONTROL SYSTEM, MAGNETIC CONTACTOR, AIRFLOW SWITCH, AND CONTROL TRANSFORMER.
2. PROVIDE SENSOR W/ ADJUSTABLE SETPOINT, COORDINATE LOCATION WITH FLOOR PLAN & ARCHITECT.
3. VALVE SIZE SELECTED BASED ON MAX. WIDE OPEN AIR PRESSURE DROP OF 0.25" W.G.
4. RUNOUTS TO BOXES SHALL BE SAME SIZE AS BOX INLET UNLESS OTHERWISE NOTED.
5. PROVIDE BOX WITH FUSED DISCONNECT.
6. PROVIDE 1" MATTE-FACED INSULATION.
7. MAXIMUM UNIT HEIGHT SHALL BE 19.5 INCHES. MAXIMUM UNIT NC RATING SHALL BE 30.

PERIMETER SLOT DIFFUSER SCHEDULE

CFM RANGE	LENGTH	NO. OF SLOTS	SLOT WIDTH	INLET SIZE	FLEX DUCT SIZE
0 - 110	24"	2	1"	6" ØVAL	8" Ø
115 - 160	48"	2	1"	8" ØVAL	8"Ø
165 - 200	48"	2	1"	10" ØVAL	10"Ø
205 - 230	48"	4	1"	10" ØVAL	10"Ø
235 - 330	48"	4	1"	10" ØVAL	10"Ø

REMARKS:

1. MAXIMUM LENGTH OF FLEX DUCT FROM LOW PRESSURE DUCTWORK TO DIFFUSER SHALL BE 5'-0".
2. SLOTS SHALL HAVE VERTICAL DISCHARGE
3. PROVIDE INTERNAL INSULATION
4. MAXIMUM DIFFUSER PLENUM HEIGHT = 5"
5. TITUS MODEL TSCI-50 OR APPROVED EQUAL.
6. ALL SUPPLY DIFFUSERS TO BE BASED ON: MAX. NC = 25, MAX. VELOCITY = 400 FPM.
7. SLOTS SHALL HAVE 180° VERTICAL OR HORIZONTAL DISCHARGE ADJUSTABILITY.

SUPPLY REGISTER SCHEDULE

CFM RANGE	DUCT / NECK SIZE
0 - 70	6 X 6
71 - 110	8 X 8
111 - 180	10 X 10
181 - 230	12 X 12
231 - 310	14 X 14
311 - 360	16 X 16

24/24 PERFORATED FACE RETURN/ EXHAUST/ TRANSFER AIR GRILLE SCHEDULE

CFM RANGE	SQUARE NECK SIZE	ROUND NECK SIZE
0 - 120	6" X 6	6"Ø
126 - 240	8" X 8	8"Ø
241 - 375	10" X 10"	10"Ø
376 - 550	12" X 12	12"Ø
551 - 725	14" X 14	14"Ø
726 - 850	15" X 15	15"Ø
851 - 1025	22" X 22	-"Ø

DIFFUSER & RUN OUT SCHEDULE

CFM RANGE	NECK SIZE	MAX. LENGTH
0 - 100	6"Ø	5'-0"
101 - 230	8"Ø	5'-0"
231 - 420	10"Ø	5'-0"
421 - 600	12"Ø	5'-0"
601 - 730	16"Ø	5'-0"
726 - 850	15" X 15	5'-0"
851 - 1025	22" X 22	5'-0"

NOTE: ALL FLEXIBLE DUCT DIAMETERS SHALL EQUAL DIFFUSER NECK SIZE. SEE PLANS AND SPECIFICATIONS FOR FACE TYPE AND MODEL NUMBERS.

ELECTRIC HEATER SCHEDULE

UNIT DES.	SERVICE	kW	VOLT / PHASE	TYPE	MANUFACTURER	MODEL	REMARKS
EUH-1	MECH / ELECT	3	277 / 1	UNIT HEATER	QMARK	MUHC3-71	1, 2

REMARKS:

1. PROVIDE DISCONNECT SWITCH AND UNIT MOUNTED THERMOSTAT.
2. PROVIDE MOUNTING BRACKET.

DIVISION OF MECHANICAL/ELECTRICAL WORK

ITEM	MECH DIV 15	ELEC DIV 16
AUTOMATIC TEMPERATURE CONTROLS	FURNISH, INSTALL, & WIRE	POWER WIRING
CONTROL PANELS FOR MECHANICAL EQUIPMENT	FURNISH & INSTALL	POWER WIRING
LOW & LINE VOLTAGE CONTROL WIRING FOR MECH. EQUIPMENT	FURNISH & INSTALL	
MECHANICAL FLOW SWITCHES	FURNISH, INSTALL, & WIRE	
THERMOSTATS/SENSORS	FURNISH, INSTALL, & WIRE	
P/E & E/P SWITCHES	FURNISH, INSTALL, & WIRE	
DISCONNECT SWITCHES FOR MECHANICAL EQUIPMENT		FURNISH, INSTALL, & WIRE
MECHANICAL EQUIPMENT MOTORS	FURNISH & INSTALL	POWER WIRING
MANUAL STARTERS FOR MECHANICAL EQUIPMENT	FURNISH	INSTALL & POWER WIRE
MAGNETIC STARTERS FOR MECHANICAL EQUIPMENT	FURNISH	INSTALL & POWER WIRE
MOTOR CONTROL CENTERS	CONTROL WIRING	FURNISH, INSTALL, & WIRE
VARIABLE SPEED CONTROLLERS	FURNISH & INSTALL	POWER WIRING
MOTORIZED DAMPERS & VALVES	FURNISH, INSTALL, & WIRE	
DUCT SMOKE DETECTORS	INSTALL	FURNISH & WIRE
HEAT TRACE CABLE FOR PIPING	FURNISH & INSTALL	POWER WIRING
OIL/GAS EMERGENCY SHUT-OFF SWITCHES		FURNISH, INSTALL, & WIRE
SPRINKLER FLOW & TAMPER SWITCHES	FURNISH & INSTALL	WIRE

ENERGY RECOVERY VENTILATOR SCHEDULE

UNIT NUMBER	RTU SERVED	SUPPLY FAN			RETURN EXHAUST FAN			SUMMER		WINTER		SEMCO MODEL	REMARKS
		CFM	E.S.P. IN. W.S.	HP	CFM	E.S.P. IN. W.S.	HP	EAT (DB/WB)	LAT (DB)	EAT	LAT		
ERV-1	RTU-1	2695	1	3	2490	1	3	95 / 78	81.2	10	51.5	PVT-3000	1 THRU 10

REMARKS:

1. PROVIDE SINGLE POINT CONNECTION.
2. UNIT TO HAVE INTEGRAL DESICCANT WHEEL.
3. UNIT TO BE PROVIDED WITH 1" OUTDOOR AND EXHAUST AIR FILTERS.
4. PROVIDE SPARE BELTS AND FILTERS.
5. UNIT SHALL OPERATE PER ITS PACKAGED CONTROLS. INTERLOCK ERV WITH RESPECTIVE RTU AND ASSOCIATED MOTORIZED DAMPERS.
6. PROVIDE WITH INTERNALLY MOUNTED MOTOR CONTROL CENTER INCLUDING STARTERS AND DISCONNECT SWITCH.
7. PROVIDE AQ FLOW AIR MEASURING SYSTEM WITH DAMPERS TO BALANCE AIR FLOWS.
8. PROVIDE WITH VFD FOR EACH FAN AND WHEEL FROST CONTROL
9. UNIT SHALL BE 460V, 3 PHASE.
10. PROVIDE REMOTE INDICATING PANEL, WHEEL ROTATION SENSOR, AND DIRTY FILTER SENSORS.

PACKAGED ROOFTOP ELECTRIC COOLING/ GAS HEATING UNIT SCHEDULE

UNIT DES.	SUPPLY FAN					COOLING CAPACITY				HEATING CAPACITY		BASIS OF DESIGN TRANE MODEL	VOLTS / PHASE	NOMINAL TONS	APPROXIMATE WEIGHT LBS.	REMARKS
	CFM	O.A. CFM	E.S.P. IN. W.S.	RPM	HP	TOTAL MBH	SENSIBLE MBH	E.A.T. DB / WB	AMBIENT AIR °F	INPUT MBH	OUTPUT MBH					
RTU-1	6595	2695	1.5	795	7.5	245.9	171.2	77.4 / 65.0	95	350	294	YHK300F	460 / 3	25	2918	1 THRU 15

REMARKS:

1. PROVIDE UNIT WITH FACTORY MOUNTED AND WIRED SUPPLY FAN VARIABLE FREQUENCY DRIVE.
2. PROVIDE DDC CONTROLS AND INTERLOCK WITH BUILDING CENTRAL CONTROL SYSTEM.
3. PROVIDE SINGLE POINT ELECTRICAL CONNECTION WITH DISCONNECT SWITCH.
4. INSTALL SUPPLY AND RETURN MOUNTED DUCT SMOKE DETECTORS, PROVIDED AND WIRED BY ELECTRICAL CONTRACTOR. INTERLOCKED W/ UNIT TO PROVIDE IMMEDIATE SHUT DOWN.
5. PROVIDE UNIT WITH AIR ECONOMIZER CAPABILITY UTILIZING COMPARATIVE ENTHALPY CONTROL WITH BAROMETRIC RELIEF.
6. PROVIDE UNIT WITH A STAGED REFRIGERATION CIRCUIT THAT IS CAPABLE OF OPERATION AT REDUCED CAPACITY (50% MIN.).
7. PROVIDE UNIT ALL ACCESSORIES REQUIRED TO ATTACH RTU TO IT'S ASSOCIATED ERV.
8. PROVIDE WITH MODULATING GAS HEAT.
9. PROVIDE FLEXIBLE CONNECTIONS AT UNIT SUPPLY AND RETURN AIR CONNECTIONS.
10. PROVIDE WITH STANDARD 2" THICK DISPOSABLE FILTERS.
11. PROVIDE UNIT WITH LOW AMBIENT OPERATION CAPABILITY.
12. PROVIDE UNIT WITH STAINLESS STEAL HEAT EXCHANGER.
13. PROVIDE HIGH EFFICIENCY TYPE UNIT WITH HIGH EFFICIENCY SUPPLY FAN MOTOR WITH HIGH STATIC DRIVE KIT.
14. INTERLOCK RTU WITH ASSOCIATED ERV.
15. PROVIDE 1 1/4" CONDENSATE DRAIN PIPING TO DISCHARGE TO SPLASH BLOCK ON GRADE.

FAN SCHEDULE

UNIT DES.	SERVICE	LOCATION	CFM	E.S.P. IN W.S.	RPM	MOTOR HP (WATTS)	ELECTRICAL VOLTS / PHASE	TYPE	GREENHECK MODEL #	REMARKS
EF-1	MECH / ELECT	ROOM	475	0.20	1172	1 / 15	115/1	DIRECT DRIVE IN-LINE EXHAUST	SP-B5-G	1 THRU 4

REMARKS:

1. PROVIDE FLEXIBLE CONNECTION AT DISCHARGE AND INLET OF FAN AS APPLICABLE.
2. FAN CONTROLLED BY COOLING ONLY WALL MOUNTED THERMOSTAT.
3. PROVIDE DISCONNECT SWITCH, MOTORIZED DAMPER, SPRING TYPE VIBRATION ISOLATORS, AND SPEED CONTROLLER.
4. INTERLOCK FAN WITH ASSOCIATED INTAKE AND EXHAUST MOTORIZED DAMPERS.

MECHANICAL LEGEND

SYMBOL	ABRV.	DESCRIPTION
		NEW EQUIPMENT OR DUCTWORK
		90° ELBOW WITH TURNING VANES
		90° RADIUS ELBOW
1		DRAWING NOTE
225		DIFFUSER WITH ROUND NECK, CFM AS INDICATED. SEE SCHEDULE FOR NECK SIZE.
225		PERIMETER SLOT DIFFUSER, CFM AS INDICATED
		EXHAUST / RETURN AIR GRILLE
		SPIN TAP WITH VOLUME CONTROL DAMPER
	V.C.D.	VOLUME CONTROL DAMPER
F.D.	F.D.	FIRE DAMPER
F.S.D.	F.S.D.	COMBINATION FIRE SMOKE DAMPER
T	T-STAT	THERMOSTAT
CO2		CARBON DIOXIDE SENSOR
U/D	U/D	UNDER CUT DOOR 1"
L/D	L/D	LOUVERED DOOR, MIN. 1 SQ. FT. FREE AREA
COND. DR.	COND. DR.	CONDENSATE DRAIN SLOPE IN THE DIRECTION OF ARROW
	OA	OUTSIDE AIR
	SA	SUPPLY AIR
	RA	RETURN AIR
	DB/WB	DRY BULB / WET BULB
	E.A.T.	ENTERING AIR TEMPERATURE
	E.S.P.	EXTERNAL STATIC PRESSURE
	T.S.P.	TOTAL STATIC PRESSURE
	E.W.T.	ENTERING WATER TEMPERATURE
	L.W.T.	LEAVING WATER TEMPERATURE
	IN. W.G.	INCHES WATER GAUGE
	FT. W.G.	FEET WATER GAUGE
	UNO	UNLESS NOTED OTHERWISE
	DED	OPEN ENDED DUCT W/ WIRE MESH SCREEN

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LICENSE NUMBER 30790
EXPIRATION DATE 10/09/2015

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

MECHANICAL SCHEDULES AND LEGENDS

ISSUE BLOCK:		
5	09.10.14	ISSUED FOR CONSTRUCTION
4	07.21.14	ADDENDUM #1
3	06.06.14	ISSUED FOR BID/PERMIT
2	10.30.13	PLANNING COMMISSION
1	10.25.13	DD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	NONE
DRAWN BY: JH	PROJ MGR: DC

M002

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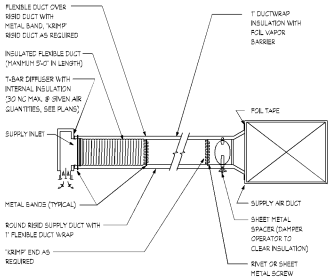
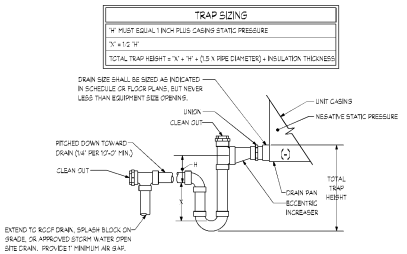
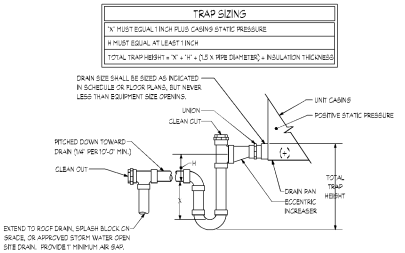


FLEXIBLE DUCT WITH
LINEAR SUPPLY AIR DIFFUSER DETAIL
NO SCALE

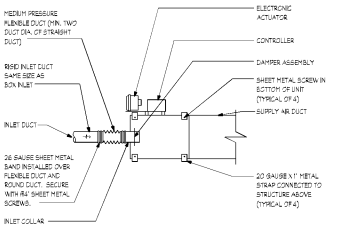
NOTE
1. DIFFUSER SHALL BE COMPLETE WITH CENTER T-BAR AND OUTER T-BAR (ON INLET SIDE).



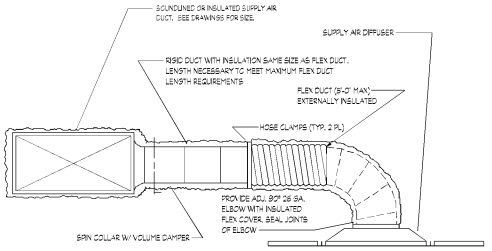
DETAIL - TYPICAL DRAW-THRU OR NEGATIVE PRESSURE
A/C CONDENSATE DRAIN TRAP ASSEMBLY
NOT TO SCALE



DETAIL - TYPICAL BLOW-THRU OR POSITIVE PRESSURE A/C
CONDENSATE DRAIN TRAP ASSEMBLY
NOT TO SCALE

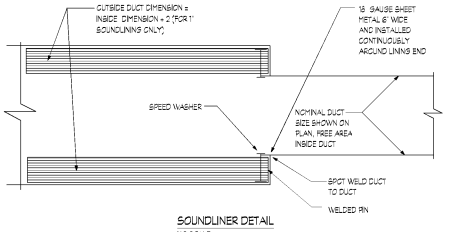


VARIABLE VOLUME TERMINAL
UNIT INSTALLATION DETAIL
NO SCALE

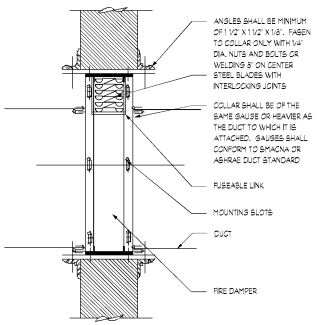


SUPPLY AIR DIFFUSER CONNECTION DETAIL
NOT TO SCALE

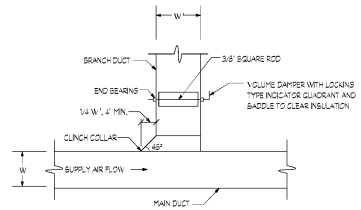
NOTES:
1. USE BRN-IN FITTING WHERE TAP SIZE IS 2" SMALLER THAN DUCT RAIL DIMENSION.
2. WHERE TAP SIZE IS 3" SMALLER THAN DUCT RAIL DIMENSION BELLMOUTH FITTING MAY BE USED.
3. MAXIMUM 6'-0" HANGER SPACING WITH A MAXIMUM SAG OF 1/2" PER FOOT OF SUPPORT SPACING FOR FLEXIBLE DUCT.



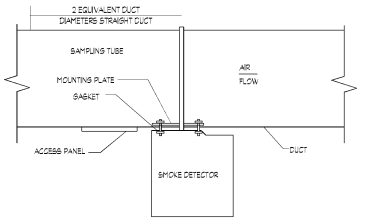
SOUNDLINER DETAIL
NO SCALE



FIRE DAMPER DETAIL
NO SCALE

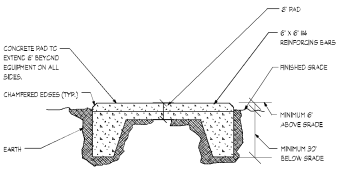


LOW PRESSURE RECTANGULAR DUCT TAP WITH VOLUME DAMPER DETAIL
NO SCALE



DUCT SMOKE DETECTOR MOUNTING DETAIL
NO SCALE

NOTES:
1. SMOKE DETECTOR, SAMPLING TUBES, MOUNTING PLATE, AND GASKET AS SPECIFIED.
2. LOCATE ACCESS PANEL UP STREAM OF SMOKE DETECTOR.
3. INSTALL SAMPLING TUBE AND SMOKE DETECTOR AS PER SPECIFICATION.
4. HOLE IN INTERNAL INSULATION TO BE ONLY AS LARGE AS SAMPLING TUBE.



CONCRETE EQUIPMENT PAD DETAIL
NO SCALE

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6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

MECHANICAL DETAILS

ISSUE BLOCK		
5	02.10.14	ISSUED FOR CONSTRUCTION
4	01.21.14	ADDENDUM #1
3	12.18.13	ISSUED FOR BID/DEPARTMENT
2	10.30.13	PLANNING COMMISSION
1	05.28.13	DD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	NONE
DRAWN BY: JH	PROJ MGR: DC

M003

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AUTOMATIC TEMPERATURE CONTROLS

GENERAL
PROVIDE A DIRECT DIGITAL CONTROL (DDC) SYSTEM. THE DDC SYSTEM WILL MONITOR AND CONTROL THE HVAC SYSTEMS. PROVIDE NEW BACNET COMPATIBLE CONTROL SYSTEM. THE SYSTEM SHALL INCLUDE A PERSONAL COMPUTER (PC), LAPTOP COMPUTERS, COLOR PRINTER, DISTRIBUTED DDC CONTROLLERS, PANELS, SENSORS, SWITCHES, ALARMS, FLOWMETERS, RELAYS, CONTROL DAMPERS, WIRING, SYSTEM GRAPHICS, CONTROL SEQUENCES, AND ACCESSORIES TO MAKE A COMPLETE AND WORKABLE SYSTEM. USE OF DDC CONTROLS SHALL RESULT IN ENERGY EFFICIENT OPERATION. INSTALL NEW BACNET COMMUNICATION NETWORK, INSTALL NEW BUILDING (B-BC) AND EQUIPMENT CONTROLLERS (B-AAC, B-ASC) AS REQUIRED. PROVIDE NEW PORTABLE OPERATORS TERMINAL. BASIS OF DESIGN SHALL BE TRANE TRACER SYSTEM.

BACNET CONTROLLER IDENTIFICATION
BACNET ADVANCED WORKSTATION BACNET BUILDING CONTROLLER BACNET ADVANCED APPLICATION CONTROLLER BACNET APPLICATION SPECIFIC CONTROLLER

SPECIFIC REQUIREMENTS CONTROL ACTUATORS
AUTOMATIC CONTROL DAMPERS SHALL BE EQUIPPED WITH ELECTRIC ACTUATORS.

CONTROL DAMPERS
SELECT AIRFOIL-TYPE CONTROL DAMPERS WITH BLADE AND EDGE SEALS TO MINIMIZE AIR LEAKAGE WHILE IN THE SHUTOFF POSITION.

END-SWITCHES
PROVIDE END-SWITCHES FOR 100% OUTDOOR AIR DAMPERS AND DUCT-MOUNTED SMOKE DAMPERS, DAMPERS SHALL BE FULLY OPEN BEFORE THE SUPPLY AIR FANS ARE ENERGIZED.

SAFETIES
PROVIDE HARD-WIRED INTERLOCKED CONNECTIONS FOR ALL SAFETY DEVICES, SUCH AS FREEZE STATS, SMOKE DETECTORS, SMOKE DAMPERS, AND REFRIGERANT LEAK DETECTION DEVICES. ALL SAFETY DEVICES SHALL BE PROVIDED WITH ADDITIONAL DRY CONTACTS AND SHALL BE CONNECTED TO THE DDC SYSTEM FOR MONITORING AND SEQUENCING.

CONTROL WIRING
PROVIDE ALL UL-LISTED COMPONENTS AND WIRING INSTALLATION IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE. ALL CONTROL WIRING SHALL BE INSTALLED IN ELECTRIC METALLIC TUBING OR CONDUITS.

PERSONAL COMPUTER (PC)
PROVIDE A PC WITH THE MAXIMUM AVAILABLE MEMORY, HARD-DRIVE CAPACITY, AND PROCESSING SPEED AT THE TIME OF DESIGN. MINIMUM PC CONFIGURATION: INTEL CORE 2 DUO E8400 PROCESSOR (3.0GHZ, 6M, 1333MHZ FSB), 8GB SDRAM, 1333MHZ, 250GB 7,200 RPM SATA HARD DRIVE, INTEGRATED INTEL GMA 4500 VIDEO, WINDOWS 7 PROFESSIONAL WITH WINDOWS OFFICE PROFESSIONAL SOFTWARE PACKAGE. PROVIDE TWO (2) 24 IN [610 MM] FLAT SCREEN MONITORS, EXPANDED KEYBOARD, CD DRIVE, AND A MOUSE. PROVIDE TWO PRINTERS: ONE FOR STATUS AND ONE FOR REPORTS. THE REPORT PRINTER SHALL BE COLOR INK JET TYPE. COORDINATE THE SELECTION AND LOCATION OF THE COMPUTER AND ASSOCIATED EQUIPMENT WITH THE END-USERS.

LAPTOP COMPUTER
THE LAPTOP COMPUTER SHALL BE SIMILAR TO THE PC ABOVE WITH AT LEAST A 19 IN [425 MM] COLOR MONITOR.

SOFTWARE
PROVIDE AN OPERATOR-PROGRAMMABLE, PRO-ACTIVE SOFTWARE SYSTEM, BASED ON PROJECT- SPECIFIC APPLICATIONS. ALL CONTROLLERS SHALL BE CONNECTED THROUGH A DEDICATED COMMUNICATION NETWORK TO SHARE COMMON DATA AND REPORTS WITH THE WORKSTATION. PROVIDE DOWNLOAD, UPLOAD AND ALL SOFTWARE CONFIGURATION CAPABILITIES BETWEEN THE PC AND THE LOCAL CONTROLLERS.

COLOR GRAPHICS
PROVIDE A COMPLETE DYNAMIC COLOR GRAPHICS PACKAGE ON THE PC AND LAPTOP COMPUTERS. PROVIDE A SCHEMATIC DIAGRAM FOR EACH CONTROL SYSTEM AND SUB-SYSTEM WITH THE DESIGN SETPOINTS AND ACTUAL CONDITIONS. INDICATE THE MODE OF OPERATION AND ALARM STATUS.

SPREADSHEETS
PROVIDE EXCEL-TYPE SPREADSHEET TABLES FOR EACH ITEM OF EQUIPMENT TO TREND AND LOG THE DATA WITH SETPOINTS, ACTUAL SENSOR READINGS, AND STATUS.

SECURITY
PROVIDE THREE LEVELS OF PASSWORD PROTECTION TO RESTRICT ALTERING THE DEVICE SETPOINTS. PROVIDE LOCKING COVERS FOR ALL WALL MOUNTED SENSORS AND THERMOSTATS.

STATUS MONITORING
PROVIDE CURRENT TRANSDUCERS (ANALOG) FOR MONITORING THE STATUS AND ENERGY OF ALL FAN MOTORS. DO NOT USE DIFFERENTIAL PRESSURE SWITCHES FOR STATUS MONITORING.

ROOM TEMPERATURE SENSORS
USE COMMERCIAL GRADE ROOM TEMPERATURE SENSORS WITH PROGRAMMABLE TEMPERATURE ADJUSTMENT LIMITS AND NIGHT SETBACK PUSH BUTTON OVERRIDE CAPABILITIES. SPECIFIC SENSOR TOLERANCES SHOULD BE NOTED IN PROJECT SPECIFICATIONS.

AIRSIDE CONTROLS
AIRSIDE CONTROLS INCLUDE OPERATION OF THE AIR-HANDLING UNITS, EXHAUST SYSTEMS, ROOM LEVEL CONTROLS, AND OTHER MISCELLANEOUS CONTROLS.

SEQUENCE OF OPERATIONS
PACKAGED RTU
SUPPLY AIR PRESSURE CONTROL (FAN PRESSURE OPTIMIZATION)

VARIABLE FREQUENCY DRIVES (VFD) CONTROL
VARIABLE FREQUENCY DRIVES ARE DRIVEN BY A MODULATING 0-10 VDC SIGNAL FROM THE VAV MODULE. A PRESSURE TRANSDUCER MEASURES DUCT STATIC PRESSURE, AND THE VFD IS MODULATED TO MAINTAIN THE SUPPLY AIR STATIC PRESSURE WITHIN AN ADJUSTABLE USER-DEFINED RANGE. THE RANGE IS DETERMINED BY THE SUPPLY AIR PRESSURE SETPOINT AND SUPPLY AIR PRESSURE DEADBAND, WHICH ARE SET THROUGH A UNIT MOUNTED POTENTIOMETER. VARIABLE FREQUENCY DRIVES PROVIDE SUPPLY FAN MOTOR SPEED MODULATION. THE DRIVE WILL ACCELERATE OR DECELERATE AS REQUIRED TO MAINTAIN THE SUPPLY STATIC PRESSURE SETPOINT. WHEN SUBJECTED TO HIGH AMBIENT RETURN CONDITIONS THE VFD SHALL REDUCE ITS OUTPUT FREQUENCY TO MAINTAIN OPERATION. BYPASS CONTROL IS OFFERED TO PROVIDE FULL NOMINAL AIRFLOW IN THE EVENT OF DRIVE FAILURE.

SUPPLY AIR STATIC PRESSURE LIMIT
THE CONTROL OF THE VFD AND VAV BOXES ARE COORDINATED, WITH RESPECT TO TIME, DURING UNIT START UP AND TRANSITION TO/FROM OCCUPIED/UNOCCUPIED MODES TO PREVENT OVER PRESSURIZATION OF THE SUPPLY AIR DUCTWORK. HOWEVER, IF FOR ANY REASON THE SUPPLY AIR PRESSURE EXCEEDS THE FIXED SUPPLY AIR STATIC PRESSURE LIMIT OF 3.5" W.C., THE SUPPLY FAN IS SHUT DOWN AND THE VAV BOXES ARE CLOSED. THE UNIT IS THEN ALLOWED TO RESTART THREE TIMES. IF THE OVER PRESSURIZATION CONDITION OCCURS ON THE FOURTH TIME, THE UNIT IS SHUT DOWN AND A MANUAL RESET DIAGNOSTIC IS SET AND COMMUNICATED TO THE INTEGRATED COMFORT SYSTEM.

SUPPLY AIR TEMPERATURE CONTROLS (SUPPLY AIR TEMPERATURE RESET)
COOLING/ECONOMIZER
DURING COOLING MODE OF OPERATION, THE ECONOMIZER AND PRIMARY COOLING ARE USED TO CONTROL THE SUPPLY AIR TEMPERATURE. THE SUPPLY AIR TEMPERATURE SETPOINT IS USER-DEFINED AT THE UNIT MOUNTED VAV SETPOINT POTENTIOMETER OR AT THE REMOTE PANEL. IF THE ENTHALPY OF THE OUTSIDE AIR IS APPROPRIATE TO USE "FREE COOLING," THE ECONOMIZER WILL BE USED FIRST TO ATTEMPT TO SATISFY THE SUPPLY SETPOINT. IN ECONOMIZER MODE, A CALL FOR COOLING WILL MODULATE THE FRESH AIR DAMPERS OPEN AND TURN OFF ERV-1. THE RATE OF ECONOMIZER MODULATION IS BASED ON DEVIATION OF THE DISCHARGE TEMPERATURE FROM SETPOINT, I.E., THE FURTHER AWAY FROM SETPOINT, THE FASTER THE FRESH AIR DAMPER WILL OPEN. IF OUTSIDE AIR IS NOT SUITABLE FOR "ECONOMIZING," THE FRESH AIR DAMPERS CLOSE AND ERV-1 IS PUT BACK INTO OPERATION. AT OUTDOOR AIR CONDITIONS ABOVE THE ENTHALPY CONTROL SETTING, PRIMARY COOLING ONLY IS USED AND THE FRESH AIR DAMPERS REMAIN CLOSED AND ERV-1 PROVIDES FRESH AIR.
WHEN MECHANICAL COOLING IS REQUIRED, THE UNIT CONTROLLER ENERGIZES THE COMPRESSOR CONTACTOR (CC1) COIL. WHEN THE CC1 CONTACTS CLOSE, THE COMPRESSOR CPR1 WILL START PROVIDING THE 3 MINUTE "OFF" TIME HAS ELAPSED. CPR1 CYCLES OFF AS REQUIRED PROVIDING THE 3 MINUTE "ON" TIME HAS ELAPSED. WITH CPR1 OPERATING FOR A MINIMUM OF 3 MINUTES. IF ADDITIONAL COOLING IS REQUIRED, THE UNIT CONTROLLER ENERGIZES THE 2ND COMPRESSOR CONTACTOR (CC2) TO BRING ON CPR2. WHILE CPR1 CONTINUES TO RUN, CPR2 CYCLES ON/OFF AS NEEDLED TO MEET THE COOLING REQUIREMENTS.

VAV SUPPLY AIR TEMPERING
GAS HEAT WILL BE MODULATED TO PREVENT THE DISCHARGE AIR TEMPERATURE FROM FALLING BELOW THE DISCHARGE AIR TEMPERATURE DEADBAND. UPON SATISFYING THE SUPPLY AIR TEMPERING REQUIREMENTS A FIVE-MINUTE 'SA TEMPERING DELAY' TIMER WILL START WHENEVER THE MODULATING HEAT IS COMMANDED TO 0% AND MUST TIME OUT BEFORE THE UNIT WILL BE ALLOWED TO RE-ENTER "COOL" MODE. THIS TIMER WILL BE RESET TO 5 MINUTES WHENEVER THERE IS AN ACTIVE CALL FOR HEAT TO MEET SUPPLY AIR TEMPERING DEMANDS. TEMPERING WILL BE DISCONTINUED WHENEVER:
- THE FIVE-MINUTE 'SA TEMPERING DELAY' TIMER HAS TIMED-OUT AND
- THERE IS AN ACTIVE COOLING REQUEST FOR VAV OCCUPIED COOLING

ZONE TEMPERATURE CONTROL UNOCCUPIED ZONE HEATING AND COOLING
DURING UNOCCUPIED MODE, THE UNIT IS OPERATED AS A CV UNIT. VAV BOXES ARE DRIVEN FULL OPEN AND THE VFD IS COMMANDED TO FULL SPEED. THE UNIT CONTROLS ZONE TEMPERATURE TO THE UNOCCUPIED ZONE COOLING AND HEATING SETPOINTS.

DAYTIME WARM-UP
DURING OCCUPIED MODE, IF THE ZONE TEMPERATURE FALLS TO A TEMPERATURE THREE DEGREES BELOW THE MORNING WARM-UP SETPOINT, DAYTIME WARM-UP IS INITIATED. THE SYSTEM CHANGES TO CV HEATING (FULL UNIT AIRFLOW), THE VAV BOXES ARE FULLY OPENED AND THE CV HEATING ALGORITHM IS IN CONTROL UNTIL THE MORNING WARM-UP SETPOINT IS REACHED. THE UNIT IS THEN RETURNED TO VAV COOLING MODE.
MORNING WARM-UP (MWU)
MORNING WARM-UP CONTROL (MWU) IS ACTIVATED WHENEVER THE UNIT SWITCHES FROM UNOCCUPIED TO OCCUPIED AND THE ZONE TEMPERATURE IS AT LEAST 1.5°F BELOW THE MWU SETPOINT. WHEN MWU IS ACTIVATED THE VAV BOX OUTPUT WILL BE ENERGIZED FOR AT LEAST 6 MINUTES TO DRIVE ALL BOXES OPEN, THE VFD IS COMMANDED TO FULL SPEED, AND FULL HEAT (GAS OR ELECTRIC) IS ENERGIZED. WHEN MWU IS ACTIVATED THE ECONOMIZER DAMPER IS DRIVEN FULLY CLOSED. WHEN THE ZONE TEMPERATURE MEETS OR EXCEEDS THE MWU SETPOINT MINUS 1.5°F, THE HEAT WILL BE TURNED OR STAGED DOWN. WHEN THE ZONE TEMPERATURE MEETS OR EXCEEDS THE MWU SETPOINT THEN MWU WILL BE TERMINATED AND THE UNIT WILL SWITCH OVER TO VAV COOLING.

HUMIDITY CONTROL
IF RETURN AIR HUMIDITY SENSOR IS HIGHER THAN 50% RH THEN ALL TEMPERATURE RESETS WILL BE OVERRIDDEN AND DISCHARGE AIR TEMPERATURE WILL BE RESET TO 55 DEGREES F (ADJUSTABLE).

ERV-1 CONTROL
THE ENERGY RECOVERY VENTILATOR (ERV-1) SHALL BE ON DURING OCCUPIED MODE AND OFF DURING UNOCCUPIED MODE. ASSOCIATED MOTORIZED DAMPERS SHALL BE INTERLOCKED WITH UNIT.

CARBON DIOXIDE CONTROL
SPACE CARBON DIOXIDE CONTROL SENSORS SHALL BE USED TO MONITOR CARBON DIOXIDE LEVELS. ERV-1 SHALL MODULATE AS NECESSARY TO MAINTAIN CARBON DIOXIDE LEVEL BELOW 800 PPM IN ANY SPACE. VENTILATION RESET / OPTIMIZATION SEQUENCE SHALL BE IMPLEMENTED TO CONTROL RTU AND VAV'S.

VAV BOX - SINGLE DUCT, ELECTRIC HEAT
BUILDING AUTOMATION SYSTEM INTERFACE:
THE BUILDING AUTOMATION SYSTEM (BAS) WILL SEND THE CONTROLLER OCCUPIED AND UNOCCUPIED COMMANDS. THE BAS MAY ALSO SEND A HEAT/COOL MODE, PRIORITY SHUTDOWN COMMANDS, SPACE TEMPERATURE AND/OR SPACE TEMPERATURE SETPOINT. IF A BAS IS NOT PRESENT, OR COMMUNICATION IS LOST WITH THE BAS, THE CONTROLLER WILL OPERATE USING ITS LOCAL SETPOINTS.

HEAT/COOL MODE:
THE HEAT/COOL MODE WILL BE SET BY A COMMUNICATED VALUE OR AUTOMATICALLY BY THE VAV. IN STANDALONE OR AUTO MODE THE VAV WILL COMPARE THE PRIMARY AIR TEMPERATURE WITH THE CONFIGURED AUTO CHANGEOVER SETPOINT TO DETERMINE IF THE AIR IS "HOT" OR "COLD". HEATING MODE WILL COMMAND THE VAV TO HEAT ONLY; IT IMPLIES THE PRIMARY AIR TEMPERATURE IS HOT. COOLING MODE COMMANDS THE VAV TO COOL ONLY; IT IMPLIES THE PRIMARY AIR TEMPERATURE IS COLD.

HEAT/COOL SETPOINT:
THE SPACE TEMPERATURE SETPOINT WILL BE DETERMINED EITHER BY A LOCAL HARDWIRED SETPOINT, THE VAV DEFAULT SETPOINT OR A COMMUNICATED VALUE. THE VAV USES THE LOCALLY STORED DEFAULT SETPOINTS WHEN NEITHER A LOCAL HARDWIRED SETPOINT NOR COMMUNICATED SETPOINT IS PRESENT. IF BOTH A HARDWIRED SETPOINT AND COMMUNICATED SETPOINT EXIST, THE VAV WILL USE THE COMMUNICATED VALUE.

OCCUPANCY MODE:
THE OCCUPANCY MODE CAN BE COMMUNICATED OR HARDWIRED TO THE VAV VIA A BINARY INPUT. VALID OCCUPANCY MODES FOR THE VAV WILL BE:

OCCUPIED:
NORMAL OPERATING MODE FOR OCCUPIED SPACES OR DAYTIME OPERATION. WHEN THE UNIT IS IN THE OCCUPIED MODE THE VAV WILL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE OCCUPIED HEATING OR COOLING SETPOINT. APPLICABLE VENTILATION AND AIRFLOW SETPOINTS WILL BE ENFORCED. THE OCCUPIED MODE WILL BE THE DEFAULT MODE OF THE VAV.

UNOCCUPIED:
NORMAL OPERATING MODE FOR UNOCCUPIED SPACES OR NIGHTTIME OPERATION. WHEN THE UNIT IS IN UNOCCUPIED MODE THE VAV WILL MAINTAIN THE SPACE TEMPERATURE AT THE STORED UNOCCUPIED HEATING OR COOLING SETPOINT REGARDLESS OF THE PRESENCE OF A HARDWIRED OR COMMUNICATED SETPOINT. WHEN THE SPACE TEMPERATURE EXCEEDS THE ACTIVE UNOCCUPIED SETPOINT THE VAV WILL MODULATE FULLY CLOSED.

OCCUPIED BYPASS:
MODE USED TO TEMPORARILY PLACE THE UNIT INTO THE OCCUPIED OPERATION. TENANTS WILL BE ABLE TO OVERRIDE THE UNOCCUPIED MODE FROM THE SPACE SENSOR. THE OVERRIDE WILL LAST FOR A MAXIMUM OF 4 HOURS (CONFIGURABLE). THE TENANTS WILL BE ABLE TO CANCEL THE OVERRIDE FROM THE SPACE SENSOR AT ANY TIME. DURING THE OVERRIDE THE UNIT WILL RUN IN OCCUPIED MODE.

COOLING MODE:
WHEN THE UNIT IS IN COOLING MODE, THE VAV WILL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE COOLING SETPOINT BY MODULATING THE AIRFLOW BETWEEN THE ACTIVE COOLING MINIMUM AIRFLOW SETPOINT TO THE MAXIMUM COOLING AIRFLOW SETPOINT. BASED ON THE VAV OCCUPANCY MODE, THE ACTIVE COOLING SETPOINT WILL BE ONE OF THE FOLLOWING:

SETPOINT	DEFAULT VALUE (ADJUSTABLE)
OCCUPIED COOLING SETPOINT	75°F
UNOCCUPIED COOLING SETPOINT	85°F
OCCUPIED STANDBY COOLING SETPOINT	78°F
OCCUPIED MIN COOLING AIRFLOW SETPOINT	SEE VAV SCHEDULE
OCCUPIED MAX COOLING AIRFLOW SETPOINT	SEE VAV SCHEDULE

THE VAV WILL USE THE MEASURED SPACE TEMPERATURE AND THE ACTIVE COOLING SETPOINT TO DETERMINE THE REQUESTED COOLING CAPACITY OF THE UNIT. THE OUTPUTS WILL BE CONTROLLED BASED ON THE UNIT CONFIGURATION AND THE REQUESTED COOLING CAPACITY.
HEATING MODE:
WHEN THE UNIT IS IN HEATING MODE, THE CONTROLLER WILL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE HEATING SETPOINT BY MODULATING THE AIRFLOW BETWEEN THE ACTIVE HEATING MINIMUM AIRFLOW SETPOINT TO THE MAXIMUM HEATING AIRFLOW SETPOINT. BASED ON THE CONTROLLER OCCUPANCY MODE, THE ACTIVE HEATING SETPOINT WILL BE ONE OF THE FOLLOWING:

SETPOINT	DEFAULT VALUE (ADJUSTABLE)
OCCUPIED HEATING SETPOINT	70°F
UNOCCUPIED HEATING SETPOINT	55°F
OCCUPIED STANDBY HEATING SETPOINT	67°F
OCCUPIED MIN HEATING AIRFLOW SETPOINT	SEE VAV SCHEDULE
OCCUPIED MAX HEATING AIRFLOW SETPOINT	SEE VAV SCHEDULE

THE CONTROLLER WILL USE THE MEASURED SPACE TEMPERATURE AND THE ACTIVE HEATING SETPOINT TO DETERMINE THE REQUESTED HEATING CAPACITY OF THE UNIT. THE OUTPUTS WILL BE CONTROLLED BASED ON THE UNIT CONFIGURATION AND THE REQUESTED HEATING CAPACITY.

REHEAT CONTROL:
REHEAT WILL ONLY BE ALLOWED WHEN THE PRIMARY AIR TEMPERATURE IS 5°F BELOW THE CONFIGURED REHEAT ENABLE SETPOINT, (70°F ADJUSTABLE). THE REHEAT WILL BE ENABLED WHEN THE SPACE TEMPERATURE DROPS BELOW THE ACTIVE COOLING SETPOINT AND THE AIRFLOW IS IN THE MINIMUM COOLING AIRFLOW SETPOINT. DURING REHEAT THE VAV WILL OPERATE AT ITS MINIMUM HEATING AIRFLOW SETPOINT AND ENERGIZE THE HEAT AS FOLLOWS:

STAGED REHEAT :
IF THE SPACE TEMPERATURE IS AT THE HEATING SETPOINT, ENERGIZE FIRST STAGE OF HEAT. THE SECOND STAGE OF HEATING WILL BE ENERGIZED BASED ON TIME AND TEMPERATURE DEVIATION FROM SETPOINT. DUTY CYCLE THESE STAGES ON A THREE-MINUTE WINDOW.

SPACE SENSOR FAILURE:
IF THERE IS A FAULT WITH THE OPERATION OF THE ZONE SENSOR, IT WILL BE FEED BACK TO THE BAS. ZONE SENSOR FAILURE WILL CAUSE THE VAV TO DRIVE THE DAMPER TO MINIMUM AIR FLOW IF THE VAV IS IN THE OCCUPIED MODE, OR DRIVE IT CLOSED IF THE VAV IS IN THE UNOCCUPIED MODE.

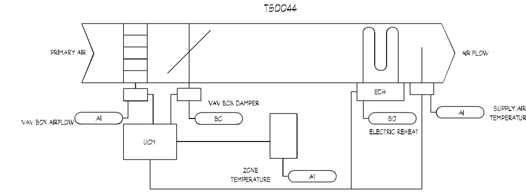
TS0044 - SYSTEM POINT LIST

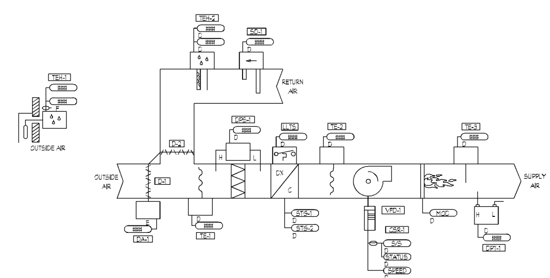
CONTROLLER: UC400		POINT TYPE					ALARMS							
SYSTEM POINT DESCRIPTION														
VAV BOX TERMINAL UNIT - SINGLE DUCT, ELECTRIC HEAT		GRAPHIC	HARDWARE INPUT	HARDWARE OUTPUT	SOFTWARE POINT	DEFAULT VALUE (ADJUSTABLE)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL	DIAGNOSTICS	NOTES:
ZONE SENSOR	ZONE TEMPERATURE (THERM)	X	AI				X	X			X		SENSOR FAILURE	
ZONE SENSOR	ZONE TEMPERATURE SETPOINT		AI								X		SENSOR FAILURE	NOTE 1
ZONE SENSOR	ON/CANCEL													NOTE 1
	VAV BOX AIRFLOW	X	AI								X		SENSOR FAILURE	
	VAV BOX DAMPER	X		BO										NOTE 5
	SUPPLY AIR TEMPERATURE SENSOR (THERM)	X	AI				X	X			X		SENSOR FAILURE	
	ELECTRIC REHEAT (PWM - PULSE WIDTH MODULATION)	X		BO										
	OCCUPIED COOLING SETPOINT				X	75°F	X	X						
	OCCUPIED HEATING SETPOINT				X	70°F	X	X						
	OCCUPIED STANDBY COOLING SETPOINT				X	78°F	X	X						NOTE 1,7
	OCCUPIED STANDBY HEATING SETPOINT				X	67°F	X	X						
	UNOCCUPIED COOLING SETPOINT				X	85°F								
	UNOCCUPIED HEATING SETPOINT				X	60°F								
	MINIMUM COOLING AIRFLOW SETPOINT				X									NOTE 6
	MAXIMUM COOLING AIRFLOW SETPOINT				X									NOTE 6
	MINIMUM HEATING AIRFLOW SETPOINT				X									NOTE 6
	MAXIMUM HEATING AIRFLOW SETPOINT				X									NOTE 6
	OCCUPIED BYPASS TIMER				X	2.0 HRS								
	BAS COMMUNICATION STATE				X							X		NOTE 3
	CONTROLLER SPARE HARDWARE POINTS													
	ANALOG INPUT(S)		2											NOTE 4
	UNIVERSAL INPUT(S)		2											NOTE 4
	BINARY INPUT(S)		3											NOTE 4
	ANALOG OUTOUT(S)/BINARY INPUT(S)		1	1										NOTE 4,8
	BINARY OUTPUT(S)			4										NOTE 4

GENERAL NOTES:

1. OPTIONAL FEATURE
2. AVAILABLE WHEN NO OCCUPANCY SENSOR IS PRESENT
3. DISPLAYED AT THE BAS USER INTERFACE IF PRESENT
4. SPARE OR UNUSED POINTS
5. TRIAC OUTPUT
6. SEE VAV SCHEDULE FOR VALUES
7. REQUIRES OCCUPANCY SENSOR
8. POINT IS CONFIGURABLE AS EITHER ANALOG OUTPUT OR BINARY INPUT

VAV BOX - SINGLE DUCT, ELECTRIC HEAT
TS0044





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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER: 30756
EXPIRATION DATE: 06/28/2016

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

MECHANICAL DETAILS

ISSUE BLOCK

MARK	DATE	DESCRIPTION
5	09.18.14	ISSUED FOR CONSTRUCTION
1 (delta)	07.21.14	ADDENDUM #1
4	06.04.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW

PROJECT NO: 2013.182.00
DATE: 02.07.2014
SCALE: NONE
DRAWN BY: JH PROJ MGR: DC

M004

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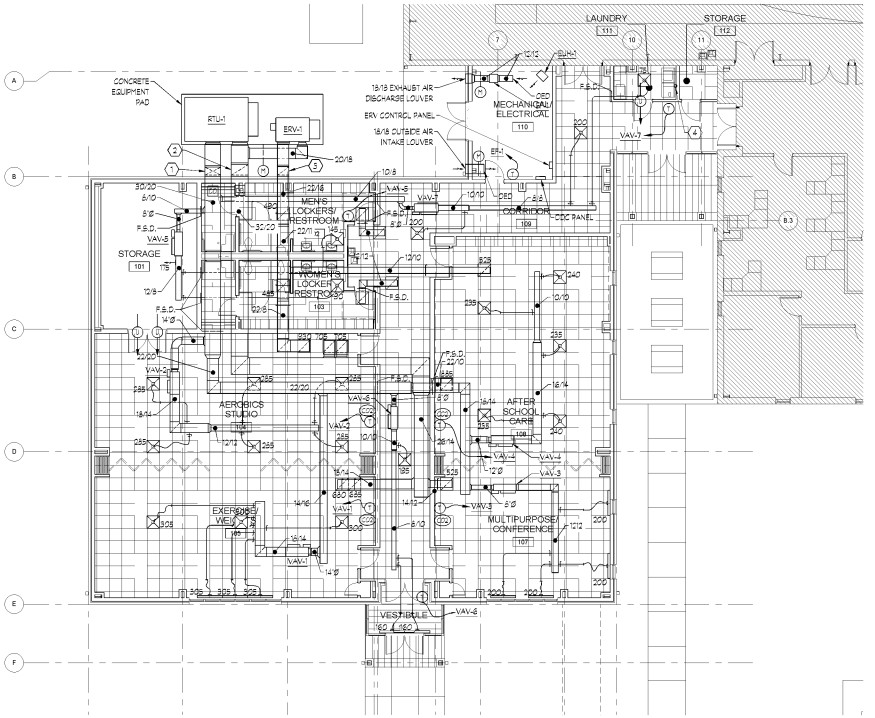

MECHANICAL FLOOR PLAN

SCALE: 1/8" = 1' - 0"

GENERAL NOTES:

1. ALL RETURN AND EXHAUST DUCTWORK SHALL BE NOT LESS THAN 26 GAUGE AND SHALL BE CONTINUOUS FROM UNIT TO GRILLES. FLEXIBLE DUCT NOT ALLOWED, PER IMC 607.5.2, EXCEPTION 3 FOR NOT REQUIRING FIRE DAMPERS AT PENETRATIONS OF FIRE BARRIERS RATED 1 HOUR OR LESS.

(#) DRAWING NOTES:

1. 20/30 SUPPLY AIR DUCTWORK DOWN WALL TO RTU-1.
2. FULL SIZE UNIT CONNECTION RETURN AIR DUCTWORK DOWN WALL TO RTU-1. REDUCE DUCTWORK TO 22/32 IN RISE BEFORE ENTERING BUILDING.
3. 18/22 EXHAUST AIR DUCTWORK DOWN WALL TO ERV-1.
4. 4'Ø ALUMINUM DRYER VENT RIGID DUCTWORK UP THRU ROOF. TERMINATE OUTSIDE WITH BACKDRAFT DAMPER AND EXHAUST HOOD PER DRYER MANUFACTURER'S WRITTEN INSTRUCTIONS. CONNECT TO DRYER PER MANUFACTURER'S WRITTEN INSTRUCTIONS.

GRAPHIC SCALE 1/8" = 1'-0"

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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER 30790
EXPIRATION DATE 10/09/2015

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

MECHANICAL FLOOR PLAN

ISSUE BLOCK		
5	07.10.14	ISSUED FOR CONSTRUCTION
4	07.21.14	ADDENDUM #1
4	06.06.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISSION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	1/8" = 1' - 0"
DRAWN BY: JH	PROJ MGR: DC

M100

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PLUMBING SPECIFICATIONS

1. PRODUCTS AND INSTALLATION SHALL COMPLY WITH ALL APPLICABLE LAWS, CODES, GOVERNMENT REGULATIONS, UTILITY COMPANY REQUIREMENTS, ETC. OF ALL AUTHORITIES HAVING JURISDICTION. WORK SHALL COMPLY WITH THE FOLLOWING CODES, STANDARDS AND ORGANIZATIONS:

- 2012 NATIONAL STANDARD PLUMBING CODE (NSPC)
- 2012 INTERNATIONAL MECHANICAL CODE (IMC)
- 2012 INTERNATIONAL ENERGY CONSERVATION CODE
- 2011 NATIONAL ELECTRIC CODE
- 2012 NATIONAL FUEL GAS CODE (NFPA 54)
- NFPA 51, 54 AND 58
- 2012 INTERNATIONAL BUILDING CODE
- COMAR 05.02.02 & ADAAG, 2010 ED.
- UNDERWRITERS LABORATORY (UL), IRI, FM

WHERE CONFLICTS EXIST BETWEEN CODES, STANDARDS OR THIS SPECIFICATION THE HIGHER REQUIREMENT SHALL APPLY. DEVIATIONS FROM THE CONTRACT DOCUMENTS REQUIRED BY THE ABOVE AUTHORITIES SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW. OBTAIN PERMITS AND PAY ALL FEES. ARRANGE FOR ALL REQUIRED INSPECTIONS AND APPROVALS. CONFIRM ALL UTILITY COMPANY REQUIREMENTS AND CONNECTION POINTS IN FIELD, PRIOR TO STARTING WORK.

2. ALL SPECIFICATIONS AND DRAWINGS, I.E., ARCHITECTURAL, MECHANICAL, PLUMBING, AND ELECTRICAL ARE COMPLIMENTARY AND MUST BE USED IN COMBINATION TO OBTAIN COMPLETE CONSTRUCTION INFORMATION. ANY INFORMATION CONFLICTS WITHIN THE SPECIFICATIONS AND DRAWINGS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION. DRAWINGS ARE DIAGRAMMATIC. CONFIRM ALL DIMENSIONS BY FIELD MEASUREMENT. THE EXACT LOCATIONS FOR APPARATUS, FIXTURES, EQUIPMENT AND PIPING WHICH IS NOT COVERED BY DRAWINGS, SHALL BE OBTAINED FROM THE ARCHITECT OR HIS REPRESENTATIVE IN THE FIELD, AND THE WORK SHALL BE LAID OUT ACCORDINGLY.

3. WORK SHALL BE EXECUTED IN A GOOD WORKMANLIKE MANNER USING MECHANICS SKILLED IN THEIR RESPECTIVE TRADES. ALL EQUIPMENT AND MATERIALS SHALL BE NEW, FREE OF DEFECTS. SYSTEMS ARE TO BE COMPLETE AND WORKABLE IN ALL RESPECTS, PLACED IN OPERATION AND PROPERLY ADJUSTED.

4. MAINTAIN THE CONSTRUCTION PREMISES IN A NEAT AND ORDERLY CONDITION AT THE END OF EACH WORKING DAY. CLEAN-UP, REMOVE AND LEGALLY DISPOSE OF ALL RUBBISH DAILY. CONTRACTOR SHALL PROTECT THEIR WORK AND EXISTING OR ADJACENT PROPERTY AGAINST WEATHER, TO MAINTAIN THEIR WORK, MATERIALS, APPARATUS AND FIXTURES FREE FROM INJURY OR DAMAGE. ANY WORK DAMAGED BY FAILURE TO PROVIDE PROTECTION REQUIRED, SHALL BE REMOVED AND REPLACED WITH NEW WORK AT THE CONTRACTOR'S EXPENSE.

5. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE SAFETY OF HIS WORKERS, ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES FOR COORDINATING THE WORK UNDER THIS CONTRACT. CONFORM TO ALL GENERAL AND SPECIAL CONDITIONS OF CONTRACT AS SPECIFIED BY ARCHITECT AND/OR OWNER.

6. IN CASES OF DOUBT AS TO THE WORK INTENDED, OR IN THE EVENT OF NEED FOR EXPLANATION THEREOF, THE CONTRACTOR SHALL REQUEST SUPPLEMENTARY INSTRUCTIONS FROM THE ENGINEER. NO CHANGES ARE TO BE MADE TO THE WORK OF THIS CONTRACT WITHOUT PRIOR KNOWLEDGE AND APPROVAL OF THE ENGINEER. THE CONTRACTOR SHALL HOLD THE OWNER AND ITS CONSULTANTS HARMLESS AGAINST ALL CLAIMS AND JUDGMENTS ARISING OUT OF THE CONTRACTORS PERFORMANCE OF THE WORK OF THIS CONTRACT. THE CONTRACTOR SHALL NOT PROCEED WITH ANY WORK, WHICH HE EXPECTS ADDITIONAL COMPENSATION BEYOND THE CONTRACT AMOUNT, WITHOUT WRITTEN AUTHORIZATION FROM THE APPROPRIATE AUTHORITY. FAILURE TO OBTAIN SUCH AUTHORIZATION SHALL INVALIDATE ANY CLAIM FOR EXTRA COMPENSATION.

7. ALL PRODUCTS LOCATED WITHIN PLENUM AREAS, INCLUDING BUT NOT LIMITED TO INSULATION AND ADHESIVE SYSTEMS, SHALL HAVE A COMPOSITE FIRE HAZARD RATING NOT TO EXCEED 25 FLAME SPREAD AND 50 SMOKE DEVELOPED PER ASTM E-84, NFPA 255 AND UL 723.

8. IT SHALL BE THE RESPONSIBILITY OF THIS CONTRACTOR TO INSTALL THE PLUMBING SYSTEM SO AS TO INSURE QUIET OPERATION. NO VIBRATION OR SOUND SHALL BE TRANSMITTED TO THE BUILDING, STRUCTURE OR OCCUPIED AREAS. THE DECISION OF THE ENGINEER AS TO THE QUIETNESS OF THE SYSTEM AND EQUIPMENT SHALL BE FINAL. IT SHALL BE THIS CONTRACTORS RESPONSIBILITY TO CORRECT OR REPLACE ANY NOISY SYSTEM OR EQUIPMENT AS REQUIRED.

WORK IN EXISTING BUILDINGS

1. EXISTING BUILDING IS TO REMAIN OCCUPIED AND ACCESSIBLE AT ALL TIMES. PROTECT THE BUILDING PREMISES AND ALL OCCUPANTS ON THE PROJECT SITE. THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGES CAUSED BY IMPROPER PROTECTION AND SHALL MAKE ALL NECESSARY REPLACEMENTS OR REPAIRS WITHOUT ANY ADDITIONAL COST. MAKE ALL ARRANGEMENTS, MAINTAIN AND PAY ALL COSTS FOR TEMPORARY WATER, PLUMBING, POWER, LIGHTING, AND HEATING OR VENTILATION AS REQUIRED TO PROPERLY CONDUCT THE WORK OF THIS CONTRACT AND MAINTAIN SERVICES. PROVIDE AND MAINTAIN FOR THE ENTIRE LENGTH OF THIS CONTRACT ALL EXITS, EXIT LIGHTING, FIRE PROTECTION DEVICES AND ALARMS TO CONFORM TO LOCAL BUILDING CODE REQUIREMENTS.

2. CONFORM WITH THE CURRENT EDITION OF THE SMACNA "IAQ GUIDELINES FOR OCCUPPIED BUILDINGS UNDER CONSTRUCTION."

3. CONTRACTOR SHALL VERIFY ALL POINTS OF CONNECTION BEFORE COMMENCING WORK. CONTRACTOR SHALL COORDINATE WORK WITH EXISTING WORK AND OTHER TRADES. ALL UNUSED EQUIPMENT SERVING THIS AREA SHALL BE REMOVED AND RETURNED TO THE OWNER.

4. EXISTING EQUIPMENT, MATERIALS OR WORK TO REMAIN, BE REUSED, OR RELOCATED WITHIN OR SERVING THE SPACE, WHICH IS DAMAGED OR DOES NOT COMPLY WITH THE SPECIFICATIONS, SHALL BE RESTORED TO LIKE NEW CONDITION SUBJECT TO REVIEW BY THE ARCHITECT AND ENGINEER, OR SHALL BE REPLACED WITH NEW MATERIALS MEETING THE SPECIFICATION REQUIREMENTS.

5. SOME WORK SHOWN MAY REQUIRE PREMIUM TIME INCLUDING NOISE PRODUCING ACTIVITIES, ACCESS INTO ADJOINING SPACES & ACTIVITIES DISRUPTING MEP SERVICES. CONFIRM THE REQUIREMENTS FOR PREMIUM TIME OR SPECIAL PROCEDURES WITH THE OWNER/LANDLORD AND INCLUDE THE COST IN BID PROPOSAL. WORK RELATED TO THE EXISTING BUILDING SHALL BE COORDINATED TO MINIMIZE INTERFERENCE OR INTERRUPTION OF NORMAL BUILDING USE BY OWNER. REFER TO ARCHITECTURAL PLANS FOR ANY PHASING REQUIREMENTS. ARRANGE FOR AND OBTAIN OWNER'S PERMISSION FOR ANY SERVICE SHUTDOWNS.

6. THE CONTRACTOR, BY SUBMITTING HIS BID PROPOSAL AGREES TO ACCEPT ALL EXISTING SITE CONDITIONS NOT SPECIFICALLY EXCEPTED. ALL EXCEPTIONS SHALL BE PROVIDED IN WRITING TO THE ARCHITECT AND ENGINEER.

SHOP DRAWING SUBMITTALS

1. COORDINATE, PREPARE AND SUBMIT SHOP DRAWINGS TO THE ARCHITECT AND ENGINEER FOR THEIR REVIEW. CONTRACTOR SHALL REVIEW AND INDICATE HIS APPROVAL OF EACH SHOP DRAWING PRIOR TO SUBMITTAL FOR REVIEW. DO NOT ORDER, START WORK OR FABRICATION UNTIL SHOP DRAWINGS HAVE BEEN REVIEWED BY THE ENGINEER AND RETURNED TO THE CONTRACTOR. SHOP DRAWINGS TO BE SUBMITTED INCLUDE BUT NOT LIMITED TO:

- ALL DRAINS, PLUMBING FIXTURES AND ACCESSORIES
- VALVES & PIPING
- INSULATION
- PUMPS, WATER HEATERS, TANKS AND ALL EQUIPMENT

2. INDICATE THE OPERATING CHARACTERISTICS FOR EACH REQUIRED ITEM. PROVIDE ADEQUATE DETAILS AND SCALES TO CLEARLY SHOW CONSTRUCTION. CLEARLY IDENTIFY EACH ITEM ON THE SUBMITTAL AS TO MARK, LOCATION AND USE, USING SAME IDENTIFICATION AS PROVIDED ON DESIGN DRAWINGS. ELECTRONIC SUBMITTALS SHALL BE PRESENTED WITH ALL SHEETS IN ALPHANUMERIC ORDER AND ALL SHEETS ORIENTED WITH TOP OF SHEET UP.

3. SUBMITTALS WILL BE REVIEWED ONLY FOR GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS AND NOT FOR DIMENSIONS OR QUANTITIES. THE SUBMITTAL REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR PURCHASE OF ANY ITEM IN FULL COMPLIANCE WITH THE CONTRACT DOCUMENTS OR ITS COMPLETE AND PROPER INSTALLATION.

RECORD DRAWINGS

1. A SET OF MEP RECORD/COORDINATION DRAWINGS SHALL BE MAINTAINED IN THE GENERAL CONTRACTORS OFFICE AT THE JOB SITE. PRINTS SHALL INDICATE ADDITIONS, DELETIONS, VARIATIONS IN LOCATION, VARIATIONS IN NUMBERING ETC. ALTERATIONS SHALL BE MARKED IN RED AND DELETIONS ALL BE MARKED IN GREEN AND SHALL BE ON THE LATEST CONTRACT DRAWING ISSUED. RECORD DRAWINGS SHALL BE KEPT CLEAN AND UNDAMAGED AND SHALL NOT BE USED FOR ANY PURPOSE OTHER THAN RECORDING DEVIATIONS FROM WORKING DRAWINGS. AFTER THE PROJECT IS COMPLETED, THESE SETS OF DRAWINGS SHALL BE DELIVERED TO THE ARCHITECT IN GOOD CONDITION, AS A PERMANENT RECORD OF THE INSTALLATION AS ACTUALLY CONSTRUCTED.

2. OCEAN CITY REQUIRES STAMPED AS-BUILT DRAWINGS PRIOR TO ISSUING A CERTIFICATE OF OCCUPANCY. PER THE MD STATE ATTORNEY'S OFFICE "UNDER THE CODE OF ETHICS GOVERNING PROFESSIONAL ENGINEERS, A PROFESSIONAL ENGINEER MAY NOT SIGN OR SEAL DRAWINGS UNLESS HE OR SHE PERSONALLY PREPARED THEM OR APPROVED THEM. THE CODE OF ETHICS DEFINES THE TERM "APPROVED" AS "(1) HAVING TECHNICAL KNOWLEDGE AND RESPONSIBLE CONTROL OVER THE CONTENT OF TECHNICAL SUBMISSIONS DURING THEIR PREPARATION AND (2) PERFORMING SUBSTANTIVE REVIEW AND HAVING AUTHORITY TO MAKE REVISIONS WITH REGARD TO THE PREPARATION OF SUBMISSIONS . . ." THEREFORE ALL SUBSTANTIVE CHANGES IN THE DESIGN OR INSTALLATION OF MEP SYSTEMS SHALL BE DISCUSSED AND APPROVED BY OUR OFFICE PRIOR TO INSTALLATION. IF THE CONTRACTOR FAILS TO DO SO OUR OFFICE WILL NOT STAMP THE AS-BUILT DRAWINGS FOR THE CERTIFICATE OF OCCUPANCY.

EQUIPMENT & FIXTURES

1. ALL PACKAGED EQUIPMENT SHALL BE INDEPENDENTLY THIRD PARTY LABELED AS A SYSTEM FOR ITS INTENDED USE BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) IN ACCORDANCE WITH OSHA FEDERAL REGULATIONS 29CFR1910.303 AND .399, AS WELL AS NFPA PAMPHLET NO. 70, AND THE NATIONAL ELECTRICAL CODE (NEC), ARTICLE 90-7.

2. MAKE ALL FINAL EQUIPMENT AND FIXTURE CONNECTIONS AND PROVIDE THE NECESSARY ADAPTORS, FITTINGS, VALVES, DEVICES, ETC. FOR A COMPLETE AND OPERABLE SYSTEM. PROVIDE COMPLETE WITH BASES, ISOLATORS, SUPPORTS AND OTHER REQUIRED ACCESSORIES. PROVIDE VALVES AND UNIONS WHERE NEEDED TO PERMIT DISCONNECTIONS OF EACH PIECE OF EQUIPMENT FOR REPAIRS. PLUMBING CONNECTIONS SHOWN ARE NOMINAL. VERIFY EXACT CONNECTION SIZE WITH EACH PIECE OF EQUIPMENT SUPPLIED. FOLLOW FIXTURE MANUFACTURER'S RECOMMENDED INSTALLATION INSTRUCTIONS, AND ROUGH-IN DIMENSIONS. REFER TO CONSULTANT AND ARCHITECTURAL DOCUMENTS FOR ADDITIONAL INFORMATION. COORDINATE WITH THE EQUIPMENT SUPPLIER FOR ADDITIONAL INFORMATION.

3. EQUIPMENT SHALL BE INSTALLED IN FULL ACCORDANCE WITH THE MANUFACTURER'S DATA AND INSTALLATION INSTRUCTIONS, INCLUDING CLEARANCES; LUBRICATE AND ADJUST AS REQUIRED. IT IS THIS CONTRACTOR'S RESPONSIBILITY TO CHECK AND CONFORM TO THESE REQUIREMENTS PRIOR TO STARTING WORK. FURNISH AND INSTALL CLEAN SET OF FILTERS PRIOR TO BALANCING.

4. THE CONTRACTOR SHALL COORDINATE ELECTRICAL CHARACTERISTICS OF ALL MECHANICAL EQUIPMENT PRIOR TO ORDERING OF EQUIPMENT. COORDINATE REQUIREMENT FOR PROVISION OF MOTOR STARTERS, DISCONNECTS, CONTACTORS, CONTROL WIRING, ETC. AS REQUIRED FOR PROPER FUNCTIONING SYSTEM WITH ELECTRICAL CONTRACTOR. NO ADDITIONAL PAYMENT WILL BE MADE FOR LACK OF CONTRACTOR COORDINATION OF ELECTRICAL CHARACTERISTICS.

5. ALL FLOOR MOUNTED EQUIPMENT SHALL BE INSTALLED ON CONCRETE HOUSEKEEPING PADS. MINIMUM PAD THICKNESS SHALL BE NOMINAL 4". PAD SHALL EXTEND BEYOND THE EQUIPMENT A MINIMUM OF 4" ON EACH SIDE. CONCRETE PADS SHALL BE PROVIDED BY THIS CONTRACTOR. IT SHALL BE THE RESPONSIBILITY OF THE THIS CONTRACTOR TO COORDINATE THE SIZE AND LOCATION OF THE CONCRETE HOUSEKEEPING PADS WITH THE GENERAL CONTRACTOR.

6. ALL EQUIPMENT SHALL BE MOUNTED ON VIBRATION ISOLATORS TO PREVENT THE TRANSMISSION OF VIBRATION AND MECHANICALLY TRANSMITTED SOUND TO THE BUILDING STRUCTURE.

7. ISOLATION EQUIPMENT SHALL BE THE PRODUCT OF A SINGLE MANUFACTURER, AND SHALL BE DESIGNED SPECIFICALLY FOR THE APPLICATION REQUIRED. THIS INCLUDES, BUT IS NOT LIMITED TO, PIPING DUCTWORK, PUMPS, COMPRESSORS. VIBRATION ISOLATORS SHALL BE RATED FOR THE WEIGHT AND SPACING REQUIRED FOR THE EQUIPMENT REQUIRING ISOLATION.

8. ALL CONDENSATE DRAINS SHALL BE TRAPPED PER DETAIL ON MECHANICAL DRAWINGS. PROVIDE CLEANOUT. PROVIDE AUXILARY DRAIN PANS AT ALL EQUIPMENT WHERE DAMAGE TO ANY BUILDING COMPONENT COULD OCCUR AS A RESULT OF OVERFLOW OR STOPPAGE OF THE PRIMARY SYSTEM. WATER LEVEL DETECTION SHALL BE PROVIDED IN AUXILARY PAN TO PROVIDE SHUT DOWN OF EQUIPMENT.

9. PROVIDE CURBS FOR ALL ROOF OPENINGS FOR DUCTS, FLUES, PIPING AND EQUIPMENT. CURBS SHALL BE FURNISHED AS ACCESSORIES TO THE EQUIPMENT OR 8" HIGH PATE OR EQUAL EQUIPMENT SUPPORTS SPANNING STRUCTURE AND FLASHED INTO ROOFING. ALL CUTTING, FLASHING, AND PATCHING OF ROOF SHALL BE BY OWNER'S ROOFING CONTRACTOR AND PAID FOR BY MECHANICAL CONTRACTOR.

PIPING SYSTEMS

1. INSTALL PIPING SYSTEMS TO PERMIT FREE MOVEMENT FOR EXPANSION. SUPPORT ALL PIPING FROM STRUCTURE WITH UL LISTED HANGERS AND SUPPORTS SUITABLE FOR THE INTENDED INSTALLATION. DESIGN, SELECTION, SPACING, AND APPLICATION OF HANGERS AND SUPPORTS SHALL COMPLY WITH ANSI B31.1 AND MSS SP-69.

2. PROVIDE INSULATION HANGER WITH PROTECTIVE SHIELDS ON SYSTEMS REQUIRING A VAPOR BARRIER. PIPING AT EACH LEVEL. HANGER SHALL BE PROVIDED AT EACH CHANGE OF DIRECTION. HANGERS AND SUPPORTS SHALL BE SPACED AT INTERVALS WHICH WILL PREVENT SAGGING AND REDUCE STRAIN ON VALVES AND SPECIALTIES. HANGERS SHALL ALLOW FOR EXPANSION AND CONTRACTION.

3. RISER CLAMPS SHALL BE INSTALLED ABOVE THE FLOOR AT EACH LEVEL. RISER CLAMPS MAY BE SUSPENDED BELOW FLOOR LEVEL, WITH HANGER RODS AND INSERTS, WHERE THE INSTALLATION OF ESCUTCHEON PLATES IS REQUIRED.

4. PROVIDE VALVES AND UNIONS WHERE NEEDED TO PERMIT DISCONNECTIONS OF EACH PIECE OF EQUIPMENT FOR REPAIRS. MAKE CONNECTIONS TO EQUIPMENT WITH SHUT-OFF VALVES ON SUPPLY AND BALANCE VALVES ON RETURNS. INSTALL UNIONS IN PIPES 2" AND SMALLER, ADJACENT TO EACH VALVE, AT FINAL CONNECTIONS EACH PIECE OF EQUIPMENT, AND ELSEWHERE AS INDICATED. UNIONS ARE NOT REQUIRED ON FLANGED DEVICES.

5. LEVER TYPE HANDLE OPERATORS SHALL BE PROVIDED ON VALVES UP TO 4". GEAR OPERATORS SHALL BE PROVIDED ON VALVES OVER 4", AND ON VALVES REQUIRING CHAIN OPERATION. VALVES USED FOR BALANCING SHALL HAVE INFINITE POSITION LEVER OR GEAR OPERATORS WITH ADJUSTABLE, OPEN POSITION "MEMORY" STOP. PROVIDE 2" EXTENSION NECKS ON ALL VALVES INSTALLED IN INSULATED LINES.

6. CONNECTIONS BETWEEN DISSIMILAR PIPING MATERIALS SHALL BE MADE WITH SUITABLE DIELECTRIC INSULATING UNIONS. ISOLATE COPPER PIPING FROM DISSIMILAR METALS, SUCH AS METAL STUDS AND VENT PIPING.

7. ALL PIPING SHALL RUN CONCEALED ABOVE CEILING OR IN WALL CHASE, UNLESS OTHERWISE NOTED. EXPOSED PIPING SHALL BE 3/4 INCH MINIMUM FROM ANY WALL SURFACE. EXCEPT WHERE OTHERWISE INDICATED ON THE DRAWINGS, PIPING IS SHOWN ON THE FLOOR WHERE IT ACTUALLY OCCURS IN THE BUILDING.

DOMESTIC WATER SYSTEMS

1. ALL DOMESTIC WATER PIPING SHALL BE TYPE L HARD DRAWN SEAMLESS COPPER WATER TUB. COPPER TUBE FITTINGS SHALL BE WROUGHT COPPER JOINT FITTINGS CONFORMING TO ANSI 316.22. SOLDERED COPPER JOINTS SHALL BE SOLDERED WITH LEAD FREE ASTM B32 GRADE 95T TIN-ANTIMONY SOLDER.

2. DOMESTIC WATER GATE VALVES FOR COPPER PIPING UP TO AND INCLUDING 2-1/2 INCHES SHALL BE NIBCO NO. S-111 OR APPROVED EQUAL, CLASS 125, 200 PSIG WOG, BRONZE BODY WITH SOLDERED ENDS, RISING STEM, SOLID WEDGE AND SCREWED BONNET. DOMESTIC WATER GATE VALVES FOR COPPER PIPING 3 INCHES AND 4 INCHES SHALL BE CRANE NO. 465-1/2 OR APPROVED EQUAL, 200# WOG CAST IRON OS&Y VALVE WITH CLASS 125 ANSI B16.1 FLAT FACED FLANGED ENDS AND BRONZE TRIM: STEMS, DISC FACES, SEAT FACES, SEAT RINGS AND BONNET BUSHINGS CONSTRUCTED OF BRONZE. ALL OF THE ABOVE GATE VALVES SHALL BE USED FOR STOP OR ISOLATION VALVE APPLICATIONS. IN LIEU OF GATE VALVES FOR PIPING 2 INCHES AND SMALLER, NIBCO 585-70 BALL VALVES MAY BE USED.

3. GLOBE VALVES FOR COPPER PIPING UP TO AND INCLUDING 2-1/2 INCHES SHALL BE NIBCO NO. S-235 OR APPROVED EQUAL, CLASS 150, 300# WOG, BRONZE BODY, BRONZE RISING STEM, UNION BONNET, RENEWABLE SEAT AND SOLDERED ENDS. DOMESTIC WATER GLOBE VALVES FOR COPPER PIPING 3 INCHES AND 4 INCHES SHALL BE CRANE NO. 351 OR APPROVED EQUAL, CLASS 125, 200# WOG CAST IRON OS&Y VALVES WITH ANSI B16.1 FLANGED ENDS, YOKE BONNET, RENEWABLE SEAT AND BRONZE TRIM: STEMS, DISC FACES, SEAT FACES AND BUSHINGS CONSTRUCTED OF BRONZE. ALL OF THE ABOVE GLOBE VALVES SHALL BE USED FOR BALANCING OR THROTTLING VALVE APPLICATIONS.

4. DOMESTIC WATER SHUT-OFF VALVES SHALL BE THREE PIECE, FULL PORT, TRUE UNION TYPE, WITH PLASTIC BODY, BLOW-OUT PROOF STEM DESIGN AND O-RING STEM SEAL. PLASTIC PARTS SHALL BE CPVC. VALVES SHALL BE NIBCO DUO-BLOC, OR EQUAL.

5. DOMESTIC WATER PRESSURE REDUCING VALVE ASSEMBLIES SHALL BE SELECTED TO PROVIDE STABLE FLOW CONDITIONS WITHOUT CAVITATION OR VALVE CHATTER.

6. SHOCK ARRESTORS SHALL BE LOCATED DOWNSTREAM OF THE DOMESTIC WATER SERVICE VALVE, AT EACH SERVICE TO A GROUP OF FIXTURES, OR AS INDICATED ON THE DRAWINGS. SHOCK ARRESTORS SHALL BE AS MANUFACTURED BY PRECISION PLUMBING PRODUCTS OR APPROVED EQUAL AND CONFORM TO THE REQUIREMENTS OF THE PLUMBING AND DRAINAGE INSTITUTE.

7. PROVIDE STOP VALVES AT ALL FIXTURE AND EQUIPMENT SUPPLIES. ALL EXPOSED FIXTURE CONNECTIONS SHALL BE CHROME PLATED, STAINLESS STEEL OR FITTED WITH CHROME PLATED SLEEVES. PROVIDE VACUUM BREAKERS WHERE REQUIRED BY CODE.

8. ALL COLD WATER, HOT WATER, AND HOT WATER RETURN PIPING THAT IS PART OF A NEW SYSTEM OR AN ADDITION OF AN EXISTING SYSTEM SHALL BE THOROUGHLY CLEANED AND DISINFECTED AS PER AWWA C651 OR AWWA C652 GUIDELINES. THE DISINFECTION PROCESS SHALL BE PERFORMED AFTER ALL PIPES, COMPONENTS, VALVES, AND FIXTURES ARE INSTALLED AND THE REQUIRED LEAK/PRESSURE TESTS HAVE BEEN COMPLETED. THE SYSTEM SHALL BE FLUSHED WITH CLEAN, POTABLE WATER UNTIL THE SYSTEM IS COMPLETELY CLEAR OF ALL DIRT, SEDIMENT, AND DEBRIS. THE SYSTEM SHALL BE FILLED WITH A WATER/CHLORINE SOLUTION AS PER CODE AND SHALL BE VALVED OFF FROM THE MAIN WATER SUPPLY AND ALLOWED TO STAND FOR A MINIMUM OF 24 HOURS. AFTER THE REQUIRED STANDING TIME, THE SYSTEM SHALL BE FLUSHED WITH CLEAN POTABLE WATER UNTIL THE DISINFECTANT SOLUTION IS COMPLETELY PURGED FROM THE SYSTEM, FIXTURES, AND COMPONENTS. REPEAT DISINFECTION PROCEDURE AS NEEDED IF BACTERIOLOGICAL EXAMINATION INDICATES THAT CONTAMINATES ARE STILL PRESENT IN THE SYSTEM.

SANITARY DRAINAGE SYSTEMS

1. ALL NEW SANITARY, SOIL, WASTE, AND VENT PIPING SHALL BE SERVICE WEIGHT CAST IRON, BELL AND SPIGOT, PIPE AND FITTINGS, ANSI A.112.5.1 AS MANUFACTURED BY TYLER PIPE AND FOUNDRY CO., U.S. PIPE AND FOUNDRY CO., CENTRAL FOUNDRY OR APPROVED EQUAL. TYLER "TY-SEAL" OR APPROVED EQUAL, NEOPRENE POSITIVE SEAL ELASTOMERIC COMPRESSION TYPE GASKETS SHALL BE USED AT ALL JOINTS. AS AN OPTION, ALL NEW SANITARY, SOIL, WASTE, AND VENT PIPING 4 INCHES AND SMALLER MAY USE HUBLESS SERVICE WEIGHT CAST IRON PIPE, FITTINGS AND JOINTS WITH TYLER "NO-HUB" STAINLESS STEEL CONNECTORS. IN ADDITION, ALL VENT PIPING MAY BE DWV COPPER PIPE AND FITTINGS WITH SOLDERED JOINTS. GASKETS, JOINTS, CONNECTORS, SPECIALTIES AND PIPE SHALL BE MANUFACTURED AND PROVIDED BY THE SAME MANUFACTURER. ALL WASTE LINES FROM DRINKING WATER FOUNTAINS SHALL BE INSULATED WITH 1/2 INCH THICK HEAVY DUTY FIBERGLASS MATERIAL WITH ALL PURPOSE NONCOMBUSTIBLE VAPOR BARRIER JACKET. INSULATION SHALL HAVE A MAXIMUM THERMAL CONDUCTIVITY (K) OF 0.23 BTU*IN/HR*FT2*°F AT 75°F. ADHESIVE SYSTEMS THAT EMPLOY RELEASE PAPER WILL NOT BE ACCEPTABLE. ALL DRAINAGE PIPE SHALL BE SUPPORTED DIRECTLY ON EACH SIDE OF A JOINT. ALL PIPING SUPPORTS AND RESTRAINTS SHALL BE IN STRICT ACCORDANCE WITH THE DRAINAGE PIPE MANUFACTURER'S RECOMMENDATIONS AND INSTALLATION GUIDELINES.

2. EXCEPT WHERE OTHERWISE INDICATED, HORIZONTAL SANITARY, SEWAGE AND WASTE PIPING SHALL SLOPE AT 1/4 INCH PER FOOT FOR PIPES 2 INCHES AND SMALLER, PIPES 3 INCHES AND LARGER SHALL SLOPE AT 1/8 INCH PER FOOT. ALL VERTICAL SANITARY SEWER AND STORM WATER PIPING, WHICH TURN 90° AFTER PASSING THROUGH A FLOOR, SHALL BE INSTALLED AS TIGHT AS POSSIBLE TO THE UNDERSIDE OF THE STRUCTURE.

3. CLEAN-OUTS SHALL BE PROVIDED IN PIPING AT EACH CHANGE IN DIRECTION, IN ALL HORIZONTAL STRAIGHT RUNS MORE THAN 50 FEET LONG, AND AT ALL OTHER LOCATIONS AS NOTED ON THE DRAWINGS. ALL CLEAN-OUTS SHALL BE THE SAME SIZE AS THE PIPE DIAMETER UP TO AND INCLUDING PIPE 4 INCHES IN DIAMETER. FOUR INCH CLEAN-OUTS SHALL BE USED FOR ALL PIPE LARGER THAN 4 INCHES, UNLESS NOTED OTHERWISE. ALL CLEAN-OUT LOCATIONS SHALL BE NO MORE THAN 5 FEET ABOVE THE BASE OF THE HORIZONTAL OFFSET AND BE APPROVED BY THE ARCHITECT. FOR CARPETED AREAS, PROVIDE A PERMANENT IDENTIFYING MARK IN THE CARPET DIRECTLY ABOVE THE CLEAN-OUT. THE CLEAN-OUT SHALL HAVE A SMOOTH POLISHED BRONZE FINISH WITH THE LETTERS "C.O." CAST IN THE COVER. FOR WALLS, PROVIDE AN ACCESS PANEL WITH CLEARANCE FOR RODDING. THE FLOOR CLEAN-OUTS SHALL BE ZURN MODEL ZN-1400-T OR APPROVED EQUAL WITH BRONZE PLUG, SQUARE NICKEL BRONZE FRAME AND COVER. THE WALL CLEAN-OUTS SHALL BE ZURN MODEL ZN-1443-BP OR APPROVED EQUAL WITH BRONZE PLUG AND 7 INCHES X 7 INCHES NICKEL BRONZE COVER. NO SANITARY, SOIL OR WASTE PIPE SHALL EXTEND GREATER THAN 2'-0" TO A DEAD-END.

6. PROVIDE ONE TRAP PRIMER VALVE FOR EACH FLOOR DRAIN WITHOUT A CONSTANT SOURCE OF WATER SUPPLY TO MAINTAIN TRAP SEAL. PRIMER VALVE SHALL BE LOCATED IN AN ACCESSIBLE AREA AND CONNECTED TO THE NEAREST 3/4 INCH COLD WATER LINE SERVING A FIXTURE. PROVIDE FLOAT TYPE BACKWATER VALVE (SIZED FOR ANTICIPATED FLOW RATE) IN ALL OPEN SITE DRAINS AND FLOOR RECEPTORS RECEIVING A/C UNIT CONDENSATE, AND/OR CLEAR WATER WASTE, SUCH AS SPRINKLER FLOW TESTING. ALL HORIZONTAL DRAINAGE PIPING AND TRAPS FROM AN OPEN SITE DRAINER RECEPTORS RECEIVING A/C UNIT CONDENSATE SHALL BE INSULATED.

GAS DISTRIBUTION SYSTEMS

1. ALL GAS PIPING 1/2 INCH AND LARGER SHALL BE A-53 SCHEDULE 40 BLACK STEEL. FOR PIPING 2-1/2 INCHES AND LARGER PROVIDE FACTORY MADE FULL LINE SIZE ALL WELDED FITTINGS. FOR PIPING 2 INCHES AND SMALLER PROVIDE CLASS 150 MALLEABLE IRON SCREW JOINT FITTINGS WITH AMERICAN PIPE THREAD STANDARD SCREW THREADS. SCREW JOINTS SHALL BE MADE UP WITH GRAPHITE AND OIL OR APPROVED EQUAL PIPE JOINT COMPOUND. PIPING SMALLER THAN 1/2 INCH SHALL BE TYPE K SOFT DRAWN COPPER ASTM-B88 WITHOUT FITTINGS. GAS PIPING AND VENTS SHALL SLOPE AT 1/4 INCH IN 15 FEET TOWARDS A DRIP LEG. GAS PIPING SHALL BE INSTALLED TO THE REQUIREMENTS OF THE AGA PAMPHLET "INSTALLATION OF GAS PIPING" AND NFPA STANDARD NO. 54. ANY OTHER TESTS, AS REQUIRED BY LOCAL GAS INSPECTION DEPARTMENT OR GAS COMPANY, SHALL ALSO BE PERFORMED.

2. PROVIDE AN AGA APPROVED OR UL LISTED GAS VALVE REGULATOR AND A QUICK-DISCONNECT UNION AT EACH PIECE OF GAS FUELED EQUIPMENT AND AS INDICATED ON THE DRAWINGS. PROVIDE ATMOSPHERIC VENTS FOR GAS REGULATORS IN ACCORDANCE WITH LOCAL CODE AND SUPPLIER'S REQUIREMENTS. VALVES SHALL BE INSTALLED AT AN ACCESSIBLE LOCATION. GAS VALVES 2 INCHES AND SMALLER SHALL BE AGA OR UL APPROVED. VALVES 2-1/2 INCHES AND LARGER SHALL BE CERTIFIED BY THE MANUFACTURER TO BE SUITABLE FOR GAS SERVICE AND SHALL BE MINIMUM 125 PSI RATED.

3. ALL EXPOSED METALLIC PIPE AND TUBING SHALL BE PROTECTED AGAINST CORROSION IN ACCORDANCE WITH NFPA 54, INTERNATIONAL FUEL GAS CODE, AND AUTHORITY HAVING JURISDICTION. PROTECTIVE COATINGS AND WRAPPINGS SHALL BE OF APPROVED TYPE FOR THE INTENDED APPLICATION.

4. ALL ABOVE GROUND, EXTERIOR PIPING SHALL BE MOUNTED NOT LESS THAN 3-1/2" ABOVE GRADE AND WHERE INSTALLED ON ROOF SURFACES. PIPING SHALL BE SUPPORTED AND LOCATED WHERE IT WILL BE PROTECTED FROM PHYSICAL DAMAGE. PIPE SUPPORTING DEVICES SHALL BE OF APPROVED TYPE FOR THE INTENDED APPLICATION.

INSULATION

1. COLD WATER AND NON-CIRCULATING HOT WATER PIPING SYSTEMS SHALL BE INSULATED WITH 1 INCH THICK HEAVY-DUTY FIBERGLASS MATERIAL WITH ALL PURPOSE NONCOMBUSTIBLE VAPOR BARRIER JACKET. INSULATION SHALL HAVE A MAXIMUM THERMAL CONDUCTIVITY FACTOR (K) OF 0.27 BTU*IN/HR*FT2°F. ADHESIVE SYSTEMS THAT EMPLOY RELEASE PAPER WILL NOT BE ACCEPTABLE.

2. CIRCULATING HOT WATER PIPING SYSTEMS SHALL BE INSULATED WITH 1 INCH THICK HEAVY-DUTY FIBERGLASS MATERIAL WITH ALL PURPOSE NONCOMBUSTIBLE VAPOR BARRIER JACKET. INSULATION SHALL HAVE A MAXIMUM THERMAL CONDUCTIVITY FACTOR (K) OF 0.27 BTU*IN/HR*FT2°F. ADHESIVE SYSTEMS THAT EMPLOY RELEASE PAPER WILL NOT BE ACCEPTABLE.

3. CONDENSATE PIPING SHALL BE INSULATED WITH 1 INCH THICK FIBERGLASS INSULATION WITH STANDARD VAPOR BARRIER JACKET OR WITH 1" THICK FLEXIBLE UNICELLULAR ("ARMAFLEX").

4. FIBERGLASS PIPE INSUALTION SHALL BE WITH STANDARD VAPOR BARRIER JACKET AND HAVE A MAXIMUM CONDUCTIVITY OF 0.27 BTU PER "/HR-FT2-°F. ALL INSULATION TO BE APPLIED IN FULL ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

5. INSULATE FITTINGS, JOINTS, AND VALVES WITH INSULATION OF LIKE MATERIAL AND THICKNESS AS ADJOINING PIPE. PROVIDE REMOVABLE INSULATION SECTIONS TO COVER PARTS OF EQUIPMENT WHICH MUST BE OPENED PERIODICALLY FOR MAINTENANCE. FINISH WITH GLASS CLOTH OR PVC FITTING COVERS.

IDENTIFICATION

1. ALL PIPING SYSTEMS, VALVES AND EQUIPMENT SHALL BE PROPERLY IDENTIFIED. ALL VALVES SHALL HAVE THEIR NORMAL (IN OPERATION) POSITION IDENTIFIED, SUCH AS "NORMALLY OPEN" OR "NORMALLY CLOSED".

2. IDENTIFICATION SHALL BE IN ACCORDANCE WITH ANSI STANDARD A13.1. PRESSURE SENSITIVE MARKERS SHALL BE MANUFACTURED BY THE BRADY CO., OR APPROVED EQUAL. MARKERS SHALL BE MANUFACTURER'S STANDARD PRODUCT.

CUTTING, PATCHING AND DRILLING

1. ALL CUTTING AND PATCHING OF THE BUILDING CONSTRUCTION REQUIRED FOR THIS WORK SHALL BE BY THIS CONTRACTOR UNLESS SHOWN ON ARCHITECTURAL DRAWINGS AND CONFIRMED AS TO SIZE AND LOCATION PRIOR TO NEW CONSTRUCTION. CUTTING SHALL BE IN A NEAT AND WORKMANLIKE MANNER.

2. NEATLY SAW CUT ALL RECTANGULAR OPENINGS, SET SLEEVE THROUGH OPENING, AND FINISH PATCH OR PROVIDE TRIM FLANGE AROUND OPENING. CORE DRILL AND SLEEVE ALL ROUND OPENINGS.

3. DO NOT CORE DRILL OR CUT ANY CONCRETE SLABS OR OTHER STRUCTURAL COMPONENTS FOR ANY REASON WITHOUT THE KNOWLEDGE AND WRITTEN CONSENT OF THE STRUCTURAL ENGINEER, ARCHITECT AND THE OWNER.

4. PATCH AND FINISH TO MATCH ADJACENT AREAS THAT HAVE BEEN CUT, DAMAGED OR MODIFIED AS A RESULT OF THE INSTALLATION OF THE MECHANICAL OR ELECTRICAL EQUIPMENT.

FIRESTOPPING

1. ALL PENETRATIONS OF SLAB-TO-SLAB PARTITIONS SHALL BE SEALED AIRTIGHT.

2. WHEREVER FIRE RATED PARTITIONS ARE PENETRATED FOR WIRE, DUCT, OR PIPE PASSAGE, SEAL PASSAGES WITH CODE APPROVED, LABORATORY TESTED AND LABELED SEALANT OF FIRE RESISTANCE RATING NOT LESS THAN THAT OF PENETRATED ASSEMBLY THAT WILL PREVENT PASSAGE OF FIRE AND SMOKE. ALL FIRE STOPPING SYSTEM SHALL MEET THE REQUIREMENTS OF ASTM E 814,UL 1479, AND BE FACTORY MUTUAL APPROVED. ALL FIRESTOPING AND/OR SMOKE STOPPING MATERIAL AND INSTALLATION SHALL BE AS MANUFACTURED BY HILTI OR APPROVED EQUAL.

ACCESS DOORS

1. ACCESS DOORS SHALL BE PROVIDED IN WALLS AND CEILINGS WHERE REQUIRED TO PERMIT PROPER ACCESS TO VALVES AND ANY OTHER SUCH DEVICES WHICH REQUIRE MAINTENANCE OR SERVICE. DOORS PLACED IN WALLS, PARTITIONS OR OTHER FIRE-RATED CONSTRUCTION SHALL HAVE A LABEL SIGNIFYING THAT THE DOOR HAS THE SAME FIRE RATING AS THE FIRE-RATED CONSTRUCTION.

2. ACCESS PANELS SHALL BE CONSTRUCTED OF 14 GAUGE STEEL, WITH 16 GAUGE STEEL FRAMES. DOORS SHALL FINISH FLUSH WITH THE SURROUNDING SURFACE. FRAMES SHALL HAVE 3" WIDE EXPANDED METAL FOR PLASTERED SURFACES AND PLAIN FLANGED TYPE FRAME FOR TILE, MASONRY OR GYPSUM BOARD SURFACES. DOORS AND FRAMES SHALL BE FURNISHED PRIME COATED. DOORS INSTALLED IN CERAMIC TILE OR OTHER NON-PAINTED SURFACES SHALL BE STAINLESS STEEL. HINGES SHALL BE CONCEALED SPRING TYPE, TO ALLOW DOORS TO BE OPENED 175 DEGREES. LOCKS SHALL BE FLUSH SCREWDRIVER TYPE WITH STEEL CAMS. ACCESS PANELS SHALL BE 16" X 16" OR LARGER AS MAY BE REQUIRED FOR PROPER ACCESS TO THE DEVICE BEING SERVED.

3. ACCESS PANELS ARE NOT REQUIRED IN COMPLETELY ACCESSIBLE LIFT OUT TILE CEILINGS. CONTRACTOR SHALL REVIEW THE ROOM FINISH SCHEDULE ON THE ARCHITECTURAL DRAWINGS IN ORDER TO VERIFY THE NEED FOR ACCESS PANELS. PROVIDE ACCESS PANELS TO GENERAL CONTRACTOR FOR INSTALLATION.

START UP AND INSTRUCTIONS

1. PERFORM A HYDROSTATIC PRESSURE TEST ON ALL PIPING, AT THE PIPING SYSTEM WORKING PRESSURE, FOR A MINIMUM PERIOD OF 24-HOURS. REPAIR ANY LEAKS AND RETEST TO DEMONSTRATE TIGHTNESS. STOP-LEAK COMPOUNDS WILL NOT BE ALLOWED. ALL PIPING FOR PRESSURIZED WATER SYSTEMS SHALL HAVE A MINIMUM PRESSURE RATING OF 150 PSI.

2. AFTER INSTALLATION, CHECK ALL EQUIPMENT, AND PERFORM START UP IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. PLACE ALL SYSTEMS INTO OPERATION.

3. CLEAN ALL PLUMBING EQUIPMENT AND PIPING OF ALL CONSTRUCTION DUST AT PROJECT COMPLETION.

4. PROVIDE OWNER TRAINING AND DEMONSTRATION OF ALL PLUMBING SYSTEMS AND EQUIPMENT. INSTRUCT OWNER ON PROPER OPERATION AND PREVENTATIVE MAINTENANCE OF SYSTEM. SUBMIT OPERATING AND MAINTENANCE MANUAL ON ALL EQUIPMENT AND SYSTEMS.

WARRANTY

1. FULLY WARRANT ALL MATERIALS, EQUIPMENT AND WORKMANSHIP FOR ONE (1) YEAR FROM DATE OF ACCEPTANCE. EXTEND ALL MANUFACTURER'S WARRANTIES TO OWNER, INCLUDING ALL EXTENDED WARRANTIES.

2. REPAIR OR REPLACE WITHOUT CHARGE TO THE OWNER ALL ITEMS FOUND DEFECTIVE DURING THE WARRANTY PERIOD. IN THE CASE OF REPLACEMENT OR REPAIR DUE TO FAILURE WITHIN THE WARRANTY PERIOD, THE WARRANTY ON THAT PORTION OF THE WORK SHALL BE EXTENDED FOR A MINIMUM PERIOD OF ONE (1) YEAR FROM THE DATE OF SUCH REPLACEMENT OR REPAIR.

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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER: 30756
EXPIRATION DATE: 06/28/2016

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION

6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

PLUMBING SPECIFICATIONS

ISSUE BLOCK

MARK	DATE	DESCRIPTION
5	09.18.14	ISSUED FOR CONSTRUCTION
⚠	07.21.14	ADDENDUM #1
4	06.04.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISION
2	10.25.13	DD REVIEW
1	09.26.13	SD REVIEW

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	NONE
DRAWN BY: PG	PROJ MGR: DC

P001

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SPRINKLER PERFORMANCE SPECIFICATION

1. THE CONTRACTOR SHALL PROVIDE THE DESIGN, MATERIALS, AND INSTALLATION OF A HYDRAULICALLY CALCULATED WET SPRINKLER SYSTEM IN CONFORMANCE WITH THE REQUIREMENTS OF NFPA STANDARD NOS. 13, 20, AND LOCAL CODES. THE CONTRACTOR SHALL PREPARE SPRINKLER SHOP DRAWINGS FOR SUBMISSION TO AND APPROVAL BY THE PROJECT ENGINEER, LOCAL AUTHORITIES, AND THE FIRE MARSHAL. ALL HYDRAULIC CALCULATIONS AND SPRINKLER SYSTEM DESIGN SHALL BE BASED ON THE AVAILABLE WATER PRESSURE. THE CONTRACTOR SHALL PERFORM THE REQUIRED WATER FLOW TESTS BEFORE PROCEEDING WITH DESIGN. SPRINKLER CONTRACTOR SHALL EMPLOY A NICET LEVEL III OR GREATER SPRINKLER DESIGNER TO LAYOUT AND SIZE SYSTEM AND STAMP DRAWINGS.

2. SPRINKLER HEAD LAYOUTS SHALL BE SYMMETRICAL. SPRINKLER CONTRACTOR SHALL COORDINATE LOCATIONS OF SPRINKLER HEADS WITH LIGHT FIXTURES, DIFFUSERS, AND CEILING ELEVATIONS FOR PROPER COVERAGE. STRUCTURAL ELEMENTS, CEILING ELEVATIONS, DUCTWORK, AND PIPING. SPRINKLER PIPING WILL NOT BE ALLOWED TO COMPROMISE LIGHTING, HVAC, OR ARCHITECTURAL ELEMENTS AND/OR THEIR LOCATIONS. THE CONTRACTOR SHALL REFER TO THE ARCHITECTURAL DRAWINGS FOR PROPOSED SPRINKLER HEAD LOCATIONS WHERE APPLICABLE. ALL SPRINKLER HEADS MOUNTED IN REMOVABLE ACCESSIBLE CEILINGS SHALL BE LOCATED AT THE CENTER (4") OF THE CEILING TILE.

3. SPRINKLER HEADS SHALL BE RATED AND UL LISTED FOR THE INTENDED TEMPERATURE CLASSIFICATION. SPRINKLERS IN AREAS REQUIRING TEMPERATURE CLASSIFICATIONS OF INTERMEDIATE AND GREATER SHALL REQUIRE THE USE OF A TEMPERATURE MEASURING DEVICE TO DETERMINE THE APPROPRIATE TEMPERATURE CLASSIFICATION.

4. UNLESS OTHERWISE NOTED, SPRINKLER HEADS SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS OR AS OTHERWISE SPECIFIED BY THE ARCHITECT. WHERE NO STANDARD IS SPECIFIED, THE SPRINKLER HEADS SHALL BE CHROME PLATED SEMI-RECESSED TYPE IN AREAS WITH CEILING AND CHROME PLATED UPRIGHT TYPE IN OTHER AREAS. SPRINKLER HEADS, VALVES, ALARMS, ETC. SHALL BE MANUFACTURED BY VIKING, GRINNELL, CENTRAL, STAR, OR RELIABLE.

5. SUPPORT ALL PIPING STRUCTURE WITH UL LISTED HANGERS AND SUPPORTS SUITABLE FOR THE INTENDED INSTALLATION. DESIGN, SELECTION, SPACING AND APPLICATION OF HANGERS AND SUPPORTS SHALL COMPLY WITH NFPA STANDARDS, ANSI B31.1 AND MSS SP-69.

6. ALL TRAPPED PIPING SHALL BE PROVIDED WITH ACCESSIBLE DRAIN VALVES, NIPPLE, AND CAP.

7. PIPING MATERIALS AND CONNECTIONS DOWNSTREAM OF MAIN CONTROL VALVES SHALL BE IN COMPLIANCE WITH NFPA STANDARD NO. 13, AND SHALL BE LISTED AND LABELED AS SUCH. PIPING SHALL BE EITHER ASTM 120, A-53, SCHEDULE 40, BLACK STEEL, TYPE L HARD DRAWN, SEAMLESS COPPER, SCHEDULE 10 (LARGER THAN 2 INCHES), OR THREADABLE THIN WALL STEEL (2 INCHES AND SMALLER). FITTINGS SHALL BE CAST FITTINGS. PLASTIC FIRE PROTECTION PIPING WITHIN PLENUM SPACES IS ONLY ALLOWABLE WITH WET SYSTEMS. PIPING SHALL HAVE A MAXIMUM PEAK OPTICAL DENSITY OF 0.50, A MAXIMUM AVERAGE OPTICAL DENSITY OF 0.15, AND A FLAME SPREAD NOT GREATER THAN 5 FEET WHEN TESTED IN ACCORDANCE WITH UL 1887.

8. ALL NEW FIRE PROTECTION PIPING SHALL HAVE THE OPTION TO BE U.L. LISTED AND FACTORY MUTUAL APPROVED PAINTED DUCTILE IRON VICTAULIC STYLE 77 OR 78 COUPLINGS ON BRANCH LINES AND VICTAULIC STYLE 07 "ZERO FLEX" COUPLINGS ON THE RISER AND MAINS, AND VICTAULIC FULL FLOW FITTINGS. VICTAULIC FLANGES, REDUCING COUPLINGS AND OUTLET COUPLINGS SHALL NOT BE ALLOWED. VICTAULIC GASKETS SHALL BE U.L. LISTED AND FACTORY MUTUAL APPROVED FOR THE SERVICE AND WORKING PRESSURE OF THE SYSTEM. GROOVE CUTTING OR ROLLING AND INSTALLATION OF GASKETS AND COUPLINGS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN RECOMMENDATIONS.

9. FIRE PROTECTION PIPING GATE VALVES UP TO AND INCLUDING 2 INCHES SHALL BE KENNEDY FIGURE 66 OR APPROVED EQUAL, RATED FOR ITS 175 PSIG WORKING PRESSURE, UL LISTED AND APPROVED, AND HAVE A BRONZE BODY, BRONZE TRIM, SINGLE DISC, OUTSIDE SCREW AND YOKE, SCREWED BONNET VALVES WITH SEATS OF BRONZE AND SCREWED ENDS. GATE VALVES 2-1/2" AND ABOVE SHALL BE KENNEDY FIGURE 65 OR APPROVED EQUAL, RATED FOR ITS 175 PSIG WORKING PRESSURE, UL LISTED AND APPROVED, AND HAVE A IRON BODY, OUTSIDE SCREW AND YOKE BOLTED BONNET VALVES WITH DOUBLE OR SINGLE DISC, CLASS 125 ANSI B16.1 FLANGED ENDS, BRONZE TRIM AND BRONZE SEATS.

10. FIRE PROTECTION PIPING SWING CHECK VALVES SHALL BE UL LISTED AND APPROVED, RATED FOR ITS 175 PSIG WORKING PRESSURE, AND HAVE A IRON BODY, BRONZE TRIM, CAST IRON OR BRONZE DISC, BOLTED COVER AND SCREWED OR FLANGED ENDS. SWING CHECK VALVES SHALL BE INSTALLED IN HORIZONTAL PIPING ONLY. VALVES MANUFACTURED BY KENNEDY, CRANE, JENKINS, GRINNELL, STOCKHAM, OR NIBCO-SCOTT WILL BE ACCEPTABLE IF THEY COMPLY WITH THESE SPECIFICATIONS.

11. FLOW AND TAMPER SWITCH ALARM ANNUNCIATION SHALL BE INTERLOCKED WITH THE CORRESPONDING ALARM SYSTEMS FOR PROPER ANNUNCIATION. WATER FLOW SWITCHES SHALL BE SIMILAR TO AUTOCALL WF-4. COORDINATE ALL REQUIREMENTS WITH THE ELECTRICAL CONTRACTOR. IF THEY COMPLY WITH THESE SPECIFICATIONS, WATER FLOW SWITCHES MANUFACTURED BY AUTOCALL, POTTER ELECTRIC SIGNAL COMPANY, GRINNELL, OR STAR SPRINKLER CORPORATION WILL BE ACCEPTABLE. SUPERVISORY (TAMPER) SWITCHES SHALL BE SINGLE POLE, DOUBLE THROW TYPE WITH CAST ALUMINUM HOUSING AND TAMPER-PROOF COVER. SWITCH RATING SHALL BE AT LEAST 7 AMPERS AT 125-250 VOLTS. SWITCHES SHALL BE POTTER ELECTRIC SIGNAL CO. MODEL OSYS-B, STAR SPRINKLER CORP. SERIES NSV, OR APPROVED EQUAL.

12. ALL PACKAGED EQUIPMENT SHALL BE INDEPENDENTLY THIRD PARTY LABELED AS A SYSTEM FOR ITS INTENDED USE BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) IN ACCORDANCE WITH OSHA FEDERAL REGULATIONS 29CFR1910.303 AND .399, AS WELL AS NFPA PAMPHLET NO. 70, THE NATIONAL ELECTRICAL CODE (NEC) ARTICLE 90-7.

13. THE NEW SPRINKLER SYSTEM SHALL ACCOUNT FOR EXPECTED LOSSES OF EXISTING PIPING CONNECTIONS TO THE SYSTEM. THE EXISTING RUN-OUTS AND DROPS SHALL BE MODIFIED AS REQUIRED TO CONFORM TO THE FLOOR PLAN SHOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE RELOCATION AND COORDINATION OF THE EXISTING SPRINKLER SYSTEM WITH THE NEW WORK OF ALL DIMSIONS. THE SPRINKLER CONTRACTOR MUST MODIFY THE EXISTING PIPING, PIPING DROPS, AND SWING ARMS TO PROVIDE PROPER COVERAGE.

17. THE CONTRACTOR SHALL MODIFY THE EXISTING SPRINKLER PIPING IN THE AREAS BEING MODIFIED TO CONFORM TO THE REQUIRED FIRE SPRINKLER AND FIRE ALARM ZONES. MODIFICATIONS, ADDITIONS, REPAIRS, EQUIPMENT AND DEVICES REQUIRED FOR THE WET SPRINKLER SYSTEM TO CONFORM TO LOCAL CODES AND TO PROVIDE A COMPLETE AND WORKING SYSTEM IN COMPLIANCE WITH THE CODE REGULATIONS AND BUILDING STANDARDS SHALL BE AT NO ADDITIONAL COST OVER THE CONTRACT. CONTRACTOR TO EXTEND SPRINKLER SYSTEM FROM EXISTING SPRINKLER SYSTEM.

PLUMBING FIXTURE SCHEDULE (BASIS OF DESIGN)

DESIGNATION	FIXTURE TYPE	C.W.	H.W.	WASTE	VENT	MANUFACTURER	MODEL NO.	TRIM	WASTE	TRAP	SUPPLY	ACCESSORIES	REMARKS
L-1A	LAVATORY - ADA	1/2"	1/2"	1-1/4"	1-1/4"	AMERICAN STANDARD	0888.012	SLOAN ETF-600-SCT	7723.018	ZURN 1021	RISID CONNECTIONS WITH LOOSE KEY STOPS	ABBE 1070 MIXING VALVE; EL-61 TRANSFORMER	1, 2, 3
WC-1	WATER CLOSET	1"	-	4"	2"	AMERICAN STANDARD	3043.001	SLOAN ROYAL 111-1.6 WITH WBF-72-A	-	-	-	BEMIS 1955SSTR	1, 4
WC-1A	WATER CLOSET - ADA	1"	-	4"	2"	AMERICAN STANDARD	3043.001	SLOAN ROYAL 111-1.6 WITH WBF-72-A	-	-	-	BEMIS 1955SSTR	1, 2, 4
U-1A	URINAL - ADA	3/4"	-	2"	1-1/2"	SLOAN	WEUS-1000.1001-0.125		-	-	-	-	1, 2
S-1A	SHOWER - ADA	1/2"	1/2"	2"	1-1/2"	AQUASUB	B643B9F.78	AMER. STAND. 1662.213	DRAIN WITH GRID BY SHOWER MANUFACTURER	-	-	ABBE 1016 MIXING VALVE	1, 2, 5
EWC-1A	WATER COOLER - ADA	1/2"	-	1-1/4"	1-1/4"	SUNROC	ADABACB	BUBBLER FILLER OPTION	-	-	-	-	1, 2
PS-1	LAUNDRY ROOM SINK	1/2"	1/2"	1-1/2"	1-1/4"	FIAT	DL-17-20	A-1 DECK FAUCET	-	ZURN 1021	RISID CONNECTIONS WITH WHEEL HANDLES	-	1, 3
HB-1	HOSE BIB	3/4"	-	-	-	WOODFORD MFG.	67	-	-	-	-	-	1
WB-1	WASHER SUPPLY BOX	1/2"	1/2"	2"	1-1/2"	IPS WATERTITE	W4700	-	-	-	-	-	1
FD-1	FLOOR DRAIN	-	-	3"	1-1/2"	ZURN	Z415-P-V	TYPE 'B' STRAINER	-	-	-	TRAP PRIMER CONN. AND BACKWATER VALVE	1

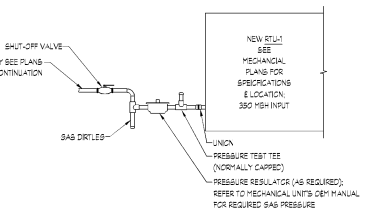
REMARKS:
1. PROVIDE ALL REQUIRED COMPONENTS FOR COMPLETE FIXTURE ROUGH-IN, I.E., SUPPLIES, STOPS, TRAPS, CARRIERS, GRID DRAINS, TAILPIECES, ETC., NOT ALL REQUIRED COMPONENTS ARE SPECIFIED ABOVE.
2. FIXTURES SHALL BE ADA COMPLIANT, PROVIDED WITH ADA COMPLIANT ACCESSORIES. MOUNT ADA COMPLIANT, SEE ARCHITECTURAL PLANS FOR ELEVATIONS.
3. PROVIDE BACK-GUARD INSULATING DEVICES ON EXPOSED UNDER-COUNTER PLUMBING.
4. COORDINATE ADA GRAB BAR INSTALLATION WITH WATER CLOSET VALVE INSTALLATION. GRAB BARS SHALL BE INSTALLED SO AS TO NOT INTERFERE WITH USE AND MAINTENANCE OF VALVE. COORDINATE LOCATION OF VALVE TRIP LEVER WITH ADA GUIDELINES.
5. SHOWER UNIT TO BE PROVIDED WITH THE FOLLOWING MANUFACTURER SUPPLIED OPTIONS: GRAB BAR, CURTAIN ROD, FOLD UP SEAT, 3/4" THRESHOLD, DOME LIGHT, AND ANTIBACTERIAL SHOWER CURTAIN WITH HOOKS.

DIVISION OF MECHANICAL/ELECTRICAL WORK

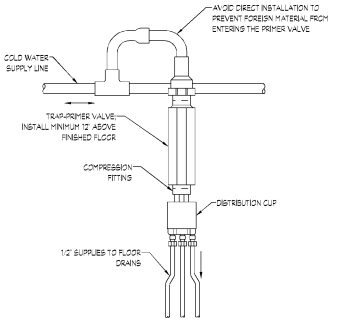
ITEM	MECH DIV 15	ELEC DIV 16
AUTOMATIC TEMPERATURE CONTROLS	FURNISH, INSTALL, & WIRE	POWER WIRING
CONTROL PANELS FOR MECHICAL EQUIPMENT	FURNISH & INSTALL	POWER WIRING
LOW & LINE VOLTAGE CONTROL WIRING FOR MECH. EQUIPMENT	FURNISH & INSTALL	
MECHANICAL FLOW SWITCHES	FURNISH, INSTALL, & WIRE	
THERMOSTATS/SENSORS	FURNISH, INSTALL, & WIRE	
P/E & E/P SWITCHES	FURNISH, INSTALL, & WIRE	
DISCONNECT SWITCHES FOR MECHANICAL EQUIPMENT		FURNISH, INSTALL, & WIRE
MECHANICAL EQUIPMENT MOTORS	FURNISH & INSTALL	POWER WIRING
MANUAL STARTERS FOR MECHANICAL EQUIPMENT	FURNISH	INSTALL & POWER WIRE
MAGNETIC STARTERS FOR MECHANICAL EQUIPMENT	FURNISH	INSTALL & POWER WIRE
MOTOR CONTROL CENTERS	CONTROL WIRING	FURNISH, INSTALL, & WIRE
VARIABLE SPEED CONTROLLERS	FURNISH & INSTALL	POWER WIRING
MOTORIZED DAMPERS & VALVES	FURNISH, INSTALL, & WIRE	
DUCT SMOKE DETECTORS	INSTALL	FURNISH & WIRE
HEAT TRACE CABLE FOR PIPING	FURNISH & INSTALL	POWER WIRING
OIL/GAS EMERGENCY SHUT-OFF SWITCHES		FURNISH, INSTALL, & WIRE
SPRINKLER FLOW & TAMPER SWITCHES	FURNISH & INSTALL	WIRE

PLUMBING LEGEND

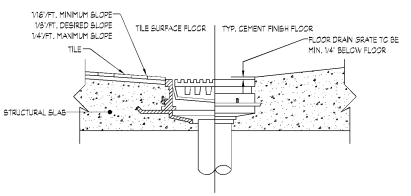
SYMBOL	ABBV.	DESCRIPTION
	SAN., W.	SANITARY PIPING
	V	VENT PIPING
	CW	COLD WATER PIPING
	HW	HOT WATER PIPING
	HWR	HOT WATER RETURN PIPING
CD	CD	CONDENSATE DRAIN PIPING
G	G	GAS PIPING
	E	EXISTING PIPING (LINE TYPE INDICATED PIPE TYPE UNO.)
		EXISTING EQUIPMENT OR PIPING TO BE REMOVED (LINE TYPE INDICATES PIPE TYPE UNO.)
		PIPE UP
		PIPE DOWN
		PIPE TEE DOWN
	CO	CLEAN OUT, FLOOR
	CO	CLEAN OUT, EXPOSED
		CAPPED PIPE
		PIPE UNION
		FLOOR DRAIN, OPEN SITE DRAIN
	BV	BALANCING VALVE
		AQUASTAT
		THERMOSTAT
	BPP	BACK FLOW PREVENTER
		BALL VALVE OR SHUTOFF VALVE
		"Y" TYPE STRAINER
	PRTRV	PRESSURE AND/OR TEMPERATURE RELIEF VALVE
		MIXING VALVE
		VACUUM RELIEF VALVE
		HOSE BIB, EXTERNAL
P		FLOOR DRAIN WITH TRAP PRIMER
X		DOMESTIC SHOCK ABSORBER WATER HAMMER ARRESTER; TENT DENOTES SIZE (FOR A - F)
	CV	CHECK VALVE
		DRAWING NOTE
		REVISION NUMBER
		CONNECTION POINT, NEW TO EXISTING
	DISC.	POINT OF DISCONNECTION
	IN. W.C.	INCHES WATER COLUMN
	UNO	UNLESS NOTED OTHERWISE
	SW	GREASE WASTE DRAIN LINE
	FCO	FLOOR CLEAN OUT
	WCO	WALL CLEAN OUT
	COTG	CLEAN OUT TO GRADE
	A.F.F.	ABOVE FINISHED FLOOR ELEVATION
	B.F.F.	BELOW FINISHED FLOOR ELEVATION
	VTR	VENT THROUGH ROOF TERMINATION



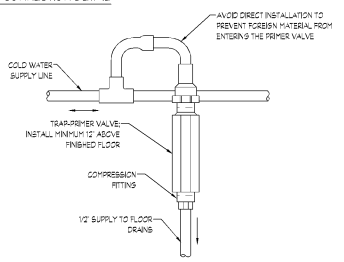
MECHANICAL EQUIPMENT CONNECTION DETAIL
NO SCALE



TRAP PRIMER PIPING DETAIL W/ DISTRIBUTION CUP
NO SCALE



TYPICAL FLOOR DRAIN DETAIL
NO SCALE



TRAP PRIMER PIPING DETAIL
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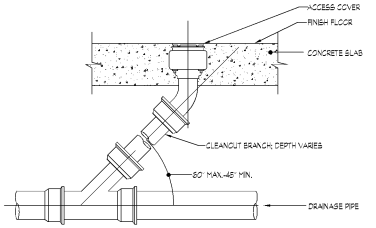

TYPICAL FLOOR CLEAN OUT DETAIL
NO SCALE
NOTES:
1. PROVIDE EXTRA HEAVY DUTY POLISHED BRONZE OR NICKEL BRONZE COVER IN FINISHED AREAS ONLY; CAST IRON IN UNFINISHED AREAS.
2. FLOOR CLEANOUT SHOWN. CLEANOUT AT SPACE SIMILAR EXCEPT PROVIDE 12"X12"X8" D CONCRETE BLOCK AT SPACE.

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PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.
LICENSE NUMBER: 30790
EXPIRATION DATE: 09/09/2015

PROJECT TITLE

WORCESTER COUNTY RECREATION CENTER ADDITION
6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

PLUMBING SPECIFICATIONS, SCHEDULES, DETAILS, & LEGEND

ISSUE BLOCK		
5	09.10.14	ISSUED FOR CONSTRUCTION
4	07.21.14	ADDENDUM #1
3	06.06.14	ISSUED FOR BID/DEVELOPMENT
2	10.30.13	PLANNING COMMISSION
1	05.28.13	DD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO: 2013.182.00
DATE: 02.07.2014
SCALE: NONE
DRAWN BY: PG | PROJ MGR: DC

P002

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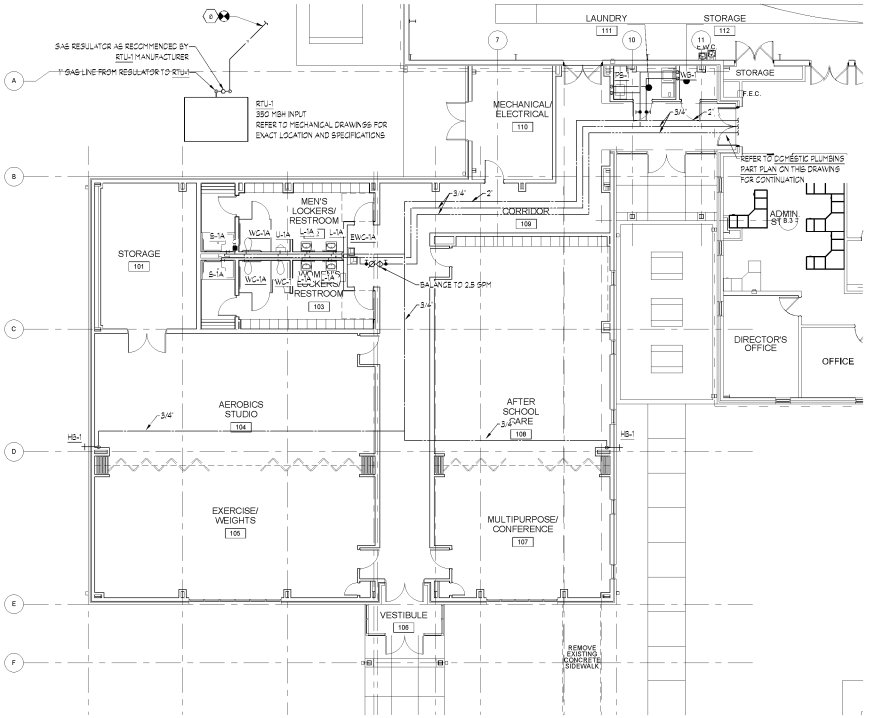
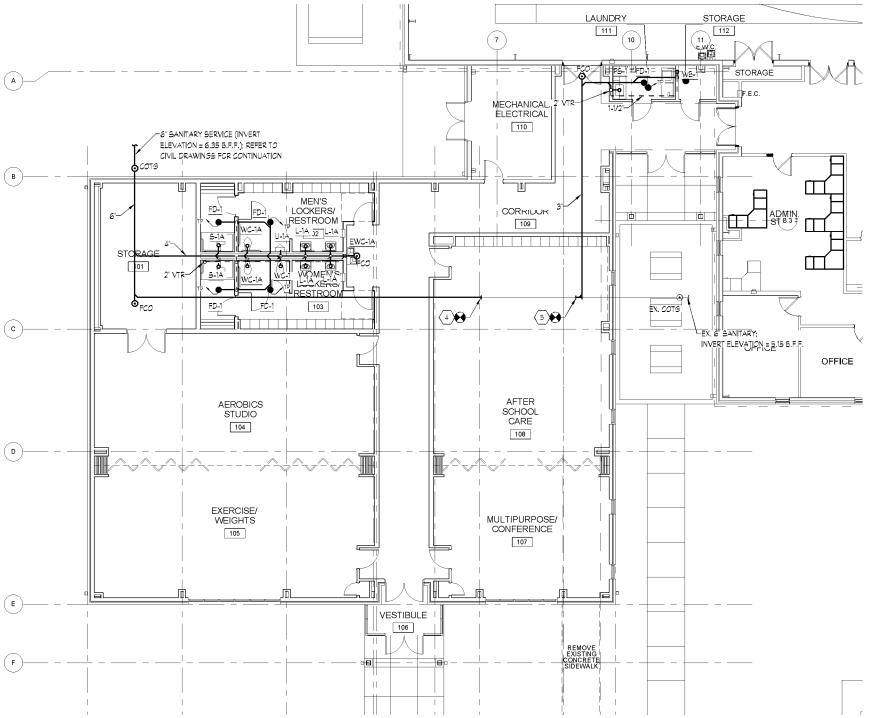


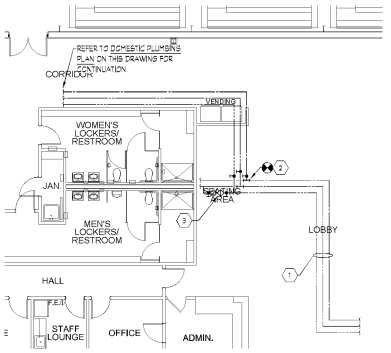
DOMESTIC PLUMBING PLAN

SCALE: 1/8" = 1'-0"



SANITARY PLUMBING PLAN

SCALE: 1/8" = 1'-0"



DOMESTIC PLUMBING PART PLAN

SCALE: 1/8" = 1'-0"

DRAWING NOTES:

1. EXISTING 2" CW, 1" HW, AND 3/4" HWR MAINS SERVING EXISTING RESTROOMS.
2. CONNECT NEW 2" CW, 3/4" HW, AND 3/4" HWR TO EXISTING MAINS TO SERVE NEW ADDITION.
3. PROVIDE NEW BALANCING AND CHECK VALVE ON EXISTING HWR LINE. BALANCE TO 2.5 GPM.
4. CONNECT NEW 6" SANITARY TO EXISTING SANITARY SERVICE.
5. CONNECT NEW 3" SANITARY TO EXISTING SANITARY SERVICE.
6. EXTEND EXISTING UNDERGROUND PROPANE GAS SERVICE SERVING EXISTING HVAC UNIT TO NEW RTU-1. CONTRACTOR TO VERIFY THAT EXISTING GAS PRESSURE SERVICE IS ADEQUATE TO ACCOMMODATE NEW AND EXISTING MECHANICAL UNITS. REFER TO MECHANICAL EQUIPMENT CONNECTION DETAIL ON DRAWING P-002.

GENERAL NOTES:

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING HAVE BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS AND / OR FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT DIRECTION BEFORE PROCEEDING WITH THE WORK.
2. PER EXISTING DRAWINGS, THE EXISTING DOMESTIC HOT WATER RECIRCULATION PUMP SHALL HAVE A CAPACITY OF 5 GPM @ 20 FT. HD. IF EXISTING PUMP DOES NOT MEET OR EXCEED THIS CAPACITY, CONTRACTOR SHALL REPLACE PUMP WITH NEW. PUMP MODEL BASIS OF DESIGN SHALL BE: BELL & GOSSETT PL-30B WITH 3/4" FLANGE CONNECTION, 1/12 HP, 120V/1Ø.
3. PROPANE GAS PIPE SIZING BASED UPON 2012 NFPA 54 TABLE 6.3(d) "SCHEDULE 40 METALLIC PIPE" WITH AN INLET PRESSURE OF 11.0 IN. W.C. AND A 0.5 SYSTEM PRESSURE DROP. GAS LOAD = 350 MBH AT 80' MAXIMUM EQUIVALENT LENGTH.

GRAPHIC SCALE 1/8" = 1'-0"

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EXPIRATION DATE 10/09/2015

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6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

PLUMBING PLANS

ISSUE BLOCK		
6	09.10.14	ISSUED FOR CONSTRUCTION
5	07.21.14	ADDENDUM #1
4	06.06.14	ISSUED FOR BIDDING/PERMIT
3	12.18.13	PLANNING COMMISSION
2	10.25.13	DD REVIEW
1	05.28.13	SD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO: 2013.182.00
DATE: 02.07.2014
SCALE: NONE
DRAWN BY: PG PROJ MGR: DC

P100

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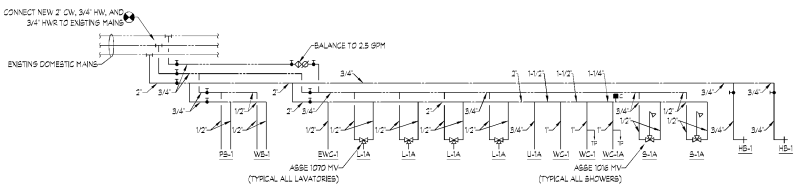
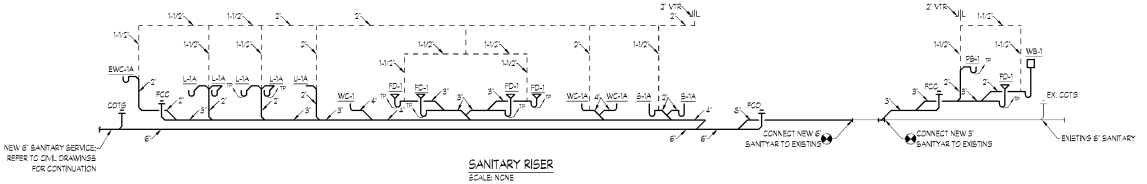


DOMESTIC RISER

SCALE: NONE

W.S.F.U.'S = 80 (81 GPM MAXIMUM POSSIBLE FLOW; DOES NOT INCLUDE EXISTING FIXTURES ON SYSTEM)



SANITARY RISER

SCALE: NONE

D.F.U.'S = 36 (DOES NOT INCLUDE EXISTING FIXTURES ON SYSTEM)

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6030 PUBLIC LANDING ROAD
SNOW HILL, MARYLAND

SHEET TITLE

PLUMBING RISERS

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5	03.10.14	ISSUED FOR CONSTRUCTION
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3	12.06.13	ISSUED FOR BIDDING/PERMIT
2	10.30.13	PLANNING COMMISSION
1	10.25.13	DD REVIEW
0	09.25.13	DD REVIEW
MARK	DATE	DESCRIPTION

PROJECT NO:	2013.182.00
DATE:	02.07.2014
SCALE:	NONE
DRAWN BY: PG	PROJ MGR: DC

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6113 Timmons Road
Snow Hill, MD 21863

Attn: Ken Whited

Date: October 15, 2007

Subject: Worcester County Recreation Center Job# 05-067

Enclosed please find one copy of the above referenced Test and Balance report for your review. If you have any questions or comments, please contact our office.

Thank you.

Christine Hipple

CHESAPEAKE TESTING & BALANCING ENGINEERS, INC.
Testing & Balancing Air-Water-Sound
400 Needwood Avenue
Easton, MD 21601

410-820-9791 410-820-7389 Fax

Test & Balance Report

Project: **Worcester County Recreation Center**

Location: **Worcester County, MD**

Client: **SPN, Inc.**

Architect: **--**

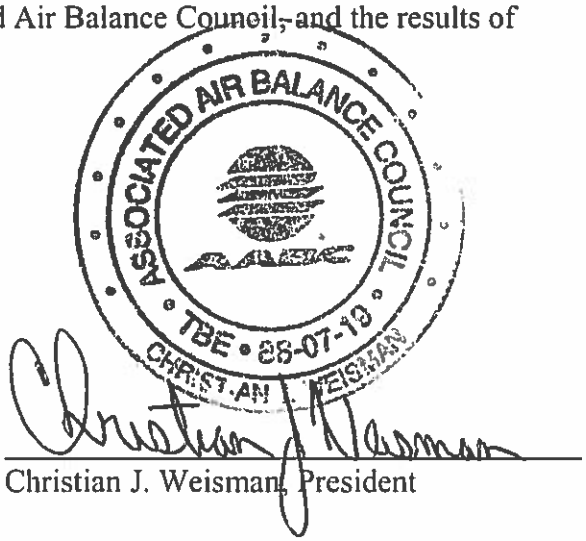
Engineer: **Claggett Engineering**

Chesapeake Testing & Balancing Engineers, Inc. Project # 05-067

Certification

This is to certify that Chesapeake Testing & Balancing Engineers, Inc. has balanced the systems described to their optimum capabilities. The Testing and Balancing has been performed in accordance with the Associated Air Balance Council, and the results of these tests are herein recorded.

Associated Air Balance Council
Certification 88-07-19



Date: October 15, 2007

Christian J. Weisman, President

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Chesapeake T+B Engineers, Inc.

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Associated Air Balance Council

Air Moving Equipment Test Sheet
ROOFTOP UNIT-1 [1]
10/13/2005
JOB #05-067

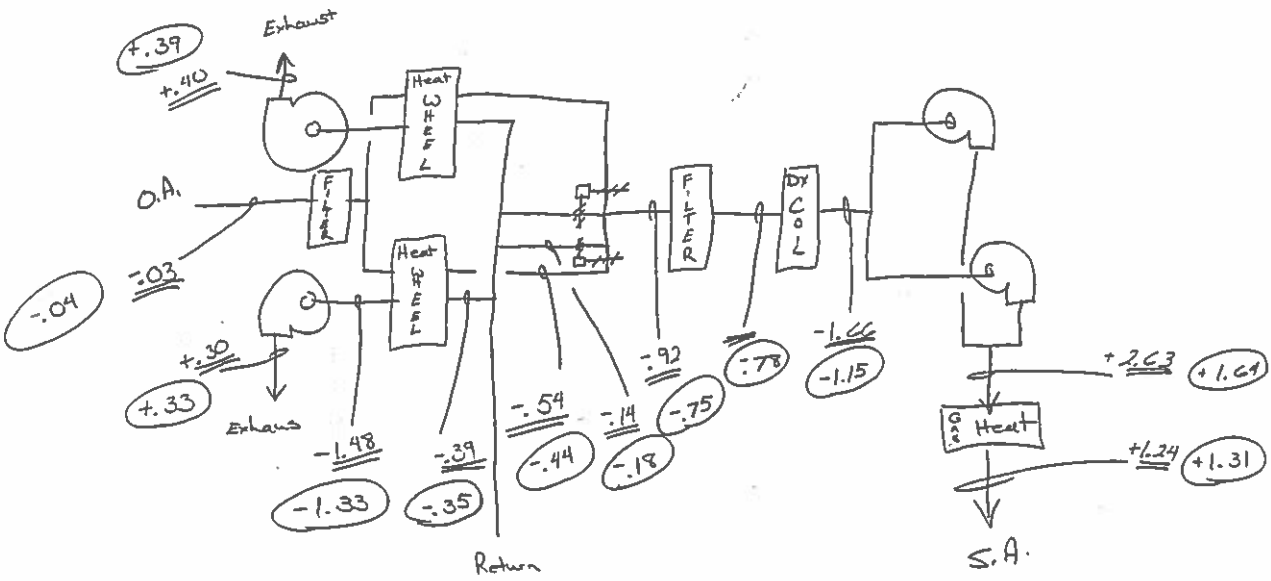
UNIT IDENTIFICATION	
Location	CONCRETE PAD
Area Served	GYM
Manufacturer	AAON
Model Number	RN-040-3-0-AB04-7A2
Serial Number	200408-ANGV00467
Motor HP	10.0[2]
Motor Voltage	460
Motor Phase	3
Motor Amperage	13.2
Motor Service Factor	1.15
Motor RPM	1760 DIRECT DRIVE

MEASUREMENTS	DESIGN	ACTUAL
Total Fan CFM	16000	14988
Return Air CFM	10850	9916
Outside Air CFM	5150	5072
External S.P.	1.0	1.38
Total S.P.	3.76	4.29
Suction S.P.		-1.66
Discharge S.P.		+2.63
Motor Voltage #1	460	380
Motor Voltage #2	460	380
Motor Voltage #3	460	380
Motor Amps #1	13.2	13.0[3]
Motor Amps #2	13.2	13.1[4]
Motor Amps #3	13.2	13.0[4]
Motor HP	10.0	8.1[5]
Fan RPM	1433	1325[6]

[1]INCREASING VFD OUTPUT WILL CAUSE VFD#2 TO SHUT DOWN ON OVERLOAD.
[2]QUANTITY TWO MOTORS.
[3]SECOND MOTOR 13.1 AMPS.
[4]SECOND MOTOR 13.0 AMPS.
[5]SECOND MOTOR 8.1BHP.
[6]SECOND MOTOR AT 1320 RPM VFD AT 45.5 HERTZ.

DIAGRAM

Diagram Information
STATIC PRESSURE SKETCH



Chesapeake T+B Engineers, Inc.

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Circular Duct Traverse Test
ROOFTOP UNIT-1 SUPPLY
10/13/2005
JOB #05-067

SUMMARY	
Location	OUTSIDE TOTAL SUPPLY
Duct Diameter inches	42
Duct Area (square feet)	9.622
Design Velocity in FPM	1663
Actual Average Velocity in FPM	1559
Design CFM	16000
Actual CFM	14988
Duct S.P.	+1.71

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TS	1317	1396						
	1549	1619						
	1425	1651						
	1519	1363						
	1581	1401						
	1571	1617						
	1606	1822						
	1299	2024						
	1494	1956						
	1070	1898						

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AIR DISTRIBUTION

Room Number	#	Size	Type	Ak	Dsgn Vlct	Dsgn CFM	Actl Vlct	Actl CFM
OUTSIDEAIR	1	32X93	OAI[1]	20.7	249	5150	245	5072
Total						**5150**		**5072**

[1]OUTSIDE AIR INTAKE.

Chesapeake T+B Engineers, Inc.

AABC
Associated Air Balance Council

Fan Test (Exhaust)
ROOFTOP UNIT-1
10/13/2005
JOB #05-067

UNIT IDENTIFICATION	
Location	CONCRETE PAD
Area Served	GYM
Manufacturer	AAON
Model Number	RN-040-3-0-AB04-7A2
Motor HP	5.0[1]
Motor Voltage	460
Motor Phase	3
Motor Amperage	7.0
Motor Service Factor	1.15
Motor RPM	1745

MEASUREMENTS	DESIGN	ACTUAL
Total CFM	16000	17400
Total S.P.	.93	1.88
Suction S.P.		-1.48
Discharge S.P.		+.40
Horse Power	5.0	3.2[2]
Motor Voltage #1	460	480
Motor Voltage #2	460	480
Motor Voltage #3	460	480
Motor Amps #1	7.0	4.3[3]
Motor Amps #2	7.0	4.1[4]
Motor Amps #3	7.0	4.4[5]
Fan RPM	1010	912[6]

ADDITIONAL DATA	
Motor Sheave	1VP56 X 1 1/8
Fan Sheave	BK90 X 1 3/16
Drive Belt Num/Size	BX 65
Center Line Distance	24"
% Sheave Adj. Closed	0% MINIMUM

[1]QUANTITY TWO MOTORS.
[2]SECOND MOTOR 3.1 BHP.
[3]SECOND MOTOR 4.2 AMPS.
[4]SECOND MOTOR 4.3 AMPS.
[5]SECOND MOTOR 4.0 AMPS.
[6]SECOND MOTOR 906 RPM.

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AIR DISTRIBUTION

Room Number	#	Size	Type	Ak	Dsgn Vlct	Dsgn CFM	Actl Vlct	Actl CFM
GYM	1	44X47	RG	11.6			300	3480
GYM	2	44X47	RG	11.6			325	3770
GYM	3	44X47	RG	11.6			450	5220
GYM	4	44X47	RG	11.6			425	4930
Total								17400

[1]NO DESIGN CFM GIVEN.

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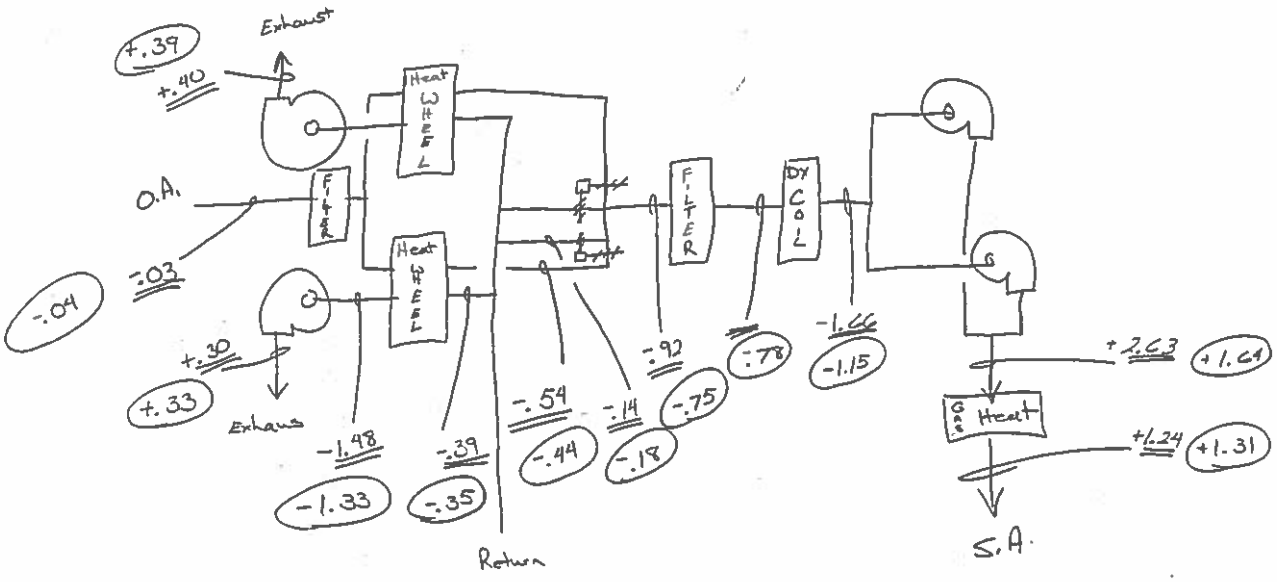
UNIT IDENTIFICATION	
Location	CONCRETE PAD
Area Served	GYM
Manufacturer	AAON
Model Number	RN-050-3-0-AB04-7A2
Serial Number	200408-ANGW00468
Motor HP	7.5[2]
Motor Voltage	460
Motor Phase	3
Motor Amperage	10.7
Motor Service Factor	1.15
Motor RPM	1180 DIRECT DRIVE

MEASUREMENTS	DESIGN	ACTUAL
Total Fan CFM	16000	13785
Return Air CFM	10850	9024
Outside Air CFM	5150	4761
External S.P.	1.0	1.49
Total S.P.	2.98	2.79
Suction S.P.		-1.15
Discharge S.P.		+1.64
Motor Voltage #1	460	440
Motor Voltage #2	460	440
Motor Voltage #3	460	440
Motor Amps #1	10.7	10.3[3]
Motor Amps #2	10.7	10.5[4]
Motor Amps #3	10.7	10.4[5]
Motor HP	7.5	6.7
Fan RPM	1142	1085[6]

[1]INCREASING VFD OUTPUT WILL CAUSE VFD#2 TO SHUTDOWN ON OVERLOAD.
[2]QUANTITY TWO MOTORS.
[3]SECOND MOTOR 10.2 AMPS.
[4]SECOND MOTOR 10.3 AMPS.
[5]SECOND MOTOR 10.1 AMPS.
[6]SECOND MOTOR 1085 RPM VFD AT 55 HERTZ.

DIAGRAM

Diagram Information
STATIC PRESSURE SKETCH



Circular Duct Traverse Test
ROOFTOP UNIT-2
09/27/2005
JOB #05-067

SUMMARY	
Location	OUTSIDE TOTAL SUPPLY
Duct Diameter inches	42
Duct Area (square feet)	9.622
Design Velocity in FPM	1663
Actual Average Velocity in FPM	1433
Design CFM	16000
Actual CFM	13785
Duct S.P.	+1.31

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TS-1	1113	1185						
	1200	1207						
	1343	1171						
	1399	1222						
	1376	1477						
	1299	1766						
	1498	1933						
	1573	1879						
	1381	1791						
	1193	1659						

AIR DISTRIBUTION

Room Number	#	Size	Type	Ak	Dsgn Vlct	Dsgn CFM	Actl Vlct	Actl CFM
OUTSIDEAIR	1	32X93	OAI[1]	20.7	248	5150	230	4760
Total						5150		4760

[1]OUTSIDE AIR INTAKE.

UNIT IDENTIFICATION	
Location	CONCRETE PAD
Area Served	GYM
Manufacturer	AAON
Model Number	RN-050-3-0-AB04-7A2
Motor HP	5.0[1]
Motor Voltage	460
Motor Phase	3
Motor Amperage	7.0
Motor Service Factor	1.15
Motor RPM	1745

MEASUREMENTS	DESIGN	ACTUAL
Total CFM	16000	16994
Total S.P.	.93	1.72
Suction S.P.		-1.33
Discharge S.P.		+.39
Horse Power	5.0	3.3
Motor Voltage #1	460	480
Motor Voltage #2	460	480
Motor Voltage #3	460	480
Motor Amps #1	7.0	4.2[2]
Motor Amps #2	7.0	4.4[3]
Motor Amps #3	7.0	4.7[4]
Fan RPM	1010	915[5]

ADDITIONAL DATA	
Motor Sheave	1VP56 X 1 1/8
Fan Sheave	BK90 X 1 3/16
Drive Belt Num/Size	BX 65
Center Line Distance	24"
% Sheave Adj. Closed	0% MINIMUM

[1]QUANTITY TWO MOTORS.
[2]SECOND MOTOR 4.3 AMPS.
[3]SECOND MOTOR 4.6 AMPS.
[4]SECOND MOTOR 4.5 AMPS.
[5]SECOND MOTOR 911 FAN RPM.

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AIR DISTRIBUTION

Room Number	#	Size	Type	Ak	Dsgn Vlct	Dsgn CFM	Actl Vlct	Actl CFM
GYM	1	44X47	RG	11.6			300	3480
GYM	2	44X47	RG	11.6			325	3770
GYM	3	44X47	RG	11.6			425	4930
GYM	4	44X47	RG	11.6			415	4814
Total								**16994**

[1]NO DESIGN CFM GIVEN.

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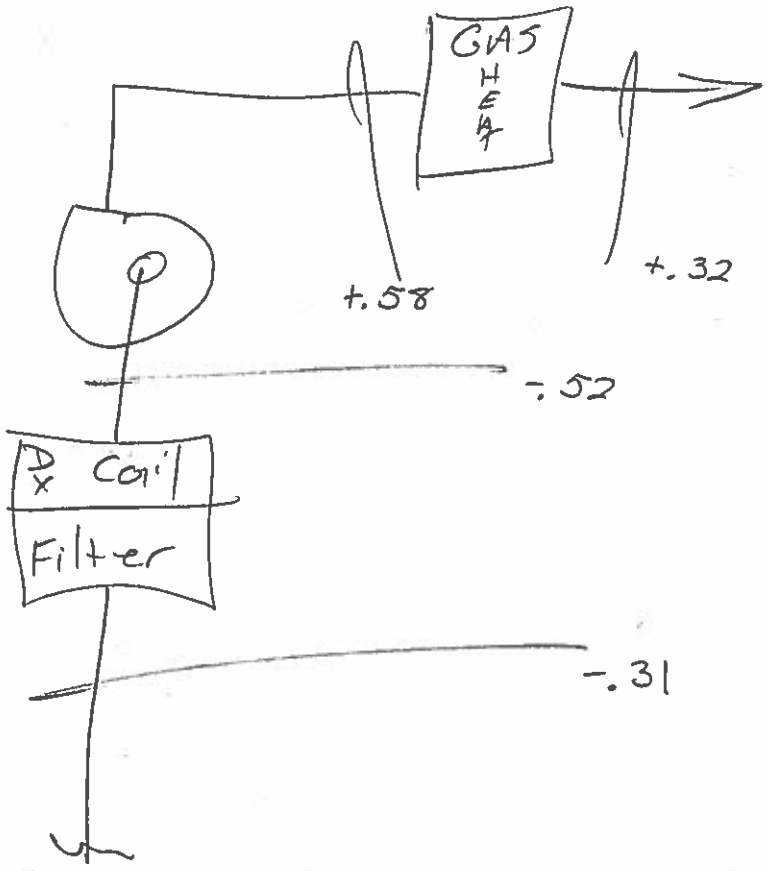
UNIT IDENTIFICATION	
Location	MEZZ
Area Served	LOBBY - TOILETS - CONCESSION
Manufacturer	TRANE
Model Number	TWE180B400EL
Serial Number	4314LN5HD
Motor HP	3.0
Motor Voltage	460
Motor Phase	3
Motor Amperage	4.6
Motor Service Factor	1.15
Motor RPM	1725

MEASUREMENTS	DESIGN	ACTUAL
Total Fan CFM	6000	6401
Total Outlet CFM	6000	6320
Total Traverse CFM	6000	6401
Return Air CFM	4200	4537
Outside Air CFM	1800	1864
External S.P.	1.2	.63
Total S.P.		1.10
Suction S.P.		-.52
Discharge S.P.		+.58
Motor Voltage #1	460	480
Motor Voltage #2	460	480
Motor Voltage #3	460	480
Motor Amps #1	4.6	3.7
Motor Amps #2	4.6	3.9
Motor Amps #3	4.6	4.0
Motor HP	3.0	2.6
Fan RPM	950	810

ADDITIONAL DATA	
Motor Sheave	AVP60 X 7/8
Fan Sheave	BK105 X 1 7/16
Drive Belt Num/Size	B-62
Center Line Distance	21"
% Sheave Adj. Closed	20%

DIAGRAM

Diagram Information
STATIC PRESSURE SKETCH



Rectangular Duct Traverse Test
AIR HANDLING UNIT-2 OUTSIDE AIR
05/25/2005
JOB #05-067

SUMMARY	
Location	MEZZ
Duct Height inches	16
Duct Width inches	16
Duct Area (square feet)	1.778
Design Velocity in FPM	1011
Actual Average Velocity in FPM	1047
Design CFM	1800
Actual CFM	1864
Duct S.P.	+.08

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TOA	828	1145	1595					
	595	588	1545					
	908	889	1331					

Rectangular Duct Traverse Test
AIR HANDLING UNIT-2 TOTAL SUPPLY
05/25/2005
JOB #05-067

SUMMARY	
Location	MEZZ
Duct Height inches	24
Duct Width inches	34
Duct Area (square feet)	5.67
Design Velocity in FPM	1058
Actual Average Velocity in FPM	1129
Design CFM	6000
Actual CFM	6401
Duct S.P.	+.32

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TS-1	1369	1412	1473	1423	1461	1527		
	1251	1368	1353	1329	1341	1345		
	969	866	848	852	949	1012		
	1127	965	715	797	713	637		

Chesapeake T+B Engineers, Inc.

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Diffuser and Grille Test Sheet
AIR HANDLING UNIT-2 SUPPLY
11/07/2005
JOB #05-067

AIR DISTRIBUTION

Room Number	Otlt #	Size	Type	Design CFM	Actual CFM
101	1	15X15	S-2	450	470
101	2	15X15	S-2	450	490
100	3	4X14	S-1	250	235
100	4	4X14	S-1	250	275
111	5	12X12	S-3	150	145
A-101-A	6	10"	S-5	300	330
A-101-A	7	10"	S-5	300	320
112	8	12X12	S-3	150	160
102	9	4X12	S-1	175	170
102	10	4X12	S-1	175	190
101	11	12X12	S-2	300	330
101	12	12X12	S-2	300	315
102	13	12X12	S-2	300	320
102	14	12X12	S-2	300	330
114	15	12X12	S-3	150	155
114	16	12X12	S-3	150	165
114	17	12X12	S-3	150	165
114	18	12X12	S-3	150	155
120	19	12X12	S-3	300	285
117	20	4X8	S-1	50	55
116	21	4X12	S-1	150	160
A-102-A	22	8"	S-5	200	210
A-102-A	23	8"	S-5	200	210
104	24	4X12	S-1	150	155
104	25	4X12	S-1	150	155
119	26	12X12	S-3	350	370
Total				**6000**	**6320**

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AIR DISTRIBUTION

Room Number	Otlt #	Size	Type	Design CFM	Actual CFM
114	1	22X22	R-2	600	390
117	2	22X22	R-2	200	135
104	3	22X22	R-2	825	520
104	4	22X22	R-2	825	535
104	5	22X22	R-2	825	465
104	6	22X22	R-2	825	520
104	7	22X22	R-2	825	575
104	8	22X22	R-2	825	525
A-102-A	9	12X12	R-1	200	140
A-102-A	10	12X12	R-1	200	145
Total				**6150**	**3950**

[1]RETURN DESIGN CFM PROPORTIONED DOWN 4200 CFM TO ALLOW FOR MINIMUM OUTSIDE AIR.

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UNIT IDENTIFICATION	
Location	MEZZ
Area Served	OFFICES
Manufacturer	TRANE
Model Number	TUX050C936C
Motor HP	.33
Motor Voltage	115
Motor Phase	1
Motor Amperage	5.8
Motor RPM	4-SPEED DIRECT DRIVE

MEASUREMENTS	DESIGN	ACTUAL
Total Fan CFM	945	1040
Total Outlet CFM	1030	1040
Return Air CFM	950	964
Outside Air CFM	80	76
External S.P.	.80	.50
Total S.P.		.55
Suction S.P.		-.36
Discharge S.P.		+.19
Motor Voltage #1	115	120
Motor Amps #1	5.8	4.0
Motor HP	.33	.24
Fan RPM	4SPD DD	MED LOW

Chesapeake T+B Engineers, Inc.

AABC
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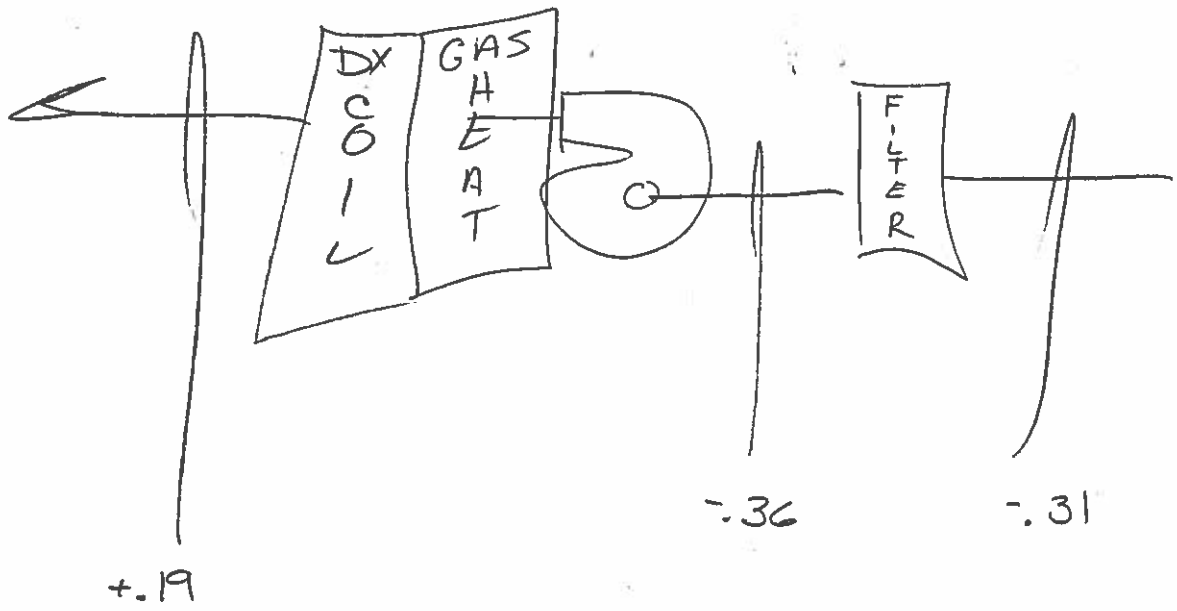
Diagram Sheet
F-1
05/31/2005
JOB #05-067

DIAGRAM

Diagram Information
STATIC PRESSURE SKETCH
BYPASS STATIC PRESSURE SETPOINT .15"



Circular Duct Traverse Test
FURNACE-1 OUTSIDE AIR
05/31/2005
JOB #05-067

SUMMARY	
Location	MEZZ
Duct Diameter inches	6
Duct Area (square feet)	.196
Design Velocity in FPM	400
Actual Average Velocity in FPM	379
Design CFM	80
Actual CFM	76
Duct S.P.	-.18

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TOA	413	402						
	412	404						
	418	407						
	398	398						
	385	367						
	372	400						
	364	368						
	321	390						
	349	358						
	294	350						

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UNIT IDENTIFICATION	
Manufacturer	CARRIER

SUMMARY

Unit Number	Model Number	Inlet Size	Mxm Dsg	Mxm Act	Mnm Dsg	Mnm Act
VVT-1	ZD-8	8"	220	220		
VVT-2	ZD-8	8"	160	150		
VVT-3	ZD-8	8"	160	165		
VVT-4	ZD-10	10"	320	340		
VVT-5	ZD-7	7"	120	110		
	Total		980	985		

AABC
Associated Air Balance Council

UNIT IDENTIFICATION	
BOX NUMBER	VVT-1
Manufacturer	CARRIER
Model Number	ZD-8
Size	8"

MEASUREMENTS	DESIGN	ACTUAL
Maximum CFM	220	220
Velocity Pressure @ Minimum		15%
Velocity Pressure @ Maximum		100%

AIR DISTRIBUTION

Room Number	Ot #	Size	Type	Dsgn Mn	Dsgn Mx	Actl Mn	Actl Mx
106	1	4X14	S-1		220		220
Total					**220**		**220**

AABC
Associated Air Balance Council

UNIT IDENTIFICATION	
BOX NUMBER	VVT-2
Manufacturer	CARRIER
Model Number	ZD-8
Size	8"

MEASUREMENTS	DESIGN	ACTUAL
Maximum CFM	160	150
Velocity Pressure @ Minimum		15%
Velocity Pressure @ Maximum		100%

AIR DISTRIBUTION

Room Number	Ot #	Size	Type	Dsgn Mn	Dsgn Mx	Actl Mn	Actl Mx
107	1	4X12	S-1		160		150
Total					160		150

UNIT IDENTIFICATION	
BOX NUMBER	VV5-3
Manufacturer	CARRIER
Model Number	ZD-8
Size	8"

MEASUREMENTS	DESIGN	ACTUAL
Maximum CFM	160	165
Velocity Pressure @ Minimum		15%
Velocity Pressure @ Maximum		100%

AIR DISTRIBUTION

Room Number	Ot #	Size	Type	Dsgn Mn	Dsgn Mx	Actl Mn	Actl Mx
109	1	4X12	S-1		160		165
Total					160		165

AABC
Associated Air Balance Council

UNIT IDENTIFICATION	
BOX NUMBER	VVT-4
Manufacturer	CARRIER
Model Number	ZD-10
Size	10"

MEASUREMENTS	DESIGN	ACTUAL
Maximum CFM	320	340
Velocity Pressure @ Minimum		15%
Velocity Pressure @ Maximum		100%

AIR DISTRIBUTION

Room Number	Ot #	Size	Type	Dsgn Mn	Dsgn Mx	Actl Mn	Actl Mx
110	1	4X12	S-1		160		170
110	2	4X12	S-1		160		170
Total					**320**		**340**

UNIT IDENTIFICATION	
BOX NUMBER	VVT-5
Manufacturer	CARRIER
Model Number	ZD-7
Size	7"

MEASUREMENTS	DESIGN	ACTUAL
Maximum CFM	120	110
Velocity Pressure @ Minimum		15
Velocity Pressure @ Maximum		100

AIR DISTRIBUTION

Room Number	Ot #	Size	Type	Dsgn Mn	Dsgn Mx	Actl Mn	Actl Mx
108	1	4X12	S-1		120		110
Total					120		110

Chesapeake T+B Engineers, Inc.

AABC
Associated Air Balance Council

Diffuser and Grille Test Sheet
FURNACE-1 SUPPLY
05/26/2005
JOB #05-067

AIR DISTRIBUTION

Room Number	Otlt #	Size	Type	Design CFM	Actual CFM
106	1		VVT1	220	220
107	2		VVT2	160	150
109	3		VVT3	160	165
110	4		VVT4	320	340
108	5		VVT5	120	110
105	1	4X8	S-1	50	55
Total				**1030**	**1040**

AABC
Associated Air Balance Council

AIR DISTRIBUTION

Room Number	Otlt #	Size	Type	Design CFM	Actual CFM
106	1	12X12	R-1	220	205
107	2	9X9	R-1	160	135
108	3	9X9	R-1	120	105
109	4	9X9	R-1	160	80
110	5	12X12	R-1	320	110
Total				**980**	**635**

AABC
Associated Air Balance Council

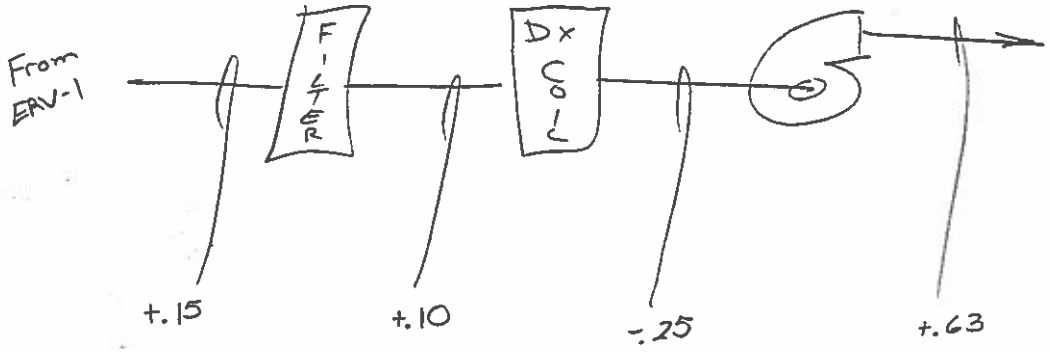
UNIT IDENTIFICATION	
Location	MEZZ
Area Served	AHU-2
Manufacturer	DESERT AIRE
Model Number	IH-500
Serial Number	1205D15173
Motor HP	1.0
Motor Voltage	208
Motor Phase	1
Motor Amperage	6.4
Motor Service Factor	1.15
Motor RPM	1725

MEASUREMENTS	DESIGN	ACTUAL
Total Fan CFM	2300	1874
Total Traverse CFM	1800	1874
Outside Air CFM	1800	1874
External S.P.	.50	.48
Total S.P.		.88
Suction S.P.		-.25
Discharge S.P.		+.63
Motor Voltage #1	208	208
Motor Amps #1	6.4	5.0
Motor HP	1.0	.78
Fan RPM	N/A	790

ADDITIONAL DATA	
Motor Sheave	OD 4" X 5/8
Fan Sheave	AK 74S X 3/4
Drive Belt Num/Size	A-43
Center Line Distance	14"
% Sheave Adj. Closed	0% MINIMUM

DIAGRAM

Diagram Information
STATIC PRESSURE SKETCH



Rectangular Duct Traverse Test
DH-1
05/25/2005
JOB #05-067

SUMMARY	
Location	MEZZ
Duct Height inches	16
Duct Width inches	14
Duct Area (square feet)	1.556
Design Velocity in FPM	1154
Actual Average Velocity in FPM	1201
Design CFM	1800
Actual CFM	1874
Duct S.P.	+.63

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TS-1	531	1743	1773					
	490	894	1731					
	241	1505	1904					

Chesapeake T+B Engineers, Inc.

Air Moving Equipment Test Sheet
ENERGY RECOVERY VENTILATOR-1
05/31/2005
JOB #05-067

AABC
Associated Air Balance Council

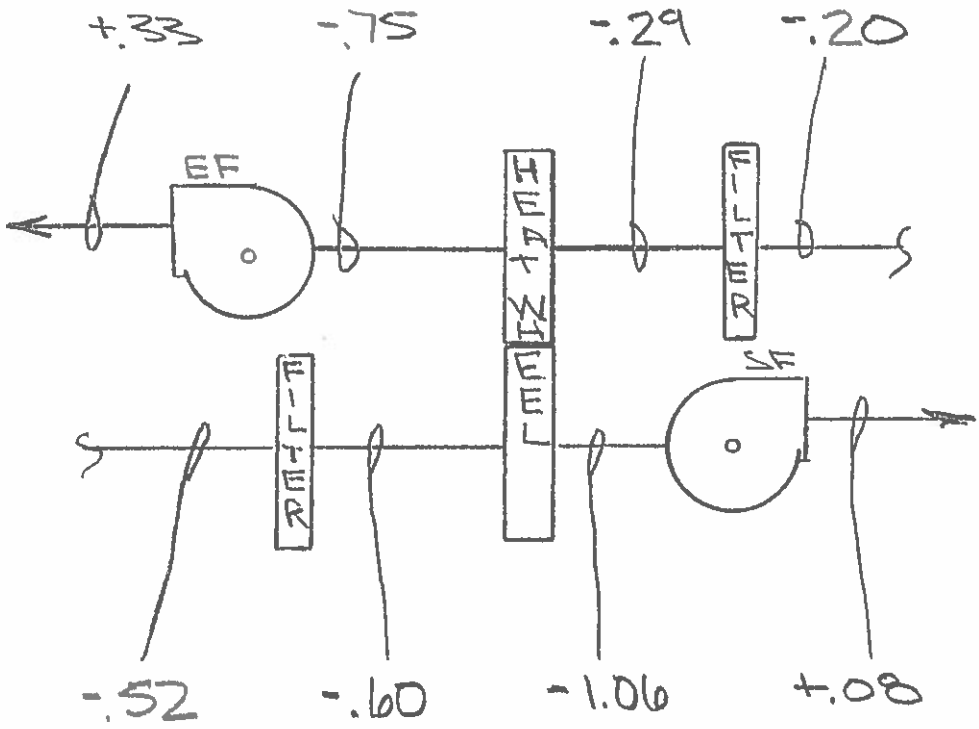
UNIT IDENTIFICATION	
Location	MEZZ.
Area Served	FURNACE-1 AND AHU-2
Manufacturer	GREENHECK
Model Number	ERV-5215-15-A
Serial Number	04L22137
Motor HP	.75
Motor Voltage	208
Motor Phase	1
Motor Amperage	5.5
Motor Service Factor	1.25
Motor RPM	1725

MEASUREMENTS	DESIGN	ACTUAL
Total Fan CFM	1900	1898
Total Outlet CFM	1880	1898
Outside Air CFM	1880	1898
External S.P.	.50	.60
Total S.P.	.605	1.14
Suction S.P.		-1.06
Discharge S.P.		+.08
Motor Voltage #1	208	208
Motor Amps #1	5.5	5.5
Motor HP	.75	.75
Fan RPM	892	870

ADDITIONAL DATA	
Motor Sheave	1VL34 X 5/8
Fan Sheave	AK51X1
Drive Belt Num/Size	AP-44
Center Line Distance	17"
% Sheave Adj. Closed	25%

DIAGRAM

Diagram Information
STATIC PRESSURE SKETCH



AABC
Associated Air Balance Council

SUMMARY	
Location	MEZZ
Duct Height inches	16
Duct Width inches	20
Duct Area (square feet)	2.222
Design Velocity in FPM	847
Actual Average Velocity in FPM	855
Design CFM	1880
Actual CFM	1898
Duct S.P.	-.44

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TOA	859	826	775					
	911	860	908					
	858	879	826					

Fan Test (Exhaust)
ENERGY RECOVERY VENTILATOR-1
05/26/2005
JOB #05-067

UNIT IDENTIFICATION	
Location	MEZZ
Area Served	TOILETS
Manufacturer	GREENHECK
Model Number	ERV-5214-15-A
Motor HP	.75
Motor Voltage	208
Motor Phase	1
Motor Amperage	5.5
Motor Service Factor	1.25
Motor RPM	1725

MEASUREMENTS	DESIGN	ACTUAL
Total CFM	1750	1840
Total Outlet CFM	1950	1680
Total Traverse CFM	1950	1840
Total S.P.	.598	1.08
Suction S.P.		-.75
Discharge S.P.		+.33
Horse Power	.75	.75
Motor Voltage #1	208	208
Motor Amps #1	5.5	5.5
Fan RPM	868	890

ADDITIONAL DATA	
Motor Sheave	1VL34 X 5/8
Fan Sheave	AK54X1
Drive Belt Num/Size	AP-44
Center Line Distance	17"
% Sheave Adj. Closed	75%

AABC
Associated Air Balance Council

SUMMARY	
Location	MEZZ
Duct Height inches	18
Duct Width inches	18
Duct Area (square feet)	2.25
Design Velocity in FPM	867
Actual Average Velocity in FPM	819
Design CFM	1950
Actual CFM	1840
Duct S.P.	+.33

VELOCITIES

Traverse	1	2	3	4	5	6	7	8
TE	844	760	703					
	858	808	774					
	850	932	838					

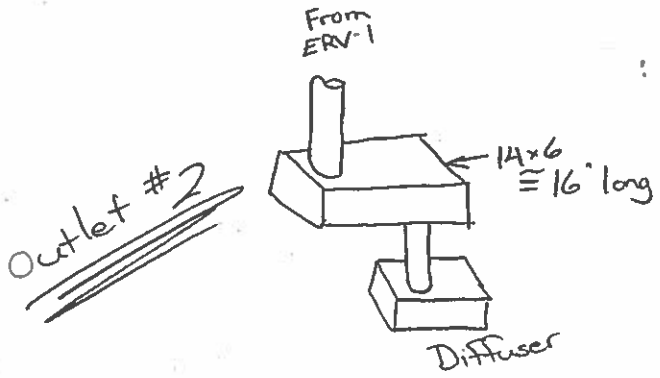
Chesapeake T+B Engineers, Inc.

AABC
Associated Air Balance Council

Diffuser and Grille Test Sheet
ERV-1 EXHAUST
05/26/2005
JOB #05-067

AIR DISTRIBUTION

Room Number	Otlt #	Size	Type	Design CFM	Actual CFM
120	1	15X15	E-1	400	370
119	2	15X15	E-1	400	290
120	3	12X12	E-1	300	275
119	4	12X12	E-1	300	290
111	5	9X9	E-1	100	85
112	6	9X9	E-1	100	90
111	7	9X9	E-1	150	110
112	8	9X9	E-1	150	125
113	9	9X9	E-1	50	45
Total				**1950**	**1680**



Fan Test (Exhaust)
EXHAUST FAN-2
05/11/2005
JOB #05-067

UNIT IDENTIFICATION	
Location	SIDEWALL GYM
Area Served	GYM
Manufacturer	GREENHECK
Model Number	SBE-2H60-30
Motor HP	3.0
Motor Voltage	460
Motor Phase	3
Motor Amperage	4.2
Motor Service Factor	1.15
Motor RPM	1745

MEASUREMENTS	DESIGN	ACTUAL
Total CFM	30000	29850
Total S.P.	.25	.24
Suction S.P.		-.24
Horse Power	3.0	2.2
Motor Voltage #1	460	495
Motor Voltage #2	460	495
Motor Voltage #3	460	495
Motor Amps #1	4.2	2.6
Motor Amps #2	4.2	3.2
Motor Amps #3	4.2	2.9
Fan RPM	411	413

ADDITIONAL DATA	
Motor Sheave	1VP50X1-1/8"
Fan Sheave	AK184H 1-1/2"?
Drive Belt Num/Size	1/AX-66
Center Line Distance	15"
% Sheave Adj. Closed	50%

AABC
Associated Air Balance Council

AIR DISTRIBUTION

Room Number	#	Size	Type	Ak	Dsgn Vlct	Dsgn CFM	Actl Vlct	Actl CFM
GYM INTAKE	1	92X83	MESH	39.8	755	30000	750	29850
Total						**30000**		**29850**

Fan Test (Exhaust)
EXHAUST FAN-3
05/11/2005
JOB #05-067

UNIT IDENTIFICATION	
Location	SIDEWALL GYM
Area Served	GYM
Manufacturer	GREENHECK
Model Number	SBE-2H60-30
Motor HP	3.0
Motor Voltage	460
Motor Phase	3
Motor Amperage	4.2
Motor Service Factor	1.15
Motor RPM	1745

MEASUREMENTS	DESIGN	ACTUAL
Total CFM	30000	29850
Total S.P.	.25	.24
Suction S.P.		-.24
Horse Power	3.0	2.3
Motor Voltage #1	460	495
Motor Voltage #2	460	495
Motor Voltage #3	460	495
Motor Amps #1	4.2	2.8
Motor Amps #2	4.2	3.1
Motor Amps #3	4.2	3.0
Fan RPM	411	411

ADDITIONAL DATA	
Motor Sheave	1VP50X1-1/8"
Fan Sheave	AK184H 1-1/2"?
Drive Belt Num/Size	1/AX-66
Center Line Distance	15"
% Sheave Adj. Closed	50%

AABC
Associated Air Balance Council

AIR DISTRIBUTION

Room Number	#	Size	Type	Ak	Dsgn Vlct	Dsgn CFM	Actl Vlct	Actl CFM
GYM INTAKE	1	92X83	MESH	39.8	755	30000	750	29850
Total						30000		29850

Fan Test (Exhaust)
EXHAUST FAN-4
05/26/2005
JOB #05-067

UNIT IDENTIFICATION	
Location	SIDEWALL
Area Served	MECH ROOM
Manufacturer	GREENHECK
Model Number	SBE-1L20-3
Motor HP	.33
Motor Voltage	115
Motor Phase	1
Motor Amperage	6.1
Motor Service Factor	1.35
Motor RPM	1725

MEASUREMENTS	DESIGN	ACTUAL
Total CFM	3300	3245[1]
Total S.P.	.15	
Horse Power	.33	.32
Motor Voltage #1	115	120
Motor Amps #1	6.1	5.6
Fan RPM	839	825

ADDITIONAL DATA	
Motor Sheave	OD 3" X 1/2
Fan Sheave	AK-59 X 3/4
Drive Belt Num/Size	AP-25
Center Line Distance	7"
% Sheave Adj. Closed	50%

[1]PROP FAN CFM CALCUALTED BY RPM LAW.

SECTION 004100: BID FORM

PART 1 GENERAL

1.1 DESCRIPTION

A. Copy of bid Form is bound herein

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 004100: BID FORM

GENERAL CONSTRUCTION CONTRACT

Date:

PROJECT IDENTIFICATION: WORCESTER CO. RECREATION CENTER HVAC SYSTEM REPLACEMENTS
SNOW HILL, WORCESTER COUNTY, MARYLAND

BID TO: **COUNTY COMMISSIONERS OF WORCESTER COUNTY, MD**

BID FROM: _____
_____
_____

1. The undersigned BIDDER agrees, if this Bid is accepted, to enter into an agreement with OWNER, on the form included in the Bidding Documents, to perform and furnish and Work as specified or indicated in the Bidding Documents, for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

2. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

   a. This Bid will remain subject to acceptance for sixty (60) days after the day of Bid opening;
   b. The Owner has the right to reject this Bid;
   c. BIDDER accepts the provisions of the Instructions and Supplementary Instructions to Bidders regarding disposition of Bid Security;
   d. BIDDER will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of OWNER'S Notice of Award;
   e. BIDDER has examined copies of all the Bidding Documents;
   f. BIDDER has visited the site and become familiar with the general, local, and site conditions;
   g. BIDDER is familiar with federal, state, and local laws and regulations;
   h. BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Bidding Documents and additional examinations, investigations, explorations, tests, studies, and data with the Bidding documents;
   i. The Bid is genuine and not made in the interest of or on behalf of an undisclosed person, firm, or corporation and is not submitted in conformity with an agreement or rules of a group, association, organization, or corporation. BIDDER has not directly or indirectly induced or solicited another Bidder to submit a false or sham Bid: BIDDER has not solicited or induced a person, firm, or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself an advantage over another BIDDER or over OWNER.

j. BIDDER has received the following Addenda receipt of which is hereby acknowledged:
Addendum No. _____ Dated _____ Addendum No. _____ Dated
Addendum No. _____ Dated _____ Addendum No. _____ Dated
Addendum No. _____ Dated _____ Addendum No. _____ Dated

3. The amount of stated allowances ($10,000.00) shall be included in the Bidder's stated stipulated lump sum bid price.

4. Delivery Time: BIDDER will indicate in weeks the delivery time from an approved submittal for HVAC Units: _____weeks."

5. BIDDER will complete the Work in accordance with the Contract Documents for the following price(s):
STIPULATED-SUM BID PRICE (also known as Base Bid) _____
_____ ($_____) (use words)
(figures)

The Bidder proposes the following Alternate prices for modifications of the work covered by the Base Bid and as set forth in the Bid Documents (General Requirements, Division 01, Section 012300 Alternates). Each Alternate may be accepted or rejected at the time of Award of Contract (use words and figures).

ALTERNATES

Alternate No. 1: ATC System by Modern Controls

Add _____ Dollars ($ _____)
(in words) (in numerals)

Alternate No. 2: Electrical Gear by Square D Company

Add _____ Dollars ($ _____)
(in words) (in numerals)

Alternate No. 3: Additional 1 Year Labor/Material Warranty

Add _____ Dollars ($ _____)
(in words) (in numerals)

6. BIDDER agrees that the Work will be substantially complete and ready for final payment in accordance with the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

7. The Owner shall retain the sum indicated in the General Conditions under Liquidated Damages for each calendar day in excess of the completion date set forth in the Contract Documents as liquidated damages and not as a penalty.

8. The following documents are attached to and made a condition of this Bid:

(a) AIA A-310 Bid Bond
(b) AIA A-305 Contractors Qualification Statement, if requested by Engineer

(c) 004350 Subcontractor's/Manufacturer's Listing Form
(d) 004500 Affidavit of Qualification to Bid
(e) 004600 Affidavit I Non-Collusion Certificate
(f) 004700 Affidavit II Disclosure of Interest by Persons Doing Business with COUNTY COMMISSIONERS OF WORCESTER COUNTY

_____ , being first duly sworn deposes and says that he is an officer in the building construction organization known as _____ , and the party making a certain proposal or bid dated _____ , 20___, to COUNTY COMMISSIONERS OF WORCESTER COUNTY and that this bid is genuine and not collusive or sham; that said bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person to put in sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person to fix the bid prices or the affidavit or any other bidder, or to fix any overhead, profit or cost element of said bid price, or that of any bidder, or to secure any advantage against the owner or any other person interested in the proposed contract; and that all statements is said proposal or bid are true.

Signature of:

x
Bidder if the bidder is an individual

x
Partner if the bidder is a partnership

x
Officer if the bidder is a corporation

Registered Maryland Contractor No.

Subscribed and sworn before me this _____ day of _____, 20__.

x
Notary Public

My commission expires: _____ , _____ .

END OF SECTION

SECTION 004350: SUBCONTRACTOR'S/MANUFACTURER'S LISTING FORM

PART 1 GENERAL

1.1 DESCRIPTION

A. Copy of Subcontractor's/Manufacturer's Listing Form is bound herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 004350: SUBCONTRACTOR'S/MANUFACTURER'S LISTING FORM

If awarded this contract, we, _____ , (name of bidder) will award subcontracts to the following subcontractors. Where we intend to perform the work with our own forces, our name is listed as subcontractor. This form is to be submitted to the same location as the bid, and at the same time as the bid.

Concrete	Name: _____
	Address: _____
Testing/Balancing	Name: _____
	Address: _____
Mechanical	Name: _____
	Address: _____
Electrical	Name: _____
	Address: _____
Mechanical Insulation Contractor	Name: _____
	Address: _____
HVAC Unit Manufacturer	Name: _____
	Address: _____
Base Bid ATC Subcontractor	Name: _____
	Address: _____
Base Bid Electrical Gear Manufacturer	Name: _____
	Address: _____

(date) Firm Name

Signature

END OF SECTION

SECTION 004900: BIDDING ADDENDA FORMAT

PART 1 GENERAL

1.1 DESCRIPTION

A. Description of Addenda formatting.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

SECTION 004900 - BIDDING ADDENDA FORMAT

Addenda where necessary, will be issued electronically by Gipe Associates, Inc. Contractors who have left a deposit for Drawings and Specification will be contacted to inform them an Addenda is being issued.

Addenda format will be as follows:

SPECIFICATIONS

Section No.	Section Name
Page No.	Article, paragraph, Subparagraph
Action:	Text

DRAWINGS

Drawing No.	Detail No.
Action:	Text

SPECIFICATION ACTION DEFINITIONS

REVISED:	Change a small portion of a particular paragraph, the change portion will be shown in *Italics.*
ADD:	Add a section, article, paragraph, or subparagraph to the Project Manual. This does not delete any existing information.
DELETE:	Remove a section, article, paragraph or subparagraph from the Project Manual.
SUBSTITUTE:	Delete the existing section, article, paragraph or subparagraph and substitute in its place the Addenda information.
CLARIFY:	If there is some ambiguity or confusion regarding a section, article, paragraph or subparagraph it would be clarified here.

DRAWING ACTION DEFINITIONS

REVISED:	Change a dimension, notes or similar small modifications to an existing drawing or detail.
ADD:	Add a note, detail or drawing to an existing drawing.
DELETE:	Remove a note, detail or drawing from the Contract Documents.
SUBSTITUTE:	Delete the existing detail or drawing and replace it with the new drawing or detail provided in the Addendum.
CLARIFY:	This will be used to give a written clarification of the drawing information

END OF SECTION

SECTION 005000: STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

PART 1 GENERAL

1.1 DESCRIPTION

A. Copy of Standard Form of Agreement Between Owner and Contractor - 2017 edition is bound herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

AIA® Document A101® – 2017

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

AGREEMENT made as of the _____ day of _____ in the year _____
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

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

The Architect:
(Name, legal status, address and other information)

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

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement.

AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Sample

The Owner and Contractor agree as follows.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

☐ The date of this Agreement.

☐ A date set forth in a notice to proceed issued by the Owner.

☐ Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

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

§ 3.3 Substantial Completion

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

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

Sample

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☐ By the following date:

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

Portion of Work	Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 Alternates

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

Item	Price

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

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

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

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

Sample

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

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

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

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

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

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

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

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

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

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

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Sample

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§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

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

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

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

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

_____ % _____

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

Sample

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§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

☐ Arbitration pursuant to Section 15.4 of AIA Document A201–2017

☐ Litigation in a court of competent jurisdiction

☐ Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

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

Sample

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§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

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

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

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☐ The Sustainability Plan:

Title	Date	Pages

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	CONTRACTOR *(Signature)*
(Printed name and title)	*(Printed name and title)*

Sample

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SECTION 005600: CONTRACTOR'S QUALIFICATION STATEMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. Copy of Contractor's Qualification Statement AIA Document A305 - 2020 edition is bound herein.

B. This Document shall be completed and submitted only if requested in writing by the Engineer.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

AIA® Document A305™ – 2020

Contractor's Qualification Statement

THE PARTIES SHOULD EXECUTE A SEPARATE CONFIDENTIALITY AGREEMENT IF THEY INTEND FOR ANY OF THE INFORMATION IN THIS A305-2020 TO BE HELD CONFIDENTIAL.

SUBMITTED BY:
(Organization name and address.)

SUBMITTED TO:
(Organization name and address.)

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

TYPE OF WORK TYPICALLY PERFORMED
(Indicate the type of work your organization typically performs, such as general contracting, construction manager as constructor services, HVAC contracting, electrical contracting, plumbing contracting, or other.)

THIS CONTRACTOR'S QUALIFICATION STATEMENT INCLUDES THE FOLLOWING:
(Check all that apply.)

- ☐ Exhibit A – General Information
- ☐ Exhibit B – Financial and Performance Information
- ☐ Exhibit C – Project-Specific Information
- ☐ Exhibit D – Past Project Experience
- ☐ Exhibit E – Past Project Experience (Continued)

CONTRACTOR CERTIFICATION
The undersigned certifies under oath that the information provided in this Contractor's Qualification Statement is true and sufficiently complete so as not to be misleading.

_____ _____
Organization's Authorized Representative Signature Date

_____
Printed Name and Title

NOTARY
State of:
County of:
Signed and sworn to before me this day of

_____
Notary Signature

My commission expires:

Sample

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SECTION 007000: GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

PART 1 GENERAL

1.1 DESCRIPTION

A. The General Conditions of this contract are the "General Conditions of the Contract for Construction", AIA Document A201, 2017 Edition, as modified.

B. A copy of AIA Document A201-2017 edition as modified by the Supplementary General Conditions is bound herein.

C. The General Conditions of the contract, as modified apply with equal force to General Contractor, all subcontractors, suppliers and tradesmen for the performance of work, extra work, and/or services under this contract and apply to each section in the specifications.

D. Refer to Section 008000 for Supplementary General Conditions.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

DRAFT

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

«Worcester Co. Recreation Center – HVAC System Replacements»
«5022 Joyner Road, Snow Hill, Maryland »

THE OWNER:
(Name, legal status and address)

«County Commissioners of Worcester County, Maryland.»
«Worcester County Government Center
1 West Market Street
Snow Hill, Maryland, 21863»

THE ARCHITECT:
(Name, legal status and address)

«Gipe Associates, Inc.»
«8719 Brooks Drive
Easton, Maryland, 21601»

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

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

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

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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

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

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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

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

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

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

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

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§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

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delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon

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the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

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§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

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

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

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

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

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

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

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

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

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

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

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

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

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

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

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

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

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

§ 9.5 Decisions to Withhold Certification

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

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

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

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

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

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

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

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

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

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

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

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

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

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promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

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or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

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

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public

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authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

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

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

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

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 Suspension by the Owner for Convenience

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

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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

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§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SECTION 008000: SUPPLEMENTARY GENERAL CONDITIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Copy of the Supplementary General Conditions is bound herein.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 008000: SUPPLEMENTARY GENERAL CONDITIONS

The following supplementary conditions modify "General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition. When a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

Add the following to the end of subparagraph 1.1.1:

"The Contract Documents executed in accordance with subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulable electronic operations involving computers." The Contract Documents include those listed in AIA document, A101-2017.

Add the following to the General Conditions Basic Definitions:

1.1.9 The words - 'as directed,' 'as permitted,' 'as required,' or words of like effect, shall mean that the direction, permission or requirement of the Engineer is intended; and similarly, the words 'approved,' 'acceptable,' 'satisfactory,' or words of like import, shall mean approved by, or acceptable or satisfactory to the Engineer unless otherwise provided herein. The words 'necessary', 'suitable', 'equal', or words of the like import, shall mean necessary or equal in the opinion of the Engineer.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1 In the first sentence, delete “the intent of the” before the words “Contract Documents” and delete “is to” after the words “Contract Documents”. At the end of the last sentence in last line delete "indicated" and insert "intended".

This paragraph shall read as follows:

1.2.1 “Contract Documents include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.”

Add the following subparagraphs:

1.2.4 "Whenever a material, article or piece of equipment is referred to in the singular number in the Contract Documents, it shall be the same as referring to it in the plural. As manufactured, such materials, articles, or pieces of equipment shall be provided as required to complete the Work."

1.2.5 "Should the Drawings, Specifications or schedules disagree in themselves or with either or both of the others, the better quality or greater quantity of work or materials shall be estimated upon and unless otherwise directed in writing by the Engineer shall be performed and provided."

1.2.6 "In case of disagreement, discrepancies or contradiction between any parts of the Contract Documents or within any part of the Contract Documents, only the Engineer may interpret the intent and requirements of the Documents and decision shall be final and no additional cost will be allowed in the account if the matter is brought to the Engineer attention after 7 days prior to the receipt of the Bids, the matter will be clarified by Bulletin Addenda."

1.2.7 "Where documents duplicate the same Work or materials under more than one contract or subcontract, such duplication shall be settled by the Engineer in writing upon request of a Contractor concerned BEFORE proposals are submitted. Any such duplications which may exist in Documents after proposals are submitted will be interpreted by the Engineer as having duplicate values in the several contract or subcontracts and proper credit to the Owner, therefore shall be made by the Contractors as the Engineer shall designate."

1.2.8 "Where reference is made to a text, standard, federal specification, manufacturer's directions, or to other publication, the latest publication published prior to the date of issuance of the Drawings shall apply, unless identified in the specification by a specific publication date."

1.2.9 "Locations, sizes, and depth of existing services (i.e., manholes, utilities, etc.) as indicated are based on records made available by the utility companies and field surveys and/or the authorities having jurisdiction. Under the work of each applicable section, examine the premises and verify visible, existing conditions prior to proposal submission and the starting of work."

1.2.10 "Drawing indication of items are generally diagrammatic. Connection and anchorage of materials, interconnection of equipment and accessories necessary to any system operation not otherwise detailed or specified shall be selected under the work of each section, subject to Engineer's approval, to suit the requirements of the items."

1.2.11 "Adhere to dimensions which may differ from scale measurements. In the absence of dimensions, or in case of doubt as to the proper measurement, consult the Engineer. Actual field dimensions where applicable shall be verified in the field prior to proceeding."

1.2.12 "Wherever in the Specifications there appears a reference to a "contractor" or the "Subcontractor", or a reference to a Contractor, installer or supplier of a particular trade, or for a particular type of Work, such reference, regardless of the language thereof, shall be deemed a reference to the Contractor. It shall not be construed as relieving the Contractor from the duty to perform all of the Work and other obligations provided for under this Contract."

1.2.13 "Sections of Division 01 - General Requirements" govern by execution of the work all sections of the specifications.

1.8 BUILDING INFORMATION MODELS USE AND RELIANCE

Delete this entire paragraph 1.8.

ARTICLE 2 – OWNER

2.2 EVIDENCE OF THE OWNER'S FINANCIAL ARRANGEMENTS

Delete paragraphs 2.2.1, 2.2.2, 2.2.3, and 2.2.4.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.3.3 Delete the following:

"to whom the Contractor has no reasonable objection and".

Add the following after subparagraph 2.3.4:

"The Contractor shall verify the location of all utilities before starting work, which shall include contacting "Miss Utility of Delmarva" and local utility companies, 1-800-441-8355."

Delete subparagraph 2.3.6 and substitute the following:

2.3.6 The Contractor will be furnished, free of charge three (3) copies of Contract Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage, and handling.

ARTICLE 3 – CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.2 Add the word "Owner/" in front of the word "Architect" at all locations.

3.5 WARRANTY

Add the following:

3.5.3 The warranty provided in paragraph 3.5 shall be concurrent with and not limited of any other warranty required by the Contract Documents. The Contractor shall repair or replace those products found not to be in compliance with the warranty terms during the period of two (2) years after the date of substantial completion.

3.6 TAXES

3.6.1 Add the following: "The County Commissioners of Worcester County shall be, for bidding purposes, considered <u>not</u> tax exempt. Sales tax shall be included in the bid."

3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

Add the following:

3.7.1.4 "The Owner shall secure and pay for the building permit. The Contractor shall secure and pay for all other permits including but not limited to, HVAC, electrical, and plumbing permits. Costs of all permits shall be included in the Base Bid."

3.9 SUPERINTENDENT

After subparagraph 3.9.3 add the following:

3.9.4 "The Superintendent shall be satisfactory to the Engineer and Owner and upon request shall furnish them within seven (7) days his/her qualifications to supervise the project. The Superintendent shall not be changed except with the consent of the Owner, unless he proves to be unsatisfactory to the contractor and ceases to be in his employment."

3.13 USE OF SITE

Add the following:

3.13.1 The Contractor shall coordinate work of the project with the Owner to allow continuous use of the building and site during the construction period. Final scheduling plans to be developed by the Contractor, are subject to approval by the Engineer/Owner. The Recreation Center shall be closed and available for the Contractor to replace the HVAC units from September 8, 2026 to November 6, 2026.

3.13.2 The Contractor shall be responsible for the security of all parts of the work not accepted by the Owner, until such time as the Owner accepts said parts of the work.

3.15 CLEANING UP

Add the following to subparagraph 3.15.1:

3.15.1 The Contractor shall, on a daily basis, police and clean the site and surrounding areas of the project of his materials, rubbish, tools, construction equipment, machinery or any materials to be stored thereon, either temporarily or permanently.

3.17 ROYALTIES, PATENTS, AND COPYRIGHTS

Replace 3.17 with the following: “The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof.

ARTICLE 7 - CHANGES IN THE WORK

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.4 In the first sentence, delete the words "reasonable expenditures and savings" and substitute "an allowance for overhead and profit in accordance with subparagraph 7.3.11".

Add the following subparagraph 7.3.11:

7.3.11 "In subparagraph 7.3.11.1, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

1. For the Contractor, for Work performed by the Contractor's own forces, the combined overhead and profit shall be based on the following schedule:

Value of Work	Combined Overhead & Profit
$ 0 - $ 1,000	15 percent
$ 1,001 - $ 5,000	15 percent
$ 5,001 - $10,000	15 percent
$10,001 - $25,000	12 percent

2. For the Contractor, for Work performed by the Contractor's Subcontractor, the overhead and profit allowance shall be 8 (eight) percent of the amount due the Subcontractor.

3. For each Subcontractor involved, for Work performed by that Subcontractor's own forces, the combined overhead and profit allowance shall be based on the same schedule indicated in 7.3.11.1

4. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.11.

5. In order to facilitate checking quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs, including labor, materials and Subcontractors. Labor and materials shall be itemized in the manner described above. Where major cost items are Subcontractors, they shall be itemized also. In no case will a change be approved without such itemization."

6. When preparing a Construction Change Directive, please use AIA G714 Construction Change Directive (Form AIA G714 is enclosed at end of Division 01, Section *Contract Modification Procedures*).

ARTICLE 8 - TIME

8.2 PROGRESS AND COMPLETION

Add the following Subparagraph after 8.2.3

8.2.4 "Should the progress of the Work be delayed by fault, neglect, act, or omission of the Contractor or by person or firm employed by him, the Contractor shall, at his own cost and expense, work such overtime as may be necessary to make up for time lost and to avoid delay in completion of the Work. If, in the opinion of the Engineer and Owner, the progress of the Work is unsatisfactory, overtime Work will be demanded and the Contractor shall institute overtime Work to meet the Construction Schedule at no additional cost to the Owner."

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 Delete the following:
"(4) by delay authorized by the Owner pending mediation and binding dispute resolution".

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following subparagraph to 9.2

9.2.1 "The Contractor's Schedule of Values data shall be submitted within fourteen (14) days after the award of Contract."

9.3 APPLICATIONS FOR PAYMENT

After subparagraph 9.3.3., add the following:

9.3.4 "On or about the thirtieth (30th) day after receipt of the Contractor's monthly request for payment from the Engineer, the Owner shall make payment on account of the contract as follows: Ninety-five (95%) of the value of the work completed up to the first (1st) day of that month, based upon the Contractor's estimate of labor and materials or equipment delivered and suitably stored at the site thereof up to the first (1st) day of that month, as approved by the Project Engineer and the Owner's Representative less the aggregate of any previous payments."

9.3.5 "Each request for payment shall be prepared on AIA Documents G702 and G703, 1992 edition, by the Contractor (copy enclosed). Present the original and three (3) copies (total of four) for joint review and action by the Engineer. The Engineer will deliver the original and two (2) copies to the Owner for processing. Owner will process payment upon approval by OWNER/APPROVAL AGENCY. Contractor to allow up to thirty (30) days after the COUNTY COMMISSIONERS OF WORCESTER COUNTY approval for issuance of payment." (A copy of G702 and G703 are enclosed at the end of Division 01, Section *Payment Procedures*.)

9.3.6 "At the time the General contractor is preparing each monthly requisition, it will be required that, upon completion of his rough pencil draft covering payment request, and prior to preparation the final draft, the rough draft will be reviewed by the Engineer and the General Contractor. Agreement shall be reached among these prior to the final draft of the requisition being forwarded to the Engineer for subsequent transmittal to the Owner for payment. It shall carry the notarized signature of the General Contractor and the Signature of the Engineer. Notarization is required by a notary public commissioned in the State of Maryland."

9.3.7 "When the "Application for Payment" includes material or equipment stored off-site, the application shall be accompanied with a certified statement including:

a) Description of item.
b) Bills of sale.
c) Location of storage and security thereof.
d) Indication that the item is currently covered by all contractual requirements, including Liability and Fire Insurance made out in the name of the Owner.
e) Indication that the material or equipment or any part thereof will not be installed in any other project construction other than work under this contract.
f) All items must be clearly marked, labeled or tagged for identification.
g) Available to the Owner and Engineer for inspection."

9.3.8 "When the "Application for Payment" includes materials or equipment delivered and suitably stored at the site but not incorporated in the work, the Engineer may require the Contractor to submit bills of sale to establish the Owner's title to such material and adequately protect the Owner's interest. Payments for stored materials should not exceed seventy-five (75%) percent of actual value."

9.3.9 "All requisitions shall have Contractor's Certification on the Application for Payment form modified to read, "I certify that the above is a true statement of the status of the work and of the accounts; that work and material conform with the Contract and duly authorized charges; that all just and lawful bills against the undersigned and his Subcontractors for labor, materials and equipment required by the Contract have been paid in full through prior certificates." This certification is required to be duly notarized."

9.3.10 "When the Engineer and Owner agree that the project is substantially complete, is on schedule and it appears that there are not complicating problems in completing the job, the retainage may be reduced to three percent (3%) at the Owner's discretion."

9.3.11 "The Owner will require a release of liens from each Subcontractor and supplier covering work for which each progress payment is made."

9.3.13 "Upon request, when the Engineer and Owner agree that the building is ready for final inspection (preparation of the final punch list), and at the Owner's discretion, retainage may be further reduced or adjusted to the value of the remaining work, whichever is greater, if the project retainage has not already been reduced."

9.7 FAILURE OF PAYMENT

Delete the following after the word "Architect" in the first sentence: "or awarded by binding dispute resolution"

9.10 FINAL COMPLETION AND FINAL PAYMENT

Delete paragraph 9.10.4 in its entirety.

After paragraph 9.10.5, add the following:

9.10.6 "The final payment to the Contractor does not become due until all requirements covered under Division 01, Project Closeout, have been certified by the Architect."

9.10.7 "Release of liens shall be required of the Contractor, each Subcontractor and each material supplier prior to the final payment of any part of the retained percentage becoming due. Execute and forward with all releases of liens on the "Contractor's Affidavit of Release of Liens and Payment of Debts and Claims, AIA Form G-706, in duplicate. Forward with release of liens, two copies of AIA Form G-707, "Consent of Surety Company to Final Payment' properly executed and attested." (Forms AIA Form G-706 and G-707 are enclosed at the end of Division 01, Section *Payment Procedures*.)

9.10.8 "The Contractor's guarantee responsibility period commences upon the date of issuance of the Engineer's Certificate of Substantial Completion."

9.10.9 "The Owner shall deduct from the General Contractor's contract all hourly billings made by the Engineer for services required after the date of Substantial Completion to Determine Final Completion other than for two on-site punch list reviews."

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

Add the following to subparagraph 10.2.6:

"This person, or approved alternate person, shall be on-site at all times while personnel for whom they are responsible are on-site. This person will be fully responsible for implementing and enforcing a program amongst his company's employees, that ensure their safety and the safety of other affected by their work, and that is in full compliance with the governing agencies including the Occupational Safety and Health Administration."

ARTICLE 11 -INSURANCE AND BONDS

After paragraph 11.1.3 add the following:

11.1.3.1 The Contractor shall obtain and continue in force, during the term of the contract, all insurance specified below. Each insurance policy shall not be canceled or changed without sixty (60) days' prior written notice by registered mail, given by the insurance carrier to County Commissioners of Worcester County. The Contractor

shall deposit with County Commissioners of Worcester County certificates evidencing the insurance it is to provide as follows:

.1 Contractor's Contractual Liability Insurance, Minimum coverage to be:

Bodily Injury	$ 500,000	for each person
	$1,000,000	for each occurrence
	$1,000,000	aggregate
Property Damage	$ 500,000	for each occurrence
	$1,000,000	aggregate

.2 Contractor's Protective Liability Insurance, Minimum coverage to be:

Bodily Injury	$ 500,000	for each person
	$1,000,000	for each occurrence
	$1,000,000	aggregate
Property Damage	$ 500,000	for each occurrence
	$ 500,000	aggregate

.3 Automotive Liability Insurance, Minimum coverage to be:

Bodily Injury	$1,000,000	for each person
	$1,000,000	for each occurrence
Property Damage	$ 500,000	per accident

.4 Builder's Risk Insurance for the value of the project.

.5 Additional insurance as described in Specifications Section 260503 "PCB Removal".

11.1.3.2 The Contractor shall cause the aforesaid insurance policies to be duly and properly endorsed by insurance underwriters as follows:

.1 To provide that County Commissioners of Worcester County is endorsed as an additional insured to the Contractor on liability coverage for work performed by the Contractor.

.2 To provide that said insurance shall be primary in all instances with respect to work performed by the Contractor for County Commissioners of Worcester County.

.3 To provide contractual liability coverage for liability assumed under the terms of the contract.

.4 To provide sixty (60) days' prior written notice of cancellation or change in coverage.

11.2 OWNERS INSURANCE

11.2.1 Paragraph 11.2.1 shall read as follows:

"The Owner shall be responsible for maintaining the Owner's usual liability insurance."

Delete paragraphs 11.2.2 and 11.2.3.

11.3 WAIVERS OF SUBROGATION

Delete paragraphs 11.3.1 and 11.3.2.

11.4 LOSS OF USE, BUSINESS INTERRUPTION, AND DELAY IN COMPLETION INSURANCE

Delete paragraph 11.4.

11.5 ADJUSTMENT AND SETTLEMENT OF INSURED LOSS

Delete paragraph 11.5.2.

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Delete the last sentence in paragraph 13.1.

ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1.4 shall read as follows:

.4 "otherwise is breach of a provision of the Contract Documents."

ARTICLE 15 - CLAIMS AND DISPUTES

15.1.2 Time Limits on Claims
Modify paragraph 15.1.2 to read as follows:

"The Owner and Contractor shall commence all claims and causes of action against one another and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the period specified by applicable law."

15.1.6 Claims for Additional Time
At the end of subparagraph 15.1.6.2 add the following:

"In no case shall any weather claims for contract time extension be honored and neither shall they be construed to add changes for Contractor's overhead

and project administration. Approved contract time extension for weather, based upon National Weather Service data for extreme weather beyond a five (5) year normal, will be acknowledged and may be accounted for in reducing liquidated damages only."

15.1.7.1 Waivers of claims for consequential damages
Delete the word “rental expenses”.

15.2 INITIAL DECISION

15.2.1 shall be modified to read as follows:

15.2.1 “Claims, excluding those where the condition giving arise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.”

15.2.5 Delete the last sentence.

Delete paragraphs 15.2.6.1 and 15.2.7.

15.3 MEDIATION

Delete Article 15.3 MEDIATION in its entirety.

15.4 ARBITRATION

Delete Article 15.4 ARBITRATION in its entirely.

Add the following ARTICLE 16 - LIQUIDATED DAMAGES:

ARTICLE 16 - LIQUIDATED DAMAGES

16.1 "It is expressly understood and agreed by and between the Contractor and the Owner that the Contract time stipulated in the bid form is a reasonable time for completion of the work, taking into consideration the average climatic range and the usual conditions prevailing in the locality of the project. Time is an essential element of the contract and it is important that the work be vigorously prosecuted and conform to the scheduled start and finish dates of the Construction Documents."

16.2 "The Contractor agrees that he can and will substantially complete the total projects work in accordance with the Contract Documents within the stated Contract Time."

16.3 "The Owner and Contractor agree that due to the uniqueness of this contract and the fact that the Owner is a private agency and the relevant factors, damages resulting from failure of the Contractor to perform the contract within the time specified therefore will result in damages to the Owner which shall be difficult, if not impossible, to ascertain; therefore, the provision

for damages herein specified shall be applied in the event of such a default. The Owner and the Contractor, both of whom are, by their own admissions, sophisticated business entities with prior experience in dealing with construction contracts, stipulate that damages shall be the sum indicated in the Worcester County Requirements based on the value of the work for each day that the work shall remain uncompleted beyond the time(s) specified elsewhere in the contract, provided, however, that due account shall be taken of any adjustment of specified completion time(s) for completion of work as granted by approved change orders."

16.4 "The Contractor, by the execution of the contract document, does hereby irrevocably constitute, designate and appoint the Owner to be his agent for the limited but express purpose of deducting on a daily basis the liquidated damages as above determined from the balance of the contract funds in the hands of the Owner and due to the Contractor, and the failure of the Owner to deduct such sum for any day or any combination of days, whether consecutive or not, shall not operates as a waiver of such liquidated damages for that period, and such damages for such day or days shall be cumulative and may be subsequently deducted by the Owner from such sums as may be due the Contractor, but work performed. In the event that the amounts due the Contractor are less than the amount of such damages, the Contractor, shall be liable to the Owner for the difference."

16.5 "The power granted by the Contractor to the Owner above is a power coupled with an interest and is irrevocable."

END OF SECTION

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Performance Bond

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Any singular reference to Contract, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond: ☐ None ☐ See Last Page

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

SURETY
Company: (Corporate Seal)

Signature: _____
Name and Title:
(Any additional signatures appear on the last page)

Signature: _____
Name and Title:

(FOR INFORMATION ONLY - Name, Address and Telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

1 The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1.

3 If there is no Owner Default, the Surety's obligation under this Bond shall arise after:

3.1 The Owner has notified the Contractor and the Surety at its address described in Paragraph 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. If the Owner, the Contractor and the Surety agree, the

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Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; and

3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Subparagraph 3.1; and

3.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the Owner.

4 When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Construction Contract; or

4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; or

4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, tender payment therefor to the Owner; or

.2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

5 If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Subparagraph 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

6 After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Subparagraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:

6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

6.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4; and

6.3 Liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

7 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators or successors.

8 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

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Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.

11 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12 DEFINITIONS

12.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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Payment Bond

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Any singular reference to Contract, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

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OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond: ☐ None ☐ See Last Page

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page)

(FOR INFORMATION ONLY - Name, Address and Telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

1 The Contractor and the Surety, jointly and severally bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference.

2 With respect to the Owner, this obligation shall be null and void if the Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2 Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for the payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

3 With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4 The Surety shall have no obligation to Claimants under this Bond until:

4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2 Claimants who do not have a direct contract with the Contractor:

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.1 Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

.2 Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and

.3 Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

5 If a notice required by Paragraph 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

When the Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7 The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

8 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any Construction Performance Bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

9 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

11 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Subparagraph 4.1 or Clause 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15 DEFINITIONS

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15.1 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature: _____		Signature: _____	
Name and Title:		Name and Title:	
Address:		Address:	

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1.8 WORK RESTRICTIONS
1.9 SPECIFICATION AND DRAWING CONVENTIONS

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.

B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Worcester County Recreation Center HVAC Replacement

1. Project Location: 6030 Public Landing Road, Snow Hill, MD 21863

B. Owner: Worcester County Commissioners, 1 W. Market Street, Snow Hill, MD 21863.
1. Owner's Representative: William Bradshaw, 410-632-1200, bbradshaw@co.worcester.md.us

C. M/E/P Engineer: Gipe Associates, Inc., 8719 Brooks Drive, Easton, MD 21601.
1. Engineer’s Representative: David Hoffman, 410-822-8688; dhoffman@gipe.net

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. The replacement of the multipurpose room HVAC systems, replacement of supporting electrical systems, and supporting work at the Worcester County Recreation Center located in Snow Hill, MD.

B. Type of Contract

1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

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

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the Worcester County Recreation Center.
2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Engineer will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy,

Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:30 p.m., Monday through Friday, except as otherwise indicated.

1. Weekend Hours: (As approved by the Owner)
2. Early Morning Hours: (As approved by the Owner)
3. Hours for Utility Shutdowns: (As approved by the Owner)
4. Hours for Core Drilling and Other noisy activity: (As approved by the Owner)
5. Lifting, crane operations, and overhead work shall not occur while staff are in the facility.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than seven (7) days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

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

1. Notify Owner not less than seven (7) days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.

F. Controlled Substances: Use of tobacco products and other controlled substances within the existing building and on the Project site is not permitted.

G. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times. Contractor must provide required information to the Owner to allow proper background checks.

H. Employee Screening: Comply with Owner's requirements regarding drug and background screening of Contractor personnel working on the Project site.

1. Maintain list of approved screened personnel with Owner's Representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

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

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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PART 1 GENERAL

1.1 RELATED DOCUMENTS
1.2 USE OF PREMISES
1.3 OCCUPANCY REQUIREMENTS

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

SECTION 011400 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine constructions operations to the jail areas permitted by the Warden.
2. Owner Occupancy: Allow for Owner occupancy of site.
3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

C. Background Checks: All workers who perform work on the site shall be subject to a full background check.

D. COVID-19 Provisions: All workers who perform work on the site shall comply with CDC guidelines related to COVID-19 and all Worcester County Commissioner’s COVID-19 requirements and Worcester County Recreation Center COVID-19 requirements.

E. Provide floor protection in the multipurpose room as indicated on the Contract Drawings.

F. Refer to the Worcester County Requirements for dates when the Recreation Center Areas served by the new HVAC units will be available for demolition of the existing units and installation of the new units.

1.3 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy site during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

DIVISION 01 SECTION 012100
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1.6 LUMP-SUM ALLOWANCES
1.7 CONTINGENCY ALLOWANCES
1.8 ADJUSTMENT OF ALLOWANCES

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION
3.2 PREPARATION
3.3 SCHEDULE OF ALLOWANCES

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Contingency allowances.

C. Related Sections:

1. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
2. Divisions 02 through 28 Sections for items of Work covered by allowances.

D. Include cost of allowance in the base bid.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

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

1.6 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include freight, and delivery to Project site.

B. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Engineer, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Engineer for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of ten thousand dollars ($10,000.00) for use according to Owner's instructions.

END OF SECTION

DIVISION 01 SECTION 012300
ALTERNATES
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1.1 RELATED DOCUMENTS
1.2 SUMMARY
1.3 DEFINITIONS
1.4 PROCEDURES

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

SECTION 012300 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
3. The costs for alternates shall include additional Bonds and Insurance costs as a results of project value increasing if alternate is accepted.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate #1- ATC System by Modern Controls

1. Base Bid: Provide ATC system and integration by any listed ATC vendor/manufacturer as specified in Specification Section 230900 “Instrumentation and Controls of HVAC and Plumbing Systems”.

2. Alternate: Provide additional costs, if any, for ATC system by Modern Controls as specified in Specification Section 230900 “Instrumentation and Controls of HVAC and Plumbing Systems” and integrate/upgrade existing ATC system. If Modern Controls is the low ATC subcontractor, then the alternate value on the bid form shall be listed as zero ($0) dollars.

B. Alternate #2 – Electrical Gear by Square D Company

1. Base Bid: Provide transformers, switchboards, panelboards, enclosed switches, motor controllers per Specification Sections 262200 “Low-Voltage Transformers”, 262413 “Switchboards”, 262416 “Panelboards”, 262816 “Enclosed Switches & Circuit Breakers”, and 262913 “Enclosed Controllers” by any of the listed manufacturers.

2. Alternate: Provide transformers, switchboards, panelboards, enclosed switches, motor controllers per Specification Sections 262200 “Low-Voltage Transformers”, 262413 “Switchboards”, 262416 “Panelboards”, 262816 “Enclosed Switches & Circuit Breakers”, and 262913 “Enclosed Controllers” by Square D Company. If Square D Company is the low cost, the alternate value listed on the Bid Form shall be zero ($0) dollars.

C. Alternate #3 – Additional 1 Year Labor/Material Warranty

1. Base Bid: The base bid labor and material warranty shall be one (1) year.

2. Alternate: Provide additional cost to extend the project labor and material warranty for an additional one (1) year.

END OF SECTION

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SUBSTITUTION PROCEDURES
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1.5 QUALITY ASSURANCE
1.6 PROCEDURES

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

PART 3 EXECUTION (Not Used)

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:

1. Division 01 Section "Allowances" for products selected under an allowance.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
4. Divisions 02 through 28 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of engineers, architects, and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed, unless otherwise indicated.

PART 3 - EXECUTION (Not Used)

END OF SECTION

Advancement of Construction Technology

SUBSTITUTION REQUEST

(After the Bidding Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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September 1996
CSI Form 13.1A

SUBSTITUTION REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

_____

_____

_____

_____

_____

_____

_____

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DIVISION 01 SECTION 012600
CONTRACT MODIFICATION PROCEDURES
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1.7 CONSTRUCTION CHANGE DIRECTIVE

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Engineer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Engineer's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

   1. Proposal Requests issued by Engineer are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.

   2. Within (7) seven days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and additional supervision directly attributable to the change.
      d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. The Proposal Request shall include the Allowable Overhead and Profit Mark-Up scheduled in the General Conditions.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Worcester County Engineer will issue a Change Order for signatures of Owner, Contractor and Engineer.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Engineer may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

ARCHITECT'S SUPPLEMENTAL INSTRUCTIONS

AIA DOCUMENT G710 - ELECTRONIC FORMAT

OWNER	☐
ARCHITECT	☐
CONSULTANT	☐
CONTRACTOR	☐
FIELD	☐
OTHER	☐

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PROJECT:
(Name, address)

ARCHITECT'S SUPPLEMENTAL INSTRUCTION NO:

OWNER:

ARCHITECT:

TO:
(Contractor)

CONTRACT FOR:

ARCHITECT'S PROJECT NO:

CONTRACT DATED:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

Description:

Attachments:
(Here insert listing of documents that support description.)

ISSUED BY:

Architect

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PROPOSAL REQUEST

AIA DOCUMENT G709 - ELECTRONIC FORMAT

OWNER	☐
ARCHITECT	☐
CONSULTANT	☐
CONTRACTOR	☐
FIELD	☐
OTHER	☐

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PROJECT:
(Name and address)

PROPOSAL REQUEST NO.:

DATE OF ISSUANCE:

OWNER:
(Name and address)

CONTRACT FOR:

CONTRACT DATED:

ARCHITECT'S PROJECT NO.:

TO CONTRACTOR:
(Name and address)

ARCHITECT:
(Name and address)

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Submit proposal within days, or notify the Architect in writing of the date on which you anticipate submitting your proposal.

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

Description:
(Insert a written description of the Work.)

Attachments:
(List attached documents that support description.)

REQUESTED BY:

(Signature) *(Printed name and title)*

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AIA® Document G701™ – 2001

Change Order

PROJECT *(Name and address)*:	CHANGE ORDER NUMBER: 001	OWNER: ☐
	DATE:	ARCHITECT: ☐
TO CONTRACTOR *(Name and address)*:	ARCHITECT'S PROJECT NUMBER:	CONTRACTOR: ☐
	CONTRACT DATE:	FIELD: ☐
	CONTRACT FOR: General Construction	OTHER: ☐

THE CONTRACT IS CHANGED AS FOLLOWS:
(Include, where applicable, any undisputed amount attributable to previously executed Construction Change Directives)

The original Contract Sum was	$	0.00
The net change by previously authorized Change Orders	$	0.00
The Contract Sum prior to this Change Order was	$	0.00
The Contract Sum will be increased by this Change Order in the amount of	$	0.00
The new Contract Sum including this Change Order will be	$	0.00

The Contract Time will be increased by Zero (0) days.
The date of Substantial Completion as of the date of this Change Order therefore is

NOTE: This Change Order does not include changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*	CONTRACTOR *(Firm name)*	OWNER *(Firm name)*
ADDRESS	ADDRESS	ADDRESS
BY *(Signature)*	BY *(Signature)*	BY *(Signature)*
(Typed name)	*(Typed name)*	*(Typed name)*
DATE	DATE	DATE

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User Notes: (3604202474)

CONSTRUCTION CHANGE DIRECTIVE

AIA DOCUMENT G714 - ELECTRONIC FORMAT

(This document replaces AIA Document G713, Construction Change Authorization.)

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
FIELD ☐
OTHER ☐

THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES; CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION. AUTHENTICATION OF THIS ELECTRONICALLY DRAFTED AIA DOCUMENT MAY BE MADE BY USING AIA DOCUMENT D401.

PROJECT:
(Name, address)

TO CONTRACTOR:
(Name, address)

DIRECTIVE NO.:

DATE:

ARCHITECT'S PROJECT NO:

CONTRACT DATED:

CONTRACT FOR:

You are hereby directed to make the following change(s) in this Contract:

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
   [ ] Lump Sum (increase) (decrease) of $
   [ ] Unit Price of $ per
   [ ] as provided in Subparagraph 7.3.6 of AIA Document A201, 1987 edition.
   [ ] as follows:

2. The Contract Time is proposed to (be adjusted) (remain unchanged). The proposed adjustment, if any, is (an increase of days) (a decrease of days).

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Signature by the Contractor indicates the Contractor's agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Construction Change Directive.

ARCHITECT	OWNER	CONTRACTOR
Address	Address	Address
BY:	BY:	BY:
DATE:	DATE:	DATE:

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DIVISION 01 SECTION 012900
PAYMENT PROCEDURES
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PART 1 GENERAL

1.1 RELATED DOCUMENTS
1.2 SUMMARY
1.3 DEFINITIONS
1.4 SCHEDULE OF VALUES
1.5 APPLICATIONS FOR PAYMENT

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
4. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of submittal schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with Continuation Sheets.
   b. Submittals Schedule.
   c. Contractor's Construction Schedule.

2. Submit the Schedule of Values to Engineer at earliest possible date but no later than the Work Initiation Conference.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

   a. Project name and location.
   b. Name of Engineer.
   c. Engineer's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets.

3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.

      1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.

10. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

11. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Materials previously stored and included in previous Applications for Payment.
b. Work completed for this Application utilizing previously stored materials.
c. Additional materials stored with this Application.
d. Total materials remaining stored, including materials with this Application.

F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

H. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Submittals Schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.
13. Performance and payment bonds.
14. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion and in accordance with the applicable sections in the College's General Terms and Conditions: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application and in accordance with the applicable sections in the College's General Terms and Conditions: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:** MASTER FORMS	**APPLICATION NO:** 001	**Distribution to:**
		PERIOD TO:	OWNER: ☐
		CONTRACT FOR: General Construction	ARCHITECT: ☐
FROM CONTRACTOR:	**VIA ARCHITECT:**	**CONTRACT DATE:**	CONTRACTOR: ☐
		PROJECT NOS: / /	FIELD: ☐
			OTHER: ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM		$ 0.00
2. Net change by Change Orders		$ 0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)		$ 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)		$ 0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$ 0.00	
b. 0 % of Stored Material (Column F on G703)	$ 0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703)		$ 0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)		$ 0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$ 0.00
8. CURRENT PAYMENT DUE		$ 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$ 0.00	

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$ 0.00	$ 0.00
Total approved this Month	$ 0.00	$ 0.00
TOTALS	$ 0.00	$ 0.00
NET CHANGES by Change Order	$	0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract

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(1737352988)
User Notes:

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT,
containing Contractor's signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD					
	GRAND TOTAL	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	0.00 %	$ 0.00	$ 0.00

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User I

(2131320776)

CONTRACTOR'S AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

AIA DOCUMENT G706 - ELECTRONIC FORMAT

OWNER	☐
ARCHITECT	☐
CONTRACTOR	☐
SURETY	☐
OTHER	☐

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TO OWNER:
(Name and address)

PROJECT:
(Name and address)

ARCHITECT'S PROJECT NO.:

CONTRACT FOR:

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose.

   Indicate attachment: ☐ yes ☐ no

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR:
(Name and address)

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

_____

Notary Public: _____

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CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

AIA DOCUMENT G706A - ELECTRONIC FORMAT

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
SURETY ☐
OTHER ☐

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TO OWNER:
(Name and address)

ARCHITECT'S PROJECT NO.:

PROJECT:
(Name and address)

CONTRACT FOR:

CONTRACT DATED:

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR:
(Name and address)

BY

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

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My Commission Expires: _____

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CONSENT OF SURETY TO FINAL PAYMENT

AIA DOCUMENT G707 - ELECTRONIC FORMAT

OWNER ☐
ARCHITECT ☐
CONTRACTOR ☐
SURETY ☐
OTHER ☐

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TO OWNER:
(Name and address)

ARCHTECT'S PROJECT NO.:

PROJECT:
(Name and address)

CONTRACT FOR:

CONTRACT DATED:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

Attest:

(Signature of authorized representative)

(Seal):

(Printed name and title)

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DIVISION 01 SECTION 013100
PROJECT MANAGEMENT AND COORDINATION
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SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination Drawings.
4. Requests for Information (RFIs).
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:
1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule (Accepted Baseline and Monthly Updates).
2. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services.
3. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 DEFINITIONS

A. RFI: Request from Owner, Engineer, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule (Accepted Baseline and Monthly Updates).
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings,

where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire Protection System: Show the following:

a. Locations of existing and new sprinkler piping, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Engineer determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Engineer will so inform the Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files in accordance with the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as the original Drawings.
2. File Preparation Format: DWG, at least Version 2024, operating in Microsoft Windows operating system.
3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
4. Engineer will furnish Contractor one set of digital data files of the Drawings for use in preparing coordination digital data files.

a. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to the Drawings.
b. Digital Data Software Program: The Drawings are available in AutoCAD Version 2024.
c. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.6 KEY PERSONNEL

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of

individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716.

D. Engineer’s Action: Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.

d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Engineer's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

E. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Engineer.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Engineer's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three days of the meeting.

B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Critical work sequencing and long-lead items.
    c. Designation of key personnel and their duties.
    d. Lines of communications.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Preparation of record documents.
    l. Use of the premises and existing building.
    m. Work restrictions.
    n. Working hours.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Procedures for moisture and mold control.
    r. Procedures for disruptions and shutdowns.
    s. Construction waste management and recycling.
    t. Parking availability.
    u. Office, work, and storage areas.
    v. Equipment deliveries and priorities.
    w. First aid.
    x. Security.
    y. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.

e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Engineer, but no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing sustainable design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.

h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.9 SUBMITTALS

A. Contractor Deliverables:

B. Monthly Progress Report Deliverables: Prepare and submit Monthly Deliverables as described below:
   1. Project Narrative providing executive summary, any schedule deviations, and current issues.
   2. Update Schedule providing status of individual Activity Time and Cost Progress projected to end of month.
   3. Safety Log providing to-date summary lists of incidents or illnesses.
   4. Submittal Log.
   5. RFI Log.
   6. Change Order Log.
   7. Quality Assurance/Quality Control Log, with summary statement.

C. Coordination Drawings: Prepare Coordination Drawings.

   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

      a. Indicate functional and spatial relationships of components of roofing, ceiling, fire protection, plumbing, mechanical, and electrical systems.
      b. Indicate required installation sequences.
      c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

   2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
   3. Number of Copies: Submit two opaque copies of each submittal. Engineer will return one copy.

      a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned.

   4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

D. Key Personnel Names: Within 15 days of receiving Notice To Proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including cell and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

   1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.10 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

DIVISION 01 SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION
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3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Baseline Construction Schedule.
2. Update Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Engineer.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Days: Unit of time duration in calendar days, unless specifically indicated to be work days.

F. Event: The starting or ending point of an activity.

G. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to Owner.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

H. Fragment: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

I. Major Area: A story of construction, a separate building, or a similar significant construction element.

J. Milestone: A key or critical point in time for reference or measurement.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.

B. Start-up construction schedule.

1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Field Condition Reports: Submit at time of discovery of differing conditions.

F. Special Reports: Submit at time of unusual event.

G. Qualification Data: For scheduling consultant.

1.5 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Engineer's final release or approval.

B. Baseline Construction Schedule: Submit two opaque copies.

1. Approval of cost-loaded Baseline Construction Schedule will not constitute approval of Schedule of Values for cost-loaded activities.

C. Update Construction Schedule: Submit two opaque copies of Update Construction Schedule, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.

D. Daily Construction Reports: Submit two copies at monthly intervals.

E. Material Location Reports: Submit two copies at monthly intervals.

F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

1.6 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Engineer's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures

related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Review delivery dates for Owner-furnished products.
4. Review schedule for work of Owner's separate contracts.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.
7. Review time required for completion and startup procedures.
8. Review and finalize list of construction activities to be included in schedule.
9. Review submittal requirements and procedures.
10. Review procedures for updating schedule.

1.7 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Baseline and Update Construction Schedules with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Baseline and Update Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

    a. At Contractor's option, show submittals on the Baseline Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Baseline Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Contractor's Construction Schedule Acceptance is represented in two forms: 1) Accepted Baseline Schedule, and 2) Accepted Monthly Update Schedule.

C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

D. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Engineer.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 30 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

    a. HVAC units
    b. Electrical Gear
    c. ATC Controls

3. Submittal Review Time: Include review and re-submittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 14 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work under More Than One Contract: Include a separate activity for each contract.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.

b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure.
c. Completion of mechanical installation.
d. Completion of ductwork.
e. Completion of electrical installation.
f. Completion of testing/balancing.
g. Substantial Completion.

F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Equipment Deliveries Complete, Equipment in Place, Systems Ready for Test, Substantial Completion, and Final Completion

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

H. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.

I. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

J. Recovery Schedule: When periodic update indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

K. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Utilize Microsoft Project, Primavera, or Prolog, for Windows XP operating system.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Emergency procedures.
12. Orders and requests of authorities having jurisdiction.
13. Change Orders received and implemented.
14. Construction Change Directives received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for

interpretation on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

AIA® Document G716™ – 2004

Request for Information ("RFI")

TO: FROM:

PROJECT: ISSUE DATE: RFI No.

PROJECT NUMBERS: / REQUESTED REPLY DATE:
COPIES TO:

RFI DESCRIPTION: *(Fully describe the question or type of information requested.)*

REFERENCES/ATTACHMENTS: *(List specific documents researched when seeking the information requested.)*
SPECIFICATIONS: DRAWINGS: OTHER:

SENDER'S RECOMMENDATION: *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*

RECEIVER'S REPLY: *(Provide answer to RFI, including cost and/or schedule considerations.)*

BY DATE COPIES TO

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

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Advancement of Construction Technology

REQUEST FOR INTERPRETATION

Project: _____ R.F.I. Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Section: Paragraph: Drawing Reference: Detail:

Request:

Signed by: Date:

Response:

☐ Attachments

Response From: To: Date Rec'd: Date Returned:

Signed by: Date:

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

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DIVISION 01 SECTION 013300
SUBMITTAL PROCEDURES
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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 01 Section "Closeout Procedures" for submitting warranties.
5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
6. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Division 01 Section "Demonstration and Training" for training of Owner's personnel.
8. Divisions 02 through 26 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Engineer's responsive action.

B. Informational Submittals: Written information that does not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals at the cost identified in Paragraph 1.5.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow 15 days for review of each submittal. Submittal will be returned to Engineer before being returned to Contractor.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Engineer.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.

h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Use CSI Form 12.1A at the end of Section.
2. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number.
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.

3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked " Approved" or "Approved as Noted."
4. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating "Approved" taken by Engineer

1.5 CONTRACTOR'S USE OF ENGINEER'S CAD FILES

A. General: At Contractor's written request, copies of Engineer's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

B. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Engineer for Contractor's use in preparing submittals.

1. The Documents for this project were prepared using commercial software on computers.
2. Drawing files (in AutoCAD V2023) are available to the Contractor.
3. These digital files will only be released with original signature on the "Digital Information Electronic Release Agreement Form enclosed at the end of Part 3.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Standard product operation and maintenance manuals.
    j. Compliance with specified referenced standards.
    k. Testing by recognized testing agency.
    l. Application of testing agency labels and seals.
    m. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit one PDF electronic file. Engineer will return one electronic copy with comment page. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Engineer's CAD Drawings are otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.
    m. Relationship to adjoining construction clearly indicated.
    n. Seal and signature of professional engineer if specified.
    o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

3. Number of Copies: Submit two opaque (bond) copies of each submittal. Engineer will return one copy.

4. Number of Copies: Submit three opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned.

5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

D. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.

E. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Engineer will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Engineer will not return copies.

2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

D. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

E. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

F. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

G. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

H. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

I. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

J. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

K. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Engineer.

1. Engineer will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

L. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of engineers, architects, and owners, and other information specified.

N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

S. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

T. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

V. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

W. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

X. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

Y. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Z. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

AA. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S / ACTION

A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
   1. Reviewed: Approved.
   2. Reviewed: Submittals which require no corrections.
   3. Rejected: Not Approved. Constricting to requirement of the Contract Documents. Do not perform work illustrated.
   4. Resubmit as specified: Item required major correction, future clarification and/or completion. Do not perform work illustrated.
   5. For Information only/Not Reviewed: Submittals that are not required by Contract Documents to be reviewed by Engineer.
   6. Comments Noted: Make corrections noted.
   7. Revise & Resubmit: To be corrected and returned for approval. Do not perform work as illustrated.
   8. Resubmit for Record Only: Proceed with work and re-submit information submitted for Engineers records.

C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

Advancement of Construction Technology

SUBMITTAL TRANSMITTAL

Project: _____ Date: _____

_____ A/E Project Number: _____

TRANSMITTAL A

To (Contractor): _____ Date: _____ Submittal No. _____

From (Subcontractor): _____ By: _____ ☐ Resubmission

Qty.	Reference / Number	Title / Description / Manufacturer	Spec. Section Title and Paragraph / Drawing Detail Reference

☐ Submitted for review and approval
☐ Resubmitted for review and approval
☐ Complies with contract requirements
☐ Will be available to meet construction schedule
☐ A/E review time included in construction schedule

☐ Substitution involved - Substitution request attached
☐ If substitution involved, submission includes point-by-point comparative data or preliminary details
☐ Items included in submission will be ordered immediately upon receipt of approval

Other remarks on above submission:

☐ One copy retained by sender

TRANSMITTAL B

To (A/E): _____ Attn: _____ Date Rec'd by Contractor: _____

From (Contractor): _____ By: _____ Date Trnsmt'd by Contractor: _____

☐ Approved
☐ Approved as noted

☐ Revise / Resubmit
☐ Rejected / Resubmit

Other remarks on above submission:

☐ One copy retained by sender

TRANSMITTAL C

To (Contractor): _____ Attn: _____ Date Rec'd by A/E: _____

From (A/E): _____ ☐ Other By: _____ Date Trnsmt'd by A/E: _____

☐ Approved
☐ Approved as noted
☐ Not subject to review
☐ No action required
☐ Revise / Resubmit
☐ Rejected / Resubmit
☐ Approved as noted / Resubmit

☐ Provide file copy with corrections identified
☐ Sepia copies only returned
☐ Point-by-point comparative data required to complete approval process
☐ Submission Incomplete / Resubmit

Other remarks on above submission:

☐ One copy retained by sender

TRANSMITTAL D

To (Subcontractor): _____ Attn: _____ Date Rec'd by Contractor: _____

From (Contractor): _____ By: _____ Date Trnsmt'd by Contractor: _____

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ One copy retained by sender

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September 1996
CSI Form 12.1A

Gipe Associates, Inc.
CONSULTING ENGINEERS

RELEASE OF ELECTRONIC MEDIA (DRAWINGS, SPECIFICATIONS, ETC.)

PROJECT:_____ DATE:_____

PROJECT NO:_____ RECORD DOCUMENT DATE _____

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by Gipe Associates, Inc., the Owner, its agents, other design professionals, or contractors covenants and agrees that all such drawings and data are instruments of service of Gipe Associates, Inc., and its Consultants (hereinafter referred to as the Engineer), who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

For documentation purposes, the original electronic media (disks) will be retained by the Engineer, and both parties acknowledge that the referenced, dated Record Document is the actual contract deliverable. The Owner shall be permitted to retain copies of Drawings and Specifications prepared in electronic form for the Owner's convenience in connection with the specific project for which this information was prepared. Due to the potential that the information set forth on the electronic media can be modified, unintentionally or otherwise, the Engineer reserves the right to remove all indicia of its ownership and/or involvement from each document on the electronic media.

No warranty is made or implied as to the suitability of these files or the information they contain for such purpose. In all cases, the Contract Drawings and Specifications shall define all requirements. The Contractor is responsible for verification of Drawings and field conditions and/recognizing the impermanence and changeability of electronic files, assumes all responsibility for their use and alteration.

The Owner, its Agents or other design professionals further agree not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Owner, its Agents, other design professionals, or contractors agree to waive all claims against the Engineer, and to the fullest extent permitted by law, to indemnify and hold the Engineer harmless from any damage, liability or cost, including reasonable attorneys' fees and cost of defense, arising from any changes or use of the Drawings and data made by anyone other than the Engineer without the prior written consent of the Engineer. Any such unauthorized use or reuse will be at the Owner's sole risk and without liability or legal exposure to the Engineer.

Under no circumstances shall transfer of the Drawings and other instruments of service on electronic media for use by the Owner, its Agents or other design professionals be deemed a sale by the Engineer, and the Engineer makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____
Accepted - Owner or Owner's Representative

_____
Printed Name and Title

_____
Date

8719 Brooks Drive, Easton, Maryland 21601 Tel: 410/822-8688 Fax: 410/822-6306

DIVISION 01 SECTION 014000
QUALITY REQUIREMENTS
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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:
1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Divisions 02 through 28 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For ductwork, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Engineer.
2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Engineer.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering

services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies

with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
7. Special Inspections: All inspections required by the authority having jurisdiction including by not limited to the following shall be included in the scope of work:

    a. Structural Inspections
    b. Steel Inspections
    c. HVAC Inspections
    d. Electrical Inspections
    e. Fire Alarm Inspections
    f. Gas Piping Inspections

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Proce-

dures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with

Contractor's construction schedule. Update as the Work progresses. .

1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution Requirements."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

DIVISION 01 SECTION 015000
TEMPORARY FACILITIES AND CONTROLS
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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 01 Section "Execution Requirements" for progress cleaning requirements.
4. Divisions 02 through 26 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 USE CHARGES

A. General: Utility usage shall not be metered. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Engineer, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Utility usage shall not be metered. Provide connections and extensions of services as required for construction operations.

E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 SUBMITTALS

A. Site Plan: Show temporary facilities, staging areas, and parking areas for construction personnel.

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Engineer, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 6 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Permanent HVAC equipment shall not be utilized for temporary heating.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Owner will not allow use of onsite sanitary facilities.

D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.

I. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

J. Provide protective coverings or other procedures to protect floor of the multipurpose room.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

C. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

DIVISION 01 SECTION 016000
PRODUCT REQUIREMENTS
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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Division 01 Section "Substitution Procedures" for requests for substitutions.
4. Division 01 Section "References" for applicable industry standards for products specified.
5. Divisions 02 through 26 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number, or first named product, or other designation, to establish the significant qualities related to type, function,

dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Engineer's Action: Engineer will respond in writing to Contractor within 15 days of receipt of completed product list. Engineer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Engineer's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.

b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.
b. Use product specified if Engineer cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."

b. Use product specified if Engineer cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 26 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Engineer's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Engineer will consider requests for substitution if received within 15 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.

B. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

Advancement of Construction Technology

SUBSTITUTION REQUEST

(After the Bidding Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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September 1996
CSI Form 13.1A

SUBSTITUTION REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

_____

_____

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_____

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DIVISION 01 SECTION 017300
EXECUTION REQUIREMENTS
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SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from the Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Electrical wiring systems.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Equipment supports.
    d. Piping, ductwork, vessels, and equipment.

e. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation", form enclosed in Division 01 Section "Construction Progress Documentation."

D. Surface and Substrate Preparation: Comply with manufacturer's recommendations for preparation of substrates to receive subsequent work.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
2. Allow for piping, building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

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CUTTING AND PATCHING
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SECTION 017310 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 01 Section "Selective Demolition" for demolition of selected portions.
2. Divisions 02 through 28 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
3. Division 07 Section "Fire Protection, HVAC, and Plumbing Penetration Firestopping" for patching fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Engineer's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 02 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

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SELECTIVE DEMOLITION
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SECTION 017320 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
3. Division 01 Section "Construction Waste Management" for disposal of demolished materials.
4. Division 01 Section "Cutting and Patching" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

D. Predemolition Videotapes: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.

E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Refrigerant Recovery Technician Qualifications: Certified by an EPA – approved certification program. Include date and name of technician and date refrigerant was recovered.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building and site immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

1. Comply with requirements specified in Division 01 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition. Video tape all existing areas prior to selective demolition work.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Owner will remove hazardous materials under a separate contract.

E. Hazardous Materials: Hazardous materials are present in construction to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain existing site fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction digital videotapes.
   1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

   1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Arrange to shut off indicated utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-campus.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

F. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. New roofing shall comply with existing Firestone Roof Warranty.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

DIVISION 01 SECTION 017419
CONSTRUCTION WASTE MANAGEMENT
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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

B. Related Sections:
1. Division 01 Section "Selective Demolition" for disposition of waste resulting from partial demolition of structures, and site improvements, and for disposition of hazardous waste.
2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of

materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate salvage of materials, including the following:

1. Demolition Waste:

    a. Asphaltic concrete paving.
    b. Concrete.
    c. Concrete reinforcing steel.
    d. Brick.
    e. Piping.
    f. Supports and hangers.
    g. Valves.
    h. Mechanical equipment.

2. Construction Waste:

    a. Site-clearing waste.
    b. Masonry and CMU.
    c. Metals.
    d. Piping.
    e. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

        1) Paper.
        2) Cardboard.
        3) Boxes.
        4) Plastic sheet and film.
        5) Polystyrene packaging.
        6) Wood crates.
        7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 15 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
5. Quantity of waste recycled, both estimated and actual in tons (tonnes).

6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Qualification Data: For waste management coordinator and refrigerant recovery technician.

G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of Projects, as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.3 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-3 for construction waste reduction work plan.

D. Form CWM-4 for demolition waste reduction work plan.

E. Form CWM-7 for construction waste

F. Form CWM-8 for demolition waste.

END OF SECTION

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FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION

MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

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FORM CWM-2: DEMOLITION WASTE IDENTIFICATION

MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

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FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

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FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

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FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT

MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

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FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT

MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								

Other:								

DIVISION 01 SECTION 017700
CLOSE-OUT PROCEDURES
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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Substantial Completion procedures.
3. Final completion procedures.
4. Warranties.
5. Final cleaning.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Divisions 02 through 26 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
15. Complete Training.
16. Obtain documentation indicating approval of all authorities having jurisdiction.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements.

Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A , enclosed at the end of Part 3.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Engineer.
    d. Name of Contractor.
    e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES, WORCESTER COUNTY RECREATION CENTER HVAC SYSTEM REPLACEMENTS" and name of Contractor.
4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers for final cleaning. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials.

Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

E. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

END OF SECTION

Advancement of Construction Technology

PUNCH LIST

Project: _____

_____

To (Contractor): _____

_____

From (A/E): _____

Site Visit Date: _____

A/E Project Number: _____

Contract For: _____

The following items require the attention of the Contractor for completion or correction. This list may not be all-inclusive, and the failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Item Number	Room Number	Location (Area)	Description	Correction/Completion Date	Verification A/E Check

☐ Attachments

Signed by: Date:

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

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DIVISION 01 SECTION 017823
OPERATION AND MAINTENANCE DATA
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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of systems and equipment.

B. Related Sections include the following:
1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 02 through 26 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Engineer will return both copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Engineer will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Engineer's comments. Submit 3 copies of

each corrected manual within 15 days of receipt of Engineer's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of equipment.
3. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.

4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Engineer.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL – WORCESTER COUNTY RECREATION CENTER HVAC SYSTEM REPLACEMENTS," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individ-

ual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular for-

mat, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

DIVISION 01 SECTION 017839
PROJECT RECORD DOCUMENTS
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PART 3 EXECUTION

3.1 RECORDING AND MAINTENANCE

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include the following:

1. Division 01 Section "Execution Requirements" for final property survey.
2. Division 01 Section "Closeout Procedures" for general closeout procedures.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 28 Sections for specific requirements for project record documents of the Work in those Sections

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up Record Prints.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Revisions to routing of piping and conduits.
    d. Revisions to electrical circuitry.
    e. Actual equipment locations.
    f. Locations of concealed internal utilities.
    g. Changes made by Change Order or Construction Change Directive.
    h. Changes made following Engineer's written orders.
    i. Details not on the original Contract Drawings.
    j. Field records for variable and concealed conditions.
    k. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Engineer. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
2. Refer instances of uncertainty to Engineer for resolution.
3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Engineer will make the Contract Drawings available to Contractor's print shop.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD

DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS – WORCESTER COUNTY RECREATION CENTER HVAC SYSTEM REPLACEMENTS."
    d. Name of Engineer.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION

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DEMONSTRATION AND TRAINING
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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
2. Divisions 02 through 26 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Instruction Program: Submit two copies of 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.

1. At completion of training, submit one complete training manual(s) for Owner's use.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

    a. Name of Project.
    b. Name of Engineer.
    c. Name of Contractor.
    d. Date of video recording.

2. Transcript: Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in heavy-duty, three-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 recording. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Electrical components and Equipment
2. ATC System
3. Single Zone VAV Units
4. Fire Alarm Devices

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
a. Operations manuals.
b. Maintenance manuals.
c. Project Record Documents.
d. Identification systems.
e. Warranties and bonds.
f. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.

e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Engineer will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Engineer.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video recording by video recording is recorded. Include description of items being viewed.

E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

F. Pre-Produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

DIVISION 01 SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS
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SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. Related Sections include the following:

1. Division 01 Section "HVAC Commissioning Requirements" for specific requirements for commissioning HVAC systems.

2. Division 01 Section "Closeout Procedures" for specific requirements for closeout at substantial and final completion.

3. Division 01 Section "Closeout Procedures" for Specific Requirements for training and demonstration of systems to Owner.

4. Division 01 Section "Closeout Procedures" for Specific Requirements related to the Preparation of systems operation and maintenance manuals.

1.3. DEFINITIONS

A. CxA: Commissioning Authority.

B. OPR: Owner's Project Requirements.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

D. TAB: Testing, Adjusting, and Balancing.

1.4. COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.

2. All contractor commissioning requirements and costs associated with commissioning the project shall be included in the base bid.

3. Representatives of the facility user and operation and maintenance personnel.

4. Engineering design professionals.

1.5. OWNER'S RESPONSIBILITIES

A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.

2. Training in operation and maintenance of systems, subsystems, and equipment.

3. Testing meetings.

4. Demonstration of operation of systems, subsystems, and equipment.

1.6. CONTRACTOR'S RESPONSIBILITIES

A. Provide utility services required for the commissioning process.

B. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in commissioning and construction-phase coordination meetings.

2. Participate in maintenance orientation and inspection.

3. Participate in operation and maintenance training sessions.

4. Participate in final review at acceptance meeting.

5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.

6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

7. Review and approve final commissioning documentation.

8. Certify that all pre-test work and pre-testing of functional performance tests are complete and operational prior to scheduling performed testing by CxA. Submit completed functional performance test forms with data from pre-testing.

9. During functional performance testing, a representative from the mechanical contractor, controls contractor, and test/balance engineer must be present and participate in testing.

C. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Pre-test all systems/equipment prior to engaging CxA for Functional Performance Testing.

2. Participate in commissioning and construction-phase coordination meetings.

3. Participate in maintenance orientation and inspection.

4. Participate in procedures meeting for testing.

5. Participate in final review at acceptance meeting.

6. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.

7. Provide information to the CxA for developing construction-phase commissioning plan.

8. Participate in training sessions for Owner's operation and maintenance personnel.

9. Provide updated Project Record Documents to the CxA on a daily basis.

10. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 01 Section "Operation and Maintenance Data."

11. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.

12. The test/balance subcontractor, mechanical contractor, and automatic temperature controls subcontractor must be on-site and provide assistance during all functional performance testing.

D. Contractors and subcontractors must pre-inspect and pre-test all equipment and systems prior to requesting functional performance testing by the CxA. All pre-start/start-up checklists and functional performance test forms must be completed and submitted to Engineer prior to scheduling formal functional performance testing.

1.7. CXA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Prepare a construction-phase commissioning plan. Collaborate with Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.

C. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

D. At a mutually agreed upon time, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.

E. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.

F. Prepare Project-specific test and inspection procedures and checklists.

G. Schedule, direct, witness, and document tests, inspections, and systems startup.

H. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

I. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

J. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 01 Section "Project Record Documents."

K. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Division 01 Section "Operation and Maintenance Data."

L. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

1.8. COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.

2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of

documents to be provided along with identification of responsible parties.

3. Identification of systems and equipment to be commissioned.

4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.

5. Identification of items that must be completed before the next operation can proceed.

6. Description of responsibilities of commissioning team members.

7. Description of observations to be made.

8. Description of requirements for operation and maintenance training, including required training materials.

9. Description of expected performance for systems, subsystems, equipment, and controls.

10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule.

11. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.

12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.

13. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.

14. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

B. Test Checklists: CxA, with assistance of Contractor and Subcontractors, shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Provide space for testing personnel to sign off on each checklist. Specific checklist content requirements are specified in Division 01 Section "HVAC Commissioning Requirements". Test checklists will be jointly developed as the project progresses. Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested item.

2. Test number.

3. Time and date of test.

4. Indication of whether the record is for a first test or retest following correction of a problem or issue.

5. Dated signatures of the person performing test and of the witness, if applicable.

6. Individuals present for test.

7. Deficiencies.

8. Issue number, if any, generated as the result of test.

C. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed test checklists signed by the responsible parties shall accompany this certificate.

D. Test and Inspection Reports: CxA shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.

F. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating an Issues Log Entry:

   a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
   b. Assign a descriptive title of the issue.
   c. Identify date and time of the issue.
   d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
   e. Identify system, subsystem, and equipment to which the issue applies.
   f. Identify location of system, subsystem, and equipment.
   g. Include information that may be helpful in diagnosing or evaluating the issue.
   h. Note recommended corrective action.
   i. Identify commissioning team member responsible for corrective action.
   j. Identify expected date of correction.
   k. Identify person documenting the issue.

2. Documenting Issue Resolution:

   a. Log date correction is completed or the issue is resolved.

b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
c. Identify changes to the Contract Documents that may require action.
d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
e. Identify person(s) who corrected or resolved the issue.
f. Identify person(s) documenting the issue resolution.

3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, CxA shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, CxA shall include the following information in the issues log and expand it in the narrative:

a. Issue number and title.
b. Date of the identification of the issue.
c. Name of the commissioning team member assigned responsibility for resolution.
d. Expected date of correction.

G. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances in the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.

2. Commissioning plan.

3. Testing plans and reports.

4. Corrective modification documentation.

5. Issues log.

6. Completed test checklists.

7. Punch Lists.

8. Test/Balance Reports.

9. Listing of off-season test(s) not performed and a schedule for their completion.

10. All commissioning documents must be submitted to the building Owner within 90

days of the date of receipt of the Certificate of Occupancy.

H. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:

1. Project Record Documents as specified in Division 01 Section "Project Record Documents."

2. Final commissioning plan.

3. Commissioning report.

4. Operation and maintenance data as specified in Division 01 Section "Operation and Maintenance Data."

1.9. SUBMITTALS

A. Test Checklists and Report Forms: CxA shall submit sample checklists and forms to Contractor quality-control manager and subcontractors for review and comment. Submit two copies of each checklist and report form.

B. Test and Inspection Reports: CxA shall submit test and inspection reports.

C. Corrective Action Documents: CxA shall submit corrective action documents.

1.10. QUALITY ASSURANCE

A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.11. COORDINATION

A. Coordinating Meetings: CxA shall conduct coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

D. Manufacturers' Field Services: CxA and Contractor shall coordinate services of manufacturers' field services.

1.12. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

PART 2. PRODUCTS (NOT USED)

PART 3. EXECUTION

3.1. OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 01 Section "Demonstration and Training," perform the following:

1. Review installed systems, subsystems, and equipment.

2. Review instructor qualifications.

3. Review instructional methods and procedures.

4. Review training module outlines and contents.

5. Review course materials (including operation and maintenance manuals).

6. Inspect and discuss locations and other facilities required for instruction.

7. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.

8. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 01 Section "Demonstration and Training."

END OF SECTION

DIVISION 01 SECTION 019115
HVAC COMMISSIONING REQUIREMENTS
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SECTION 019115 - HVAC COMMISSIONING REQUIREMENTS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes requirements for commissioning the HVAC system and its subsystems and equipment. This Section supplements the general requirements specified in Division 01 Section "General Commissioning Requirements."

B. Related Sections include the following:

1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.

C. The following systems and/or equipment shall be commissioned:

1. Air Flow Monitoring Stations.
2. Automatic Temperature Control System.
3. Carbon Monoxide Sensors.
4. Carbon Dioxide Sensors.
5. Condensate overflow alarms.
6. Heat Pumps.
7. Dampers.
8. Differential Static Pressure Controllers.
9. Duct smoke detectors.
10. Energy recovery ventilators (Including variable frequency drives).
11. Exhaust Fans.
12. Fire Fighter Air Handling Equipment Shut-Down Switch.
13. Fire Fighter Smoke Evacuation Equipment Shut-Down Switch.
14. Gas Furnaces.
15. High and low temperature alarms.

16. Hot Gas Reheat coils.

17. HVAC controls and sequences of operation.

18. Refrigerant Mitigation Controls.

19. Relative Humidity Sensors.

20. Relief Air Dampers.

21. Refrigerant Leak Detectors.

22. Single Zone VAV Units.

23. Existing Smoke Evacuation Fans/Dampers.

24. Static Pressure Sensors.

25. Temperature Sensors.

26. Variable frequency drives.

1.3. DEFINITIONS

A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.

B. CxA: Commissioning Authority.

C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

D. TAB: Testing, Adjusting, and Balancing.

1.4. CONTRACTOR'S RESPONSIBILITIES

A. The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Contractor:

1. Attend procedures meeting for TAB Work.

2. Certify that TAB Work is complete.

3. Assist performing functional performance tests.

C. Mechanical Contractor:

1. Attend TAB verification testing.

2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.

3. Assist performing functional performance tests.

D. HVAC Instrumentation and Control Contractor: With the CxA, review control designs for compliance with the Contract Documents, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions. Assist with performing functional performance tests.

E. TAB Subcontractor:

1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.

a. Verify the following:
i. Accessibility of equipment and components required for TAB Work.
ii. Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
iii. Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
iv. Air flow rates have been specified and compared to central equipment output capacities.
b. Identify discontinuities and omissions in the Contract Documents.
c. This review of the Contract Documents by the TAB Subcontractor satisfies requirements for a design review report as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."
d. Assist performing functional performance tests.

2. Additional Responsibilities: Participate in tests specified in Division 23 Sections "Instrumentation & Controls of HVAC & Plumbing Systems."

F. Electrical Contractor:

1. With the Mechanical Contractor, coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.

2. Attend TAB verification testing.

1.5. COMMISSIONING DOCUMENTATION

A. The following are in addition to documentation specified in Division 01 Section "General Commissioning Requirements."

B. Test Checklists: CxA with assistance of Contractor shall develop test checklists for HVAC systems, subsystems, and equipment, including interfaces and interlocks with other

systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 01 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:

1. Calibration of sensors and sensor function.

2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.

3. Control sequences for HVAC systems.

4. Strength of control signal for each set point at specified conditions.

5. Responses to control signals at specified conditions.

6. Sequence of response(s) to control signals at specified conditions.

7. Electrical demand or power input at specified conditions.

8. Power quality and related measurements.

9. Expected performance of systems, subsystems, and equipment at each step of test.

10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.

11. Interaction of auxiliary equipment.

12. Issues log.

1.6. SUBMITTALS

A. The following submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."

B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.

C. Certificate of Readiness: CxA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.

D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed. Certification shall include completed checklists provided by TAB Subcontractor as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

E. Test and Inspection Reports: CxA shall compile and submit test and inspection reports and

certificates, and shall include them in systems manual and commissioning report.

F. Corrective Action Documents: CxA shall submit corrective action documents.

G. Certified TAB Reports: CxA shall submit verified, certified TAB reports.

1.7. ALTERNATES

A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

PART 2. PRODUCTS (NOT USED)

PART 3. EXECUTION

3.1. TESTING PREPARATION

A. Prerequisites for Testing:

1. Certify that HVAC systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.

2. Certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.

3. Certify that TAB procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

4. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.

5. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

6. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.

7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.

8. Check safety cutouts, alarms, and interlocks with duct detectors and life-safety systems during each mode of operation.

9. Annotate checklist or data sheet when a deficiency is observed.

10. Verify equipment interface with monitoring and control system and TAB criteria; include the following:

a. All temperature alarms.
b. Duct Smoke detectors operation and interlocks with fire alarm system.
c. Fire fighter air handling unit shut down switches monitoring and fan shut-down control.
d. Gas furnace operation, control, and leaving air temperature.
e. Head pressure controls for air cooled heat pump units.
f. Minimum outdoor-air intake in each operational mode and at minimum and maximum airflows.
g. Operation of heat pump units in both heating and cooling cycles.
h. Operation/Accuracy of air flow measuring stations at various flow rates.
i. Refrigeration mitigation controls, interlocks, and leak detection system operation.
j. Sequences of operation of all HVAC equipment.
k. Set point and operation of high temperature alarms.
l. Supply and return air flow rates for all HVAC equipment.
m. Test and calibrate all static pressure sensors.
n. Test operation and air temperatures of hot gas re-heat coils.
o. Total exhaust airflow and total outdoor-air intake.
p. Variable speed drive parameters at each operated mode.

11. Verify proper responses of monitoring and control system controllers and sensors to include the following:

    a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    b. Report deficiencies and prepare an issues log entry.

12. Verify that HVAC equipment field quality-control testing has been completed and approved. CxA shall direct, witness, and document field quality-control tests, inspections, and startup specified in individual Division 23 Sections.

B. Testing Instrumentation: Install measuring instruments and logging devices to record test data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of operation. For individual room cooling tests, provide temporary heaters to impose a cooling load. Operational modes include the following:

1. Heating/Cooling Mode.

2. Occupied and unoccupied.

3. Warm up and cool down.

4. Economizer cycle/relief air fan/damper operation.

5. Emergency power supply.

6. Life-safety and safety systems.

7. Duct detectors.

8. Fire safety.

9. Temporary upset of system operation.

10. Partial occupancy conditions.

11. Special cycles.

12. Single Zone VAV Unit supply/exhaust air flow at partial CO2 levels.

13. All alarms.

14. Condensate overflow safety switch shut-down and alarm.

15. Hot gas re-heat coils in dehumidification mode.

16. Test operation and accuracy of air flow measuring stations.

17. Test refrigerant mitigation controls including fan interlocks and refrigerant leak detection sensors.

3.2. TAB VERIFICATION

A. TAB Subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing." TAB Subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.

B. Contractor, HVAC Contractor, and CxA shall witness TAB Work.

C. TAB Preparation:

1. TAB Subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports" specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.

D. Verification of Final TAB Report:

1. CxA shall select, at random, 10 percent of report for field verification.

2. CxA shall notify TAB Subcontractor 10 days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

3. Failure of an item is defined as follows:

a. For all readings a deviation of more than 10 percent.

4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.

E. If deficiencies are identified during verification testing, CxA shall notify the HVAC Contractor and Engineer and shall take action to remedy the deficiency. Engineer shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.

F. CxA shall certify that TAB Work has been successfully completed.

3.3. TESTING

A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.

B. Contractors and subcontractors must pre-inspect and pre-test all equipment and systems prior to requesting functional performance testing by the CxA. All pre-start/start-up checklists and functional performance test forms must be completed and submitted to Engineer prior to scheduling formal functional performance testing.

C. Perform tests using design conditions whenever possible.

1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

2. Alter set points when simulating conditions is not practical and when written approval is received from CxA.

3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.

D. Scope of HVAC Contractor Testing:

1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.

2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

E. Detailed Testing Procedures: CxA, with HVAC Contractor, TAB Subcontractor, and HVAC Instrumentation and Control Contractor, shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

F. HVAC Instrumentation and Control System Testing:

1. Field testing plans and testing requirements are specified in Division 23 Section "Instrumentation & Controls of HVAC & Plumbing Systems". The CxA, HVAC Contractor, Equipment Provider/Manufacturer and the HVAC Instrumentation and Control Contractor shall collaborate to prepare testing plans.

2. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems.

G. Energy Supply System Testing: HVAC Contractor shall prepare a testing plan to verify performance of gas systems and equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each equipment item and pipe section to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

H. Heat-Generation System Testing: HVAC Contractor shall prepare a testing plan to verify performance of single zone VAV units, gas furnaces, hot gas re-heat coils. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings for each pipe sector showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

I. Refrigeration/Heat Rejection System Testing: HVAC Contractor shall prepare a testing plan to verify performance of refrigerant compressors, single zone VAV units, heat pump units, hot gas re-heat coils, and other refrigeration systems. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

J. HVAC Distribution System Testing: HVAC Contractor shall prepare a testing plan to

verify performance of air handling units, single zone VAV units and other distribution systems. Include HVAC terminal equipment and unitary equipment. Plan shall include the following:

1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.

2. Tracking checklist for managing and ensuring that all pipe sections have been tested.

3. Equipment, air flow rates, air temperatures, safeties, and demand controlled ventilation.

K. Deferred Testing:

1. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.

2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.

L. Testing Reports:

1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.

2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.

3. Prepare a preliminary test report. Deficiencies will be evaluated by Engineer to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION

DIVISION 07 SECTION 078413
FIRE PROTECTION, HVAC & PLUMBING PENETRATION FIRESTOPPING
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SECTION 078413 FIRE PROTECTION, HVAC & PLUMBING PENETRATION FIRESTOPPING

PART 1. GENERAL

1.1. SUMMARY

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

B. Section includes:

1. Through-penetration firestopping in fire rated construction.

2. Through-penetration smoke-stopping in smoke partitions.

1.2. REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory

a. Through-penetration firestop devices (XHCR)
b. Fire resistance rating (BXUV)
c. Through-penetration firestop systems (XHEZ)
d. Fill, void, or cavity material (XHHW)

B. American Society for Testing and Materials Standards:

C. ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.3. DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

F. Sleeve: Metal fabrication or pipe section extended through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.4. SYSTEM DESCRIPTION

A. Design Requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations.

2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.5. SUBMITTALS

A. Submit in accordance with Division 01 Section Submittal Procedures, unless otherwise indicated.

B. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.

2. Manufacturer's installation instructions.

C. Shop drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable UL system number, or UL classified devices.

2. Manufacturer or manufacturer's representative shall provide qualified engineering judgment and drawings relating to non-standard applications as needed.

D. Quality control submittals:

1. Statement of qualifications.

E. Applicators' qualifications statement:

1. List past projects indicating required experience.

1.6. QUALITY ASSURANCE

A. Installer's qualifications: Fire experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, State or local authority where applicable.

2. At least 2 years experience with systems.

3. Successfully completed at least 5 comparable scale projects using this system.

B. Local and State regulatory requirements: Submit forms or acceptance for proposed

assemblies not conforming to specific UL Firestop System numbers, or UL classified devices.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.

2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.8. PROJECT CONDITIONS

A. Existing condition:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.

2. Furnish forced air ventilation during installation if required by manufacturer.

3. Keep flammable materials away from sparks or flame.

4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

1.9. WARRANTY

A. Submit copies of written warranty agreeing to repair or replace joint sealers which fail in joint adhesion, extrusion resistance, migration resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The warranty period shall be two (2) years from date of substantial completion unless otherwise noted.

PART 2. PRODUCTS

2.1. THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems of devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.

2. Acceptable manufacturers and products.

a. Those listed in the UL Fire Resistance directory for the UL System involved and as further defined in the System and Applications Schedule in Part 3.6 of this section.

3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer unless otherwise noted.

2.2. SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in The Systems and Applications Schedule in Part 3.6 of this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.3. ACCESSORIES

A. Fill, void or cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.

B. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.

PART 3. EXECUTION

3.1. EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.

2. Do not proceed until unsatisfactory conditions have been corrected.

B. Coordinate an inspection of all Mechanical Firestopping systems with the Fire Marshal prior to installation of ceilings, walls, etc.

3.2. PREPARATION

A. Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3. INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Protect materials from damage on surfaces subject to traffic.

D. When large openings are created in walls or floors to permit installation of pipes, ducts, or other items, close unused portions of opening with firestopping materials tested for the application. See UL Fire Resistance Directory or Section 3.6 of this document.

1. Install smoke stopping as specified for firestopping.

3.4. FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.5. ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.6. SYSTEMS AND APPLICATION SCHEDULES*

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
Metal Pipe	CAJ1001 CP25S/L, CP25N/S CAJ1006 CS-195+, FS-195+ CAJ1007 FS-195+, 1-inch& 2-inch Wide CAJ1009 2000, 2000+, 2003 CAJ1010 2000, 2000+, 2003 CAJ1012 2000, 2000+, 2003 CAJ1013 2000, 2000+, 2003 CAJ1014 2000, 2000+, 2003 CAJ1015 2000, 2000+, 2003 CAJ1017 FD 150 CAJ1021 FD 150 CAJ1027 MPS-2+ CAJ1044 CP 25WB+ CAJ1052 CP 25S/L, CP 25N/S CAJ1058 2000, 2000+, 2003 CAJ1060 2000, 2000+, 2003 CAJ1063 2000, 2000+, 2003 CAJ1066 CP 25N/S,CP 25S/L, CP 25WB+ CAJ1091 CP 25N/S,CP 25S/L, CP 25WB+ CAJ1092 CP 25WB+ CAJ1112 FS-195+ CAJ1160 CP 25S/L, CP 25N/S CAJ1175 CP 25WB+ CAJ1176 CP 25WB+ CAJ1188 2000+ CBJ1020 CS-195+, FS-195+ CBJ1021 CS-195+, MPS-2+ CBJ1031 2001 CBJ1032 2001 FA1002 CP 25WB+ WJ1010 CP25WB+ WJ1023 2001	WL1001 CP 25 WL1002 FS-195+ WL1003 CP 25WB+,CP 25N/S WL1008 2000+ WL1009 2000+ WL1010 2000+ WL1016 CP 25WB+ WL1017 CP 25WB+,CP 25N/S WL1032 CP 25WB+,CP 25N/S WL1036 FD 150 WL1037 CS-195+,FS-195+ WL1067 CP 25N/S WL1073 CP 25WB+ WL1080 MPS2+ WL1082 2000+	FC1002 CP 25 FC1003 2000,2000+,20003 FC1006 CP 25WB+
Non-Metallic	CAJ2001 FS-195+, 1-inch& 2-inch WIDE, PPD'S CAJ2002 FS-195+ CAJ2003 CS-195+, FS-195+ CAJ2005 FS-195 CAJ2006 FS-195+ CAJ2013 FS-195+ CAJ2019 2000, 2000+, 2003 CAJ2027 FS-195+, CP 25N/S, CP 25S/L, CP 25WB+ CAJ2028 FS-195, MPS-2+ CAJ2029 FS-195+, PPD'S CAJ2030 CS-195+, FS-195+ CAJ2040 FS-195+, CP 25WB+ CAJ2044 FS-195+, CP 25N/S, CP 25S/L CP 25 WB+ CAJ2090 FS-195+ CAJ2177 FS-195+, PPD'S FA2001 FS-195+, PPD'S FS2002 CS-195+, FS-195+, MPS-2+, PPD'S FA2011 FS-195+ WJ2012 FS-195+ 1-inch WIDE	WL2002 FS-195+, PPD'S WL2003 FS-195+ WL2004 FS-195+ WL2005 FS-195+ 4' WIDE WL2006 FS-195+ WL2013 FS-195+ WL2031 CS-195+, FS-195+ WL2032 CS-195+, FS-195+ WL2033 FS-195+ WL2073 FS-195+ 1-inch WIDE	FC2002 FS-195+, PPD'S FC2007 FS-195+, PPD'S FC2008 FS-195+ FC2009 FS-195+, PPD'S FC2024 FS-195 FC2026 FS-195+ FC2028 FS-195, 1' & 2-inch WIDE, PPD'S

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
Insulated Metallic Pipe	CAJ5001 CP 25N/S, CP 25S/L, CP 25WB+ CAJ5002 FS-195+ CAJ5003 FS-195+ CAJ5005 MPS-2+ CAJ5009 2000+, 2003 CAJ5017 FS-195+, CP 25 CAJ5022 FS-195+ CAJ5024 FS-195+ CAJ5030 CS-195+, FS-195+ CAJ5041 2000, 2000+, 2003 CAJ5060 CP 25WB+ CAJ5074 2000+ CBJ5002 CP 25 CBJ5003 FS-195+ FA5001 FS-195+, CP 25WB+	WL5001 FS-195+ WL5002 FS-195+ WL5009 FS-195+ WL5010 FS-195+ WL5011 CP 25WB+ WL5032 2000+ WL5038 CP 25WB+ WL5039 CP 25WB+ WL5040 CP 25WB+ WL5045 CP 25WB+ WL5053 2000+	FC5002 FS-195+ FC5008 FS-195+
Miscellaneous Mechanical HVAC Ducts	CAJ7001 CP 25N/S CP 25S/L CAJ7003 CP 25WB+ CAJ7009 DUCT WRAP, BULK PUTTY		FC7001 CP 25S/L, CP 25N/S
Mixed Penetrating Items Combos	CAJ8001 CS-195+ FS-195 CAJ8003 2000, 2000+, 20003 CAJ8004 2000, 2000+, 20003 CAJ8006 2001 CAJ8013 FS-195+, CP 25 CBJ8004 CS-195, FS-195+ CBJ8005 CS-195+, MPS-2+ CBJ8008 2001 FA8001 FS-195+, CP 25WB+	WL8002 CS-195+, FS-195+	

*Underwriter's Laboratories, Inc., Fire Resistance Directory.

END OF SECTION

DIVISION 22 SECTION 220500
COMMON WORK RESULTS FOR PLUMBING
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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1. GENERAL

1.1. SUMMARY

A. All work under Division 22 is subject to the Division 01, General Requirements, the General Conditions and Supplementary Conditions.

B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all plumbing work.

C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Engineer.

D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange piping, equipment, and other work generally as shown on the contract drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Submittals specified below. The right is reserved to make reasonable changes in location of equipment, piping, up to the time of rough-in or fabrication.

E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.

F. Coordinate the work under Division 22 with the work of all other construction trades.

G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the contract documents.

1.2. PERMITS AND FEES

A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.

B. Permits and fees shall comply with the Division 01, General Requirements of the specification.

1.3. EXAMINATION OF SITE

A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for contractors failure to do so.

B. Examine and verify specific conditions described in individual specifications sections.

C. Verify that utility services are available, of the correct characteristics, and in the correct

locations.

1.4. CONTRACTOR QUALIFICATION

A. Any Contractor or Subcontractor performing work under Division 22 shall be fully qualified and acceptable to the Engineer and Owner. Submit the following evidence when requested:

1. A list of not less than five comparable projects which the Contractor completed.

2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.

3. Local and/or State License, where required.

4. Membership in trade or professional organizations where required.

B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.

C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

1.5. MATERIALS AND EQUIPMENT

A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality. Existing items of equipment are being relocated under another Division of these specifications. The Contractor shall be responsible for connecting all utilities as shown on the drawings, to equipment identified as existing.

B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.

C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.

D. Substitution will not be permitted for specified items of material or equipment where noted.

E. All items of equipment furnished shall have a service record of at least five (5) years.

1.6. FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.7. REFERENCED STANDARDS, CODES AND SPECIFICATIONS

A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.

B.	ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
C.	ASME	-	American Society of Mechanical Engineers
D.	ASPE	-	American Society of Plumbing Engineers
E.	ASTM	-	American Society for Testing and Materials
F.	FM	-	Factory Mutual
G.	IBC	-	International Building Code
H.	IEEE	-	Institute of Electrical and Electronics Engineers
I.	MSSP Industry	-	Manufacturers Standards Society of the Valve and Fittings
J.	NEC	-	National Electrical Code
K.	NEMA	-	National Electrical Manufacturers Association
L.	UL	-	Underwriters' Laboratories

M. All plumbing equipment and materials shall comply with the codes and standards listed in the latest edition of ASHRAE HVAC Applications Handbook, Chapter entitled Codes and Standards.

1.8. SUBMITTALS, REVIEW AND ACCEPTANCE

A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in best interest of Owner.

B. After acceptance of Material and Equipment List, submit three (3) copies or more as required under General Conditions of complete descriptive data for all items. Data shall consist of specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, installation instructions, and any other information necessary to indicate complete compliance with Contract Documents. Edit submittal data specifically for application to this project.

C. Thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission. Coordinate installation requirements and any electrical requirements for equipment submitted. Contractor shall be responsible for correctness of all submittals.

D. Submittals will be reviewed for general compliance with design concept in accordance with contract documents, but dimensions, quantities, or other details will not be verified.

E. Identify submittals, indicating intended application, location and service of submitted items. Refer to specification sections or paragraphs and drawings where applicable. Clearly indicate exact type, model number, style, size and special features of proposed item. Submittals of a general nature will not be acceptable. For substituted items, clearly list on the first page of the submittal all differences between the specified item and the proposed item. The contractor shall be responsible for corrective action and maintaining the specification requirements if differences have not been clearly indicated in the submittal.

F. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Call attention, in writing, to deviation from contract requirements.

G. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted. Use only final or corrected submittals and data prior to fabrication and/or installation.

H. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

I. For resubmissions, the Contractor must address in writing all of the Engineer’s comments on the original submission to verify compliance.

1.9. SHOP DRAWINGS

A. Prepare and submit shop drawings for all plumbing equipment, specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on contract drawings.

B. Submit data and shop drawings including but not limited to the list below, in addition to provisions of the paragraph above. Identify all shop drawings by the name of the item and system and the applicable specification paragraph number and drawing number.

C. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct shop drawing. Grouping of items/systems that are not related shall be unacceptable.

D. Items and Systems

1. Exterior Equipment/Piping Supports

2. Fire Stopping - Methods and Materials

3. Gas Pressure Regulating Valves

4. Gauges

5. Identification System

6. Material and Equipment List

7. Operations and Maintenance Manuals

8. Strainers

9. Test Certificates

10. Thermal Insulation Materials Include Table Summary

11. Valves

12. Weatherproof Assembly Components

13. Wiring Diagrams, Flow Diagrams and Operating Instructions

E. Contractor, additionally, shall submit for review any other shop drawings as required by the Engineer. No item shall be delivered to the site, or installed, until the Contractor has received a submittal from the Engineer marked Reviewed or Comments Noted. After the proposed materials have been reviewed, no substitution will be permitted except where approved by the Engineer.

1.10. SUPERVISION AND COORDINATION

A. Provide complete supervision, direction, scheduling, and coordination of all work under the Contract, including that of subcontractors.

B. Coordinate rough-in of all work and installation of sleeves, anchors, and supports for piping, equipment, and other work performed under Division 22.

C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

D. Supply services of an experienced (10 years minimum) and competent Project Manager to be in constant charge of work at site.

E. Where a discrepancy exists within the specifications or drawings or between the specifications and drawings, the more stringent (or costly) requirement shall apply until clarification can be obtained from the Engineer. Failure to clarify such discrepancies with the Engineer will not relieve the Contractor of the responsibility of conforming to the requirements of the Contract.

F. Failure of contractor to obtain a full and complete set of contract documents (either before or after bidding) will not relieve the contractor of the responsibility of complying with the

intent of the contract documents.

1.11. CUTTING AND PATCHING

A. Accomplish all cutting and patching necessary for the installation of work under Division 22. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and work¬manlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.

B. Do not cut structural members without approval from the Engineer.

1.12. PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, sleeves, flashings, fittings and caulking to make penetrations absolutely watertight.

1.13. CONNECTIONS AND ALTERATIONS TO EXISTING WORK

A. Unless otherwise noted on the drawings, where existing plumbing work is removed all pipes, valves, etc., shall be removed, including hangers, to a point below finished floors or behind finished walls and capped. Such point shall be far enough behind finished surfaces to allow for installation of normal thickness of required finish material.

B. Where work specified in Division 22 connects to existing equipment, piping, etc., Contractor shall perform all necessary alterations, cuttings, fittings, etc., of existing work as may be necessary to make satisfactory connections between new and existing work, and to leave completed work in a finished and workmanlike condition.

C. Where the work specified under Division 22, or under other Divisions, requires relocation of existing equipment, piping, etc., Contractor shall perform all work and make necessary changes to existing work as may be required to leave completed work in a finished and workmanlike condition. Where existing insulation is disturbed, replace insulation where removed or damaged equal to existing, in type, thickness, density, finish and thermal resistance (R-value) value.

D. Where the relocation of existing equipment is required for access or the installation of new equipment, the contractor shall temporarily remove and/or relocate and re-install as required to leave the existing and new work in a finished and workman like condition.

1.14. DEMOLITION

A. Unless otherwise noted all existing equipment, piping, etc., shall remain.

B. Where existing equipment is indicated to be removed, all associated piping, conduit, power, controls, control panels, sensors, tubing, insulation, hangers, supports and housekeeping pads, etc., patch, paint and repair walls/roof/floor to match existing and/or new finishes.

C. Provide necessary piping, valves, traps, temporary feeds, etc., as required. Drain and refill piping systems as often as necessary to accommodate phasing and to minimize time lengths of outages.

D. The Contractor shall be responsible for visiting the site and determining the existing conditions in which the work is to be performed.

E. Where any abandoned pipes in existing floors, walls, pipe tunnels, ceilings, etc., conflict with new work, remove abandoned pipes as necessary to accommodate new work.

F. The location of all existing equipment, piping, etc., indicated is approximate only and shall be checked and verified. Install all new plumbing work to connect to or clear existing work as applicable.

G. Maintain egress at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and the authorities having jurisdiction.

H. When applicable, make provisions and include in bid all costs associated with confined entry/space requirements and all other applicable OSHA and MOSH regulations.

I. Where required to maintain the existing systems in operation, temporarily backfeed existing systems from new equipment. Contractor shall temporarily extend existing piping systems to new piping systems with the appropriate shut-off valves.

J. At completion of project all temporary piping, valves, controls, etc., shall be removed in their entirely.

K. Existing piping, equipment, materials, etc., not required for re-use or re-installation in this project, shall be removed from the project site.

L. Deliver to the Owner, on the premises where directed, existing equipment and materials which are removed and which are desired by the Owner or are indicated to remain the property of the Owner.

M. All other materials and equipment which are removed shall become property of the Contractor and shall be promptly removed, from the premises, and disposed of by the Contractor, in an approved manner. Contractor shall be responsible for proper disposal of all removed equipment containing refrigerants.

N. Where piping is removed, remove all pipe hangers which were supporting the removed piping. Patch the remaining penetration voids with like materials and paint to match existing construction.

O. Where required, provide and coordinate removal and re-installation of existing equipment. Take care to protect materials and equipment indicated for reuse. Contractor shall repair or replace items which are damaged. Contractor shall have Owner's representative present to confirm condition of equipment prior to demolition.

P. Before demolition begins, and in the presence of the Owners representative, test and note all deficiencies in all existing systems affected by demolition but not completely removed by demolition. Provide a copy of the list of system deficiencies to the Owner and the

Engineer. Videotape existing conditions in each space prior to beginning demolition work.

Q. All existing equipment refused by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor in a timely manner and disposed of in a legal manner.

R. Work Abandoned in Place: cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

S. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

T. Terminate services and utilities in accordance with local laws, ordinances, rules and regulations.

1.15. VIBRATION ISOLATION

A. Furnish and install vibration isolators, flexible connections, supports, anchors and/or foundations required to prevent transmission of vibration from equipment, or piping to building structure. See Division 23 Section, Vibration Controls for HVAC, Plumbing and Fire Protection.

1.16. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

1.17. DEFINITIONS

A. Approve - to permit use of material, equipment or methods conditional upon compliance with contract documents requirements.

B. Furnish and install or provide means to supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.

C. Contractor means the mechanical contractor and any of his subcontractors, vendors, suppliers, or fabricators.

D. Piping includes pipe, all fittings, valves, hangers, insulation, identification, and other accessories relative to such piping.

E. Concealed means hidden from sight in chases, formed spaces, shafts, hung ceilings, embedded in construction or in crawl space.

F. Exposed means not installed underground or concealed as defined above.

G. Invert Elevation means the elevation of the inside bottom of pipe.

H. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.

I. Review - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

J. Building Line: Exterior wall of building.

PART 2. ELECTRICAL REQUIREMENTS – NOT USED

PART 3. EXECUTION

3.1. EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to the Engineer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Do not install equipment or piping over electrical gear, electrical panels, motor controllers, and similar electrical equipment. Install equipment and piping to maintain clear space above and in front of all electrical components per the National Electric Code.

3.2. SUPPORTS, HANGERS AND FOUNDATIONS

A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.

B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. For un-insulated copper piping provide copper hanger to prevent contact of dissimilar metals. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

3.3. DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record demonstration and training video recordings. Record each training module separately.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Engineer

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

3.4. PAINTING AND FINISHES

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 22 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed.

F. Remove all construction marking and writing from exposed equipment, piping and building surfaces. Do not paint manufacturer's labels or tags.

G. All exposed piping, equipment, etc. shall be painted. Colors shall be as stated in this division or as selected by the Owner and conform to ANSI Standards.

H. All exposed piping, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Owner and conform to ANSI Standards.

3.5. CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior surfaces are free of foreign matter.

B. Maintain strainers and dirt pockets in clean condition.

C. Pay for labor and materials required to locate and remove obstructions from systems that are clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

D. Leave systems clean, and in complete running order.

3.6. COLOR SELECTION

A. Color of finishes shall be as selected by the Owner.

B. Submit color of factory-finished equipment for acceptance prior to ordering.

3.7. PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.

B. Cover temporary openings in piping and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver pipes and tubes with factory applied end caps.

C. Cover or otherwise protect all finishes.

D. Replace damaged materials, devices, finishes and equipment.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

3.8. OPERATION OF EQUIPMENT

A. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.

B. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the commencement of testing and balancing work. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

C. Upon completion of work, clean and restore all equipment to new conditions.

3.9. IDENTIFICATIONS, FLOW DIAGRAMS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS

A. All items of equipment, including motor starters and disconnects shall be furnished with white on black plastic permanent identification cards. Lettering shall be a minimum of ¼ inch high. Identification plates shall be secured, affixed to each piece of equipment, starters, disconnects, panels by screw or adhesive (tuff bond #TB2 or as approved equal). Equipment identification and room name or area served shall be on each panel.

B. Provide three (3) copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the Operations and Maintenance Manuals as hereinafter specified.

C. All lines piping installed under this contract shall be stenciled with direction of flow arrows and with stenciled letters naming each pipe and service. Refer to Division 22 Section, Plumbing Piping, Fittings, Valves, Etc. Color code all direction of flow arrows and labels. In finished spaces omit labeling and direction of flow arrows. Paint in color as selected by Owner.

D. Submit list of wording, symbols, letter size, and color coding for plumbing identification. Submit samples of equipment identification cards, piping labels, labels, and valve tags to Engineer for review prior to installation.

E. Provide at least 4 hours of straight time instruction to the operating personnel. Time of instruction shall be designated by the Owner. Additional instruction time for the automatic temperature control (ATC) system is specified in Division 23 Section, Instrumentation and Controls of HVAC and Plumbing Systems.

F. Contractor shall demonstrate Sequences of Operation of all plumbing equipment in presence of Owner's representative, Engineer, and ATC subcontractor.

3.10. WALL AND FLOOR PENETRATION

A. All penetrations of partitions, ceilings, roofs and floors by piping or conduit under Division 22 shall be sleeved, sealed, and caulked airtight for sound and air transfer control. Penetrations of mechanical room partitions, ceilings, and floors shall be as specified in Division 07 Section, "Fire Protection, HVAC and Plumbing Penetration Firestopping".

B. All penetration of fire rated assemblies shall be sleeved, sealed, caulked and protected to maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized. See Division 07 Section, "Fire Protection, HVAC and Plumbing Penetration Firestopping".

C. Where piping extends through exterior walls or below grade, provide waterproof pipe penetration seals, as specified in another division of these specifications.

D. Provide pipe escutcheons for sleeved pipes in finished areas.

E. Piping sleeves:

1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.

2. Twenty-two (22) gauge galvanized steel elsewhere.

3.11. RECORD DRAWINGS

A. Upon completion of the mechanical installations, the Contractor shall deliver to the Engineer one complete set of prints of the mechanical contract drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.

B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering to Engineer.

3.12. WARRANTY

A. Contractor's attention is directed to warranty obligations contained in the General

Conditions and Supplementary Conditions.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer's warranties shall be included in the operations and maintenance manuals.

C. The contractor guarantees for a two (2) year period from the time of final acceptance by the Owner.

1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That the contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The contractor shall also make good all damages caused to their work or materials in the process of complying with this section.

4. That the entire work shall be water-tight and leak-proof.

3.13. OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall have prepared three (3) hardcopies and one (1) electronic copy of the Operations and Maintenance Manuals and deliver these copies of the manuals to the Owner. The manuals shall be as specified herein. The manuals must be approved and will not be accepted as final until so stamped.

B. The manuals shall be bound in a three ring loose-leaf binder similar to National No. 3881 with the following title lettered on the front: Operations and Maintenance Manual – Worcester County Recreation Center - HVAC System Replacements – Plumbing Systems. No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out. Provide divider tabs and table of contents for organizing and separating information.

C. Electronic copies of the manual shall be saved on USB flash drives, and shall be in searchable PDF format with interactive index tabs. Approved electronic copies shall be stored in flash drive zipper cases in front of Volume 1 (if applicable) of hard copies of the manual.

D. Provide the following data in the booklet:

1. As first entry, an approved letter indicating the starting/ending time of Contractor's warranty period.

2. Complete catalog data on each piece of plumbing equipment furnished including approved shop drawing.

3. Provide sales and authorized service representatives names, address, and phone

numbers of all equipment and subcontractors.

4. Provide supplier and subcontractor's names, address, and phone number.

5. Catalog data of all equipment, valves, etc. shall include wiring diagrams, parts list and assembly drawing.

6. Approved Plumbing, and Electrical Certificates.

7. Start-up reports for equipment.

E. Electronic copies of the manual shall be saved on USB flash drives, and shall be in searchable PDF format with interactive index tabs. Approved electronic copies shall be stored in flash drive zipper cases in front of volume 1 (if applicable) of hard copies of the manual.

F. Submit Operations and Maintenance Manuals prior to the anticipated date of substantial completion for Engineer review and approval. Substantial completion requires that Operations and Maintenance Manuals are reviewed and approved.

3.14. INSTALLATION AND COORDINATION DRAWINGS

A. Prepare, submit, and use composite installation and coordination drawings to assure proper coordination and installation of work. Drawings shall include, but not be limited, to the following:

1. Complete Plumbing, Sprinkler and HVAC Piping Drawings showing coordination with lights, electrical equipment, HVAC equipment and structural amenities.

B. Draw plans to a scale not less than 3/8-inch equals one foot. Include plans, sections, and elevations of proposed work, showing all equipment, and piping in areas involved. Fully dimension all work including lighting fixtures, conduits, pullboxes, panelboards, and other electrical work, walls, doors, ceilings, columns, beams, joists and other architectural and structural work.

C. Identify all equipment and devices on wiring diagrams and schematics. Where field connections are shown to factory-wired terminals, include manu¬facturer's literature showing internal wiring.

3.15. PIPING SYSTEMS TESTING

A. The entire new plumbing piping systems shall be tested hydrostatically before insulation covering is applied and proven tight under the following gauge pressures for a duration of twenty-four (24) hours. Testing to be witnessed by Owner's representative and documented in writing.

SYSTEM	TEST PRESSURE
Coil Drain Piping	50 psig

B. All gas piping shall be pressure tested in accordance with NFPA-54 and NFPA-58. Gas

piping systems shall be proven tight under the following gauge pressures for a duration of four (4) hours:

SYSTEM	TEST PRESSURE
Gas Piping	100 psig

C. Testing and acceptance thereof shall be in accordance with local requirements and shall meet approval of authority having jurisdiction. Submit certificates and approved permits and insert one (1) copy in the Operations and Maintenance Manuals.

3.16. OUTAGES

A. Provide a minimum of fourteen (14) days' notice to schedule outages. The Contractor shall include in their bid outages and/or work in occupied areas to occur on weekends, holidays, or at night. Coordinate and get approval of all outages with the Owner.

B. Submit Outage Request form, attached at end of this Section, to Owner for approval.

END OF SECTION

OUTAGE REQUEST

DATE APPLIED: _____ BY: _____

DATE FOR OUTAGE: _____ FIRM: _____

START OUTAGE-TIME: _____ DATE: _____

END OUTAGE -- TIME: _____ DATE: _____

AREAS AND ROOMS: _____

FLOOR(S): _____

AREA(S): _____

ROOM(S): _____

WORK TO BE PERFORMED: _____

SYSTEM(S): _____

REQUEST APPROVED BY: _____

(FOREMAN OR OTHER PERSON IN CHARGE)

(FOR OWNER'S USE ONLY):

APPROVED: _____

YES ____ NO ___ BY: _____ DATE: _____

DATE/TIME-AS REQUESTED: _____ OTHER : _____

OWNER'S PRESENCE REQUIRED: _____

YES: ____ NO: ___ NAME: _____

DIVISION 22 SECTION 220505
PLUMBING PIPING, FITTINGS & VALVES
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SECTION 220505 - PLUMBING PIPING, FITTINGS AND VALVES

PART 1. GENERAL

1.1. SUMMARY

A. The conditions of the contract and other general requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 22 Section, Common Work Results for Plumbing and Division 01, General Requirements.

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

1.2. SYSTEM DESCRIPTION CONDITIONS

A. Provide all labor and materials necessary to furnish and install all piping systems on this project as herein specified and/or shown on the drawings. Final connections to equipment furnished in other sections of the specifications shall be included under this section.

B. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

D. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

E. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.

1.3. QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

C. Maintain one copy of each document on site.

1.4. DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under as hereinbefore specified.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed systems.

1.5. ALTERNATES

A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

PART 2. PRODUCTS

2.1. PIPE MATERIALS

A. All materials, unless otherwise specified, shall be new and of the best quality of their respective kinds, and shall conform to the requirements and ordinances of local, state and insurance authorities having jurisdiction.

1. Gas Piping:

a. Outside building above grade: Schedule 40 black steel pipe, ASTM A53 or A120.
b. Fittings & Joints: 150 lb. screwed malleable iron ASTM B16.3 with joints sealed with litharge and glycerin. Piping 2 ½ inches and larger and any concealed piping within walls must be welded, ASTM A24 forged steel welded type joints shall be threaded or welded to ANSI B31.1 or ASME Sec. 1.
c. Plug Valves: 2- ½ inches & larger ASME B16.38 and MSS SP-78 cast iron lubricated plug valves with 125 psig pressure rating, 3 turn type. Gas valves are prohibited above ceilings.
d. Cocks: 2 inches& smaller - bronze, Crane 270. AGA certified bronze body, plug type with bronze plug, ball type with chrome plated brass ball, for 5 psig or less gas. Include AGA stamp, flat or square head or lever handle, and threaded ends conforming to ASME B1.20.1
e. Ball Valves: Full flow, double seal, ball type with bronze body, Buna-N seals and O-ring packing, chrome plated brass ball and designed for working pressures up to 175 psig. Valves shall be 3 turn type. MSS SP-78, class 175 WOG.
f. Gas Vents: Install vent piping for gas pressure regulators and gas trains, extend outside building to a non-hazardous location away from any potential source of ignition, and vent to atmosphere. Pipe material shall be identical to gas piping here-in before specified. Terminate vents with turned down, reducing elbow fittings with corrosion-resistant insect screen in large end.
g. Finish: All gas piping downstream of regulator, installed exposed outside, shall be primed and finished with two coats of rust resistant paint with pewter gray finish. Paint shall be two part epoxy-exterior paint as manufactured by Pittsburgh Paint, Themeco, or approved equal. Painting shall be provided under another Section of these Specifications.

B. Steel pipe shall be similar and equal to National Tube Company, Grinnell, Republic, or Bethlehem black or zinc-coated (galvanized) as hereinafter specified. Pipe shall be free from all defects which may affect the durability for the intended use. Each length of pipe shall be stamped with the manufacturer's name.

2.2. PIPE HANGERS, ROLLER SUPPORTS, ANCHORS, GUIDES, AND SADDLES

A. All hangers for metallic piping shall be adjustable, wrought clevis type, or adjustable malleable split ring swivel type, having rods with machine threads. Hangers shall be Grinnell Company's Figure 260, Carpenter and Patterson, or approved equal for pipe ¾-inch and larger, and Figure 65 for pipe 2-inches and smaller, or approved equal. Adjustable pipe stanchion with U-bolt shall be Grinnell Company's Figure 191. Pipe roller supports shall be Grinnell's Figure 181 or Figure 271. Exterior pipe hangers shall be galvanized or stainless steel construction. For copper piping in direct contact with the hanger, hanger construction shall be copper coated to prevent contact of dissimilar metals similar to Grinnell's Figure CT-65. Hanger spacing and rod sizes for steel and copper pipe shall not be less than the following:

NOMINAL PIPE SIZE IN	STD. STEEL PIPE	MAXIMUM SPAN FT. COPPER TUBE	MINIMUM ROD DIAMETER INCHES OF ASTM A36 STEEL THREADED RODS
3/4 & 1	6	5	3/8
1 - ½	6	8	3/8
2	8	8	3/8
2 – ½	10	9	½
3	12	10	½

B. Hangers for pipe sizes ½ to 1 ½ inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.

C. Hangers for cold pipe sizes 2 inches (50 mm) and over: Carbon steel, adjustable, clevis.

D. Hangers for cold pipe sizes 2 to 4 inches (50 to 100 mm): Carbon steel, adjustable, clevis.

E. Multiple or Trapeze hangers: Steel channels with welded spacers and hanger rods.

F. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

G. Copper pipe support: Carbon steel ring, adjustable, copper plated.

H. Hanger rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

I. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.3. VALVES

A. Provide parts list and assembly drawings (exploded view) for all valves in shop drawing submittals. Provide valves of the same type by the same manufacturer.

2.4. STRAINERS

A. Strainers shall be of the basket or "Y" type and shall be heavy and durable, constructed of best grade gray iron with the bottoms drilled and plugged. Bodies shall have arrows clearly cast on the sides to show flow direction. Strainers shall be equipped with easily removable covers and brass sediment baskets made of brass not less than #22 gauge in thickness. Total area of basket perforations shall be not less than four times the cross section of the entering pipe. Flow shall be into basket, and then out through the perforations. Strainers shall be suitable for propane gas. Strainers 2 inches and smaller shall have threaded or solder ends, 2 inches and larger shall have flanged ends.

B. Strainer screens shall be stainless steel with perforations and shall be 1/16-inch for pipe sizes 5 inches and less, 1/8-inch (40 percent open area) perforations for pipe sizes 6-inch and greater.

C. Provide valved and capped (with chain) blowdowns in each strainer. Blowdown valves shall be Appolo 78-100/200 series or as approved equal.

D. Strainers shall be manufactured by Watts, Mueller, Armstrong, Yarway, Spirax/Sarco or as approved equal.

2.5. UNIONS, FLANGES, AND COUPLINGS

A. Unions in steel pipe 2-inches and smaller shall be malleable iron with brass inserted seats designed for a working pressure of 150 psig.

B. Unions in copper pipe 2-inches and smaller shall be sweat fittings with bronze seats designed for a working pressure of 125 psig.

C. Flanges for steel pipe over 2 inches shall be 150 psig, forged steel, and slip on type. Gaskets shall be 1/16 inch thick pre-formed neoprene.

D. Flanges for copper pipe over 2 inches shall be bronze. Gaskets shall be 1/16 inch thick preformed neoprene.

2.6. PRESSURE GAUGES

A. Unless otherwise indicated, pressure gauges shall be the bronze bourdon tube type, 4-1/2-inch dial, stem mounting, cast aluminum adjustable pointer, 1 percent accuracy over middle half of scale range, 1-1/2 percent over balance: Trerice Model 600C; Weksler Instruments, Ernst Gage Co., Miljoco, or as approved equal.

B. Gauges shall have pressure, vacuum, compound, or retard ranges as required, select ranges so that the normal readings are at the approximate midpoint and maximum system pressures do not exceed full scale.

C. Furnish and install a gauge valve at each pressure gauge. Gauge valves shall be Crane Model No. 88, Needle Valve, Ernst Gage Co. FLG 200, Wexler Instrument Corp. Type BBV4, or approved equal, rated for pressure intended.

D. Gauge connections for pressure gauges, thermometers, or control instruments shall be made using tee fittings, except that gauge connections up to 1-inch size in steel may be using threaded extra heavy pipe couplings welded directly to the main, provided that the main is at least 2-inch size for 2-inch connections, 3-inch size for 3/4-inch connections, and 4-inch size for 1-inch connections. Minimum gauge connection shall be 2-inch ips.

E. Provide snubbers on all gauges. Snubbers shall be No. 872 by Trerice, RS1/RS6 by Wexler Instruments, Miljoco or as approved equal.

2.7. ESCUTCHEONS

A. Provide chromium plated escutcheons properly fitted and secured with set screws on all exposed piping which passes through walls, floors or ceilings of finished spaces.

B. All escutcheon plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface. Plastic escutcheon plates will not be accepted.

2.8. DIELECTRIC CONNECTIONS

A. Furnish and install electrically insulated dielectric unions, or flanges, as manufactured by Victaulic Company, EPCO Sales, Inc., at the following locations:

1. Where steel piping systems join copper piping.

2. Where copper tube connects to heat exchangers, and other steel vessels.

3. Avoid the installation of steel nipples, cast iron or steel valves and specialties, or other ferrous components in predominately copper piping systems. Where such installation is necessary, isolate the component with dielectric connections. Do not mix steel pipe and copper tube in the same run of pipe or in the same section of a piping system.

4. Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with

grooved and/or threaded ends. UL classified in accordance with NSF-61 for potable water service, and shall meet the low lead requirements of NSF-372. Basis of Design: Victaulic Series 647.

2.9. SLEEVES

A. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, roof structure members or other building parts. Sleeves shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.

B. Sleeves through floors shall be sealed with a waterproof caulking compound.

C. Firestop at sleeves that penetrate smoke barriers smoke partitions and/or rated walls/floors.

2.10. GAS PRESSURE REGULATORS

A. Gas pressure regulators shall be as manufactured by Equimeter, Inc., Maxitrol Co., Rockwell, Fisher Controls, American Meter Co., Pietro Fiorentini, or approved equal. Gas pressure regulators shall maintain a constant downstream pressure with a variable inlet pressure.

B. Gas pressure regulators shall comply with ANSI Z21.18 and shall be single stage, steel jacketed, corrosion-resistant type. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 for 2 inch NPS and smaller and flanged ends for 2 ½ inch NPS and larger.

C. Gas pressure regulator shall be a positive lock-up type regulator where required by equipment manufacturer.

D. Each pressure regulator shall have an identification stamped on diaphragm cover and shall be painted AGA grey. Regulator inlet and outlet pressures, and flow volume in cubic feet per hour of specified gas are as indicated on the contract drawings.

E. Install gas pressure regulators a minimum of 3 feet and no more than 8 feet from the equipment per the manufacturer's requirements.

F. When installed outside, gas pressure regulators shall be listed for such applications.

2.11. GAS PIPING SUPPORTS/BASES

A. Furnish and install gas piping supports for all piping installed. Entire system shall be as manufactured by Eberl Iron Works or approved equal.

B. Bases: the base supports shall be the non-penetrating type preventing need for additional barriers. Base material shall be heavy duty rubber manufactured from 100% recycled ground crumb rubber.

C. Pipe Supports: The pipe supports shall be elevated pipe roller supports. To allow for expansion and contraction the supports shall include pipe rollers, threaded rods, and

supporting hardware. All supports shall be type 304 stainless steel with stainless steel hardware. Furnish with pipe straps to restrain pipes on the rollers.

PART 3. EXECUTION

3.1. GENERAL PIPING INSTALLATION REQUIREMENTS

A. All pipes shall be cut accurately to measurements established at the building, and shall be worked into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted. All pipes shall be so installed as to permit free expansion and contraction without causing damage. All open ends of pipe lines, equipment, etc., shall be properly capped or plugged during installation to keep dirt or other foreign material out of the system. All pipes shall be run parallel with the lines of the building and as close to walls, columns and ceilings as may be practical, with proper pitch. All piping shall be arranged so as not to interfere with removal of other equipment on devices not to block access to doors, windows, manholes, or other access openings. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment, coils, etc., and installed so that there will be no interference with the installation of the equipment, ducts, etc. All valves and specialties shall be placed to permit easy operation and access and all valves shall be regulated, packed and glands adjusted at the completion of the work before final acceptance. All piping shall be installed so as to avoid air or liquid pockets throughout the work. Ends of pipe shall be reamed so as to remove all burrs.

B. All piping shall be run to provide a minimum clearance of 2-inches between finished covering on such piping and all adjacent work. Group piping wherever practical at common elevations.

C. All valves, strainers, caps, and other fittings shall be readily accessible.

D. Rough-in and final connections are required to all equipment and fixtures provided under this Contract.

E. Cutoff valves shall be provided on each branch line from the mains on all plumbing lines.

F. Shut-off valves shall be installed at the inlet and outlet of each piece of equipment to permit isolation for maintenance and repair.

G. Unions shall be installed on all bypasses, at all connections to equipment, where shown on drawings or where required to facilitate removal of equipment whether shown or not.

H. Spring clamp plates (escutcheons) shall be provided where pipes are exposed in the building and run through walls, floors, or ceilings. Plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface.

I. If the size of any piping is not clearly evident in the drawings, the Contractor shall request instructions for the Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at his expense. Where pipe size discrepancies or conflicts exist in the drawings, the larger pipe size shall govern.

J. Install all valves with stem upright or horizontal, not inverted.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld and apply one coat of zinc rich primer.

L. Provide clearance for installation of insulation and access to valves and fittings.

M. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.2. PRESSURE GAGE INSTALLATION REQUIREMENTS.

A. Install gauges and adjust vertical and tilted positions.

B. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.

1. Install with socket extending to one-third diameter of pipe.

2. Fill sockets with oil or graphite and secure caps.

C. Install pressure gages in piping tees with pressure-gage valve located on a pipe at most readable location.

D. Adjust faces of gages to proper angle for best visibility.

E. Clean windows of gauges and clean factory-finished surfaces. Replace cracked and broken window, and repair scratched and marred surfaces with manufacturer's touch up paint.

3.3. VALVE INSTALLATION REQUIREMENTS

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Examine grooved ends for form and cleanliness. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

G. Do not attempt to repair defective valves; replace with new valves.

H. Install valves as indicated, according to manufacturer's written instructions.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

J. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

K. Locate valves for easy access and provide separate support where necessary.

L. Install valves in horizontal piping with stem at or above the center of the pipe.

M. Install valves in a position to allow full stem movement.

N. Adjust or replace packing after piping systems have been tested and put into service. Replace valves if leak persists.

3.4. PIPE JOINTS INSTALLATION REQUIREMENTS

A. Screwed Joints: All screwed joints shall be made with tapered threads properly cut. Screwed joints shall be made perfectly tight with a stiff mixture of graphite and oil, applied with a brush to the male threads on the fittings.

B. Soldered Joints and Copper Piping: Joints in copper piping shall conform to the following minimum standards.

1. The pipes shall be cut to a length making certain that the ends are square, using a fins hacksaw blade or tube cutter. The ends of all pipes shall be reamed and all burrs removed.

2. The outside end of the pipe and the cut end of the fitting shall be cleaned with steel wool, sand cloth, or steel wire brush. All dark spots shall be removed.

3. The flux shall be applied evenly and sparingly to the outside end of the pipe and the inside of the outer end of the fitting until all surfaces to be jointed are completely covered. The piping and fitting shall be slipped together and reworked several times to insure an even distribution of the flux.

4. The correct amount of solder per joint for each size pipe shall be used in accordance with the manufacturer's recommendations.

5. Solder joints shall be made by using a direct flame from a torch.

6. On pipe sizes larger than ¼-inch, the fittings and valves in the pipe shall be moved or tapped with a hammer when the solder starts to melt to insure an even distribution of the solder.

7. The excess solder shall be removed while it is still in the plastic state leaving a fillet around the cup of the fitting.

8. Solder joints shall be suitable for working pressure of 100 psig and for working temperature of not less than 250 degrees F. The type of solder and flux used will

be submitted for approval. Type 95-5 shall be the minimum standard.

9. Lead and antimony-based solders shall not be used for potable water systems. Brazing and silver solders are acceptable.

C. Where copper piping joins steel piping, approved bronze adapters shall be used.

D. Prohibited Connections: No direct weld, soldered, or brazed connections, without unions or flanges, shall be made to valves, strainers, apparatus, or related equipment. Right and left couplings, long threads, or caulking of pipe threads or gasket joints will not be permitted.

E. When installing gas piping which is to be concealed (i.e., in walls), unions, tube fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combination of fittings shall not be used. All concealed piping within walls shall be welded.

1. Gas Piping

2. Final Gas Connections: Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings.

3. Pipe Joints:

a. Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.
b. Threaded Metallic Joints: Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.
c. Welded Metallic Joints: Beveling, alignment, heat treatment, and inspection of welds shall conform to ASME B31.2. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stores so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.
d. Thermoplastic Joints: Jointing procedures shall conform to AGA 01. Solvent cement or heat of fusion joints shall not be made between different kinds of plastics.
e. Joining Thermoplastic to Metallic Piping: When compression-type mechanical joints are used, the gasket material in the fittings shall be compatible with the plastic piping and with the gas in the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting, and the stiffener shall be flush with the end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. A split tubular stiffener shall not be used.
f. Special Requirements; Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall comply with NFPA 54

and/or NFPA-58.

4. Gas pressure regulators shall be installed and located per the manufacturer's requirements for gas furnaces the gas regulators shall not be installed less than 3 feet nor more than 8 feet from the unit unless the manufacturer require otherwise.

3.5. HANGERS AND SUPPORTS INSTALLATION REQUIREMENTS

A. General: All hangers shall be of an approved type arranged to maintain the required grading and pitching of lines to prevent vibration and to provide for expansion and contraction. Provide protection saddles between hangers and insulation on heating water insulated pipe. Saddles shall be Victaulic, Grinnells Figure 173/273, Sure-Joint, or approved equal. Provide approved spacers between saddles and pipe where flexible insulation is specified. Provide insulation protection shields for insulated piping without saddles. Shields shall be Carpenter Patterson, Grinnell Figure 167 or as approved equal.

B. Spacing: Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.

C. Racks and Brackets: All horizontal piping on vertical walls shall be properly supported by suitable racks securely anchored into the wall construction. Where not practical to obtain ceiling anchorage, all piping near walls shall be supported by approved brackets securely anchored into the wall construction. Washer plates (Fib. 60, 60L) and other miscellaneous attachments, fasteners, etc., shall be Carpenter Patterson, Grinnell or as approved equal. All exterior hanger and bracket systems in their entirety shall be galvanized.

D. Pipe Hangers and supports shall be attached to the panel point at the top chord of bar joist or at a location approved by the structural engineer.

E. Select hangers and components for loads imposed. Secure rods with double nuts.

F. Support of horizontal piping shall allow for vertical adjustment after installation of piping.

G. Support overhead piping with clevis hangers.

3.6. DIRT POCKETS INSTALLATION REQUIREMENTS

A. Dirt pockets shall be installed at the base of all risers, upstream of gas regulators, and ahead of all gas equipment and as indicated on the drawings.

3.7. PIPING IDENTIFICATION REQUIREMENTS

A. All piping shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color code and system identification shall comply with ANSI Standards and piping identification system shall comply with ASME A13.1-81., scheme for the identification of piping systems and ASHRAE Fundamentals Handbook, latest edition.

B. Markings shall be plain block letters, stenciled on pipes, and shall be located near each branch connection, near each valve, and at least every 10 feet on straight runs of pipe.

Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor. Pipe identification schedule shall be as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
½ to 1 ¼	8	½
1-½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
Over 10	32	3 ½

3.8. PRESSURE SEAL FITTING INSTALLATION REQUIREMENTS

A. Viega, ProPress Pressure Seal bronze, Mueller Streamline, or approved equal or copper fittings: Sealing element shall be verified for the intended use. Tube ends shall be cut on a right angle (square) to the tube. Tube ends shall be reamed and chamfered, all grease oil or dirt shall be removed from the tube end with a clean rag. Visually examine the fitting sealing element to ensure there is no damage, and it is properly seated into the fitting. Utilizing a Viega Insertion Depth Inspection Gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the tube fully into the fitting and mark the tube wall at the face of the fitting. Always examine the tube to ensure it is fully inserted into the fitting prior to pressing the joint. ProPress fittings shall be installed according to the most current edition of the Viega installation guidelines. Installers shall attend a Viega ProPress installation training class.

B. After ProPress, Mueller Streamline, or approved equal. Pressure seal fittings have been installed a “two step test” shall be followed. Pressurize the system with application appropriate test medium, water between 15 and 85 psi, or air/dry nitrogen between .5 and 45 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, walk the system and check for un-pressed fittings. Should you identify an un-pressed fitting ensure the tube is fully inserted into the fitting and properly marked, prior to pressing the joint. After appropriate repairs have been made, retest the system per local code, or specification requirements, not to exceed 600 psi with water or 200 psi when using air fitting.

END OF SECTION

DIVISION 23 SECTION 230500
COMMON WORK RESULTS FOR HVAC
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SECTION 230500 COMMON WORK RESULTS FOR HVAC

PART 1. GENERAL

1.1. SUMMARY

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

B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all mechanical work.

C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the the Engineer.

D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange piping, ductwork, equipment, and other work generally as shown on the contract drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Submittals specified below. The right is reserved to make reasonable changes in location of equipment, piping, and ductwork, up to the time of rough-in or fabrication.

E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.

F. Coordinate the work under Division 23 with the work of all other construction trades.

G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the contract documents.

1.2. PERMITS AND FEES

A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.

B. Permits and fees shall comply with the Division 01, General Requirements of the specification.

1.3. EXAMINATION OF SITE

A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for contractors' failure to do so.

B. Examine and verify specific conditions described in individual specifications sections.

C. Verify that utility services are available, of the correct characteristics, and in the correct

locations.

1.4. CONTRACTOR QUALIFICATION

A. Any Contractor or Subcontractor performing work under Division 23 shall be fully qualified and acceptable to the Engineer and Owner. Submit the following evidence when requested:

1. A list of not less than five comparable projects which the Contractor completed.

2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.

3. Local and/or State License, where required.

4. Membership in trade or professional organizations where required.

B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.

C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

1.5. MATERIALS AND EQUIPMENT

A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality. Existing items of equipment are being relocated under another Division of these specifications. The Contractor shall be responsible for connecting all utilities as shown on the drawings, to equipment identified as existing.

B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.

C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.

D. Substitution will not be permitted for specified items of material or equipment where noted.

E. All items of equipment furnished shall have a service record of at least five (5) years.

1.6. FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.7. REFERENCED STANDARDS, CODES AND SPECIFICATIONS

A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.

B.	AABC		Associated Air Balance Council
C.	ACCA	-	Air Conditioning Contractors of America
D.	ADC		Air Diffusion Council
E.	AGA		American Gas Association
F.	AMCA		Air Movement and Control Association
G.	ANSI	-	American National Standards Institute
H.	ARI	-	Air Conditioning and Refrigeration Institute
I.	ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
J.	ASME	-	American Society of Mechanical Engineers
K.	ASPE	-	American Society of Plumbing Engineers
L.	ASTM	-	American Society for Testing and Materials
M.	IBC	-	International Building Code
N.	IEEE	-	Institute of Electrical and Electronics Engineers
O.	MSSP Industry	-	Manufacturers Standards Society of the Valve and Fittings
P.	NEC	-	National Electrical Code
Q.	NEMA	-	National Electrical Manufacturers Association
R.	NFPA	-	National Fire Protection Association
S.	NSF	-	National Sanitation Foundation
T.	SMACNA Association	-	Sheet Metal and Air Conditioning Contractors National

U. UL - Underwriters' Laboratories

V. All mechanical equipment and materials shall comply with the codes and standards listed in the latest edition of ASHRAE HVAC Applications Handbook, Chapter entitled Codes and Standards.

1.8. SUBMITTALS, REVIEW AND ACCEPTANCE

A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in best interest of Owner.

B. After acceptance of Material and Equipment List, submit three (3) copies or more as required under General Conditions of complete descriptive data for all items. Data shall consist of specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, installation instructions, and any other information necessary to indicate complete compliance with Contract Documents. Edit submittal data specifically for application to this project.

C. Thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission. Coordinate installation requirements and any electrical requirements for equipment submitted. Contractor shall be responsible for correctness of all submittals.

D. Submittals will be reviewed for general compliance with design concept in accordance with contract documents, but dimensions, quantities, or other details will not be verified.

E. Identify submittals, indicating intended application, location and service of submitted items. Refer to specification sections or paragraphs and drawings where applicable. Clearly indicate exact type, model number, style, size and special features of proposed item. Submittals of a general nature will not be acceptable. For substituted items, clearly list on the first page of the submittal all differences between the specified item and the proposed item. The contractor shall be responsible for corrective action and maintaining the specification requirements if differences have not been clearly indicated in the submittal.

F. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Call attention, in writing, to deviation from contract requirements.

G. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted. Use only final or corrected submittals and data prior to fabrication and/or installation.

H. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

I. For resubmissions, the Contractor must address in writing all of the Engineer’s comments

on the original submission to verify compliance.

1.9. SHOP DRAWINGS

A. Prepare and submit shop drawings for all mechanical equipment, specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on contract drawings.

B. Submit data and shop drawings including but not limited to the list below, in addition to provisions of the paragraph above. Identify all shop drawings by the name of the item and system and the applicable specification paragraph number and drawing number.

C. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct shop drawing. Grouping of items/systems that are not related shall be unacceptable.

D. Items and Systems

1. Airflow Monitoring Stations
2. Air Distribution Systems
3. Automatic Temperature Control Systems and Equipment
4. Carbon Dioxide Sensors/Carbon Monoxide Sensors
5. Central Control and Monitoring Systems (CCMS) and Equipment
6. Duct Sox
7. Drip Pans
8. Duct Materials
9. Equipment Rails
10. Exterior Equipment/Duct/Piping Supports
11. Exterior Ductwork
12. Filters
13. Fire Stopping - Methods and Materials
14. Grilles, Registers
15. Identification Systems
16. Louvers and Insulated Blank-Off Panels
17. Material and Equipment Lists

18. Motor Operated Dampers
19. Operations and Maintenance Manuals
20. Pipe Materials Including Itemized Schedules
21. Preliminary Testing and Balancing Reports
22. Refrigerant Mitigation Controls
23. Refrigerant Monitoring Systems
24. Relief Air Dampers
25. Screen shots of ATC System Graphics
26. Single Zone VAV Units
27. Static Pressure Sensors
28. Strainers
29. Test Certificates
30. Thermal Insulation Materials Include Table Summaries
31. Variable Frequency Drive Motor Bearing Protective Rings
32. Variable Speed Drives
33. Vibration Isolation Materials
34. Weatherproof Assembly Components
35. Wiring Diagrams, Flow Diagrams and Operating Instructions

E. Contractor, additionally, shall submit for review any other shop drawings as required by the Engineer. No item shall be delivered to the site, or installed, until the Contractor has received a submittal from the Engineer marked Reviewed or Comments Noted. After the proposed materials have been reviewed, no substitution will be permitted except where approved by the Engineer.

F. For any shop drawing requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

1.10. SUPERVISION AND COORDINATION

A. Provide complete supervision, direction, scheduling, and coordination of all work under the Contract, including that of subcontractors.

B. Coordinate rough-in of all work and installation of sleeves, anchors, and supports for piping, ductwork, equipment, and other work performed under Division 23.

C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

D. Coordinate electrical work required under Division 23 with that under Division 26. Coordinate all work under Division 23 with work under all other Divisions.

E. Supply services of an experienced (10 year minimum) and competent Project Manager to be in constant charge of work at site.

F. Where a discrepancy exists within the specifications or drawings or between the specifications and drawings, the more stringent (or costly) requirement shall apply until clarification can be obtained from the Engineer. Failure to clarify such discrepancies with the Engineer will not relieve the Contractor of the responsibility of conforming to the requirements of the Contract.

G. Failure of contractor to obtain a full and complete set of contract documents (either before or after bidding) will not relieve the contractor of the responsibility of complying with the intent of the contract documents.

H. Coordinate installation of large equipment requiring positioning. Where required arrange for manufacturer to ship equipment in modules.

1.11. CUTTING AND PATCHING

A. Accomplish all cutting and patching necessary for the installation of work under Division 23. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and work¬manlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.

B. Do not cut structural members without approval from the Engineer.

1.12. PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, sleeves, flashings, fittings and caulking to make penetrations absolutely watertight.

1.13. CONCRETE AND MASONRY WORK

A. Furnish and install concrete and masonry work for equipment foundations, supports, pads, and other items required under Division 23. Perform work in accordance with requirements of other applicable Divisions of these specifications.

B. Concrete shall test not less than 3,000 psi compressive strength after 28 days.

C. Grout shall be non-shrink, high strength mortar, free of iron of chlorides and suitable for use in contact with all metals, without caps or other protective finishes. Apply in accordance with manufacturer's instructions and standard grouting practices.

D. Paint the perimeter of all housekeeping pads safety yellow.

1.14. CONNECTIONS AND ALTERATIONS TO EXISTING WORK

A. Unless otherwise noted on the drawings, where existing mechanical work is removed, pipes, valves, ductwork, etc., shall be removed, including hangers, to a point below finished floors or behind finished walls and capped. Such point shall be far enough behind finished surfaces to allow for installation of normal thickness of required finish material.

B. Where work specified in Division 23 connects to existing equipment, piping, ductwork, etc., Contractor shall perform all necessary alterations, cuttings, fittings, etc., of existing work as may be necessary to make satisfactory connections between new and existing work, and to leave completed work in a finished and workmanlike condition.

C. Where the work specified under Division 23, or under other Divisions, requires relocation of existing equipment, piping, ductwork, etc., Contractor shall perform all work and make necessary changes to existing work as may be required to leave completed work in a finished and workmanlike condition. Where existing insulation is disturbed, replace insulation where removed or damaged equal to existing, in type, thickness, density, finish and thermal resistance (R-value) value.

D. Where the relocation of existing equipment is required for access or the installation of new equipment, the contractor shall temporarily remove and/or relocate and re-install as required to leave the existing and new work in a finished and workman like condition.

1.15. DEMOLITION

A. Unless otherwise noted all existing equipment, piping, ductwork, etc., shall remain.

B. Where existing equipment is indicated to be removed, all associated piping, conduit, power, controls, control panels, sensors, tubing, insulation, hangers, ductwork, supports and housekeeping pads, etc., patch, paint and repair walls/roof/floor to match existing and/or new finishes.

C. Provide necessary piping, valves, traps, temporary feeds, etc., as required. Drain and refill piping systems as often as necessary to accommodate phasing and to minimize time lengths of outages.

D. The Contractor shall be responsible for visiting the site and determining the existing conditions in which the work is to be performed.

E. Refer to phasing plans for additional requirements.

F. Where any abandoned pipes in existing floors, walls, pipe tunnels, ceilings, etc., conflict with new work, remove abandoned pipes as necessary to accommodate new work.

G. The location of all existing equipment, piping, ductwork, etc., indicated is approximate

only and shall be checked and verified. Install all new mechanical/plumbing/fire protection work to connect to or clear existing work as applicable.

H. Maintain egress at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and the authorities having jurisdiction.

I. Make provisions and include in bid all costs associated with confined entry/space requirements and all other applicable OSHA and MOSH regulations.

J. Where required to maintain the existing systems in operation, temporarily backfeed existing systems from new equipment. Contractor shall temporarily extend existing piping systems to new piping systems with the appropriate shut-off valves.

K. At completion of project all temporary piping, valves, controls, etc., shall be removed in their entirely.

L. Existing piping, equipment, ductwork, materials, etc., not required for re-use or re-installation in this project, shall be removed from the project site.

M. Deliver to the Owner, on the premises where directed, existing equipment and materials which are removed and which are desired by the Owner or are indicated to remain the property of the Owner.

N. All other materials and equipment which are removed shall become property of the Contractor and shall be promptly removed, from the premises, and disposed of by the Contractor, in an approved manner. Contractor shall be responsible for proper disposal of all removed equipment containing refrigerants. Contractor shall include in his bid all cost associated with the evacuation, removal and disposal of all existing equipment containing refrigerants in accordance with EPA and Health Department requirements.

O. Where piping and/or ductwork is removed, remove all pipe or ductwork hangers which were supporting the removed piping or ductwork. Patch the remaining penetration voids with like materials and paint to match existing construction.

P. Where required, provide and coordinate removal and re-installation of existing equipment. Take care to protect materials and equipment indicated for reuse. Contractor shall repair or replace items which are damaged. Contractor shall have Owner’s representative present to confirm condition of equipment prior to demolition.

Q. Before demolition begins, and in the presence of the Owners representative, test and note all deficiencies in all existing systems affected by demolition but not completely removed by demolition. Provide a copy of the list of system deficiencies to the Owner and the Engineer. Videotape existing conditions in each space prior to beginning demolition work.

R. The Owner shall have the first right of refusal for all fixtures, devices and equipment removed by the Contractor.

S. All devices and equipment designated by the Owner to remain the property of the Owner shall be moved and stored by the Contractor at a location on site as designated by the Owner. It shall be the Contractor’s responsibility to store all devices and equipment in a safe manner to prevent damage while stored.

T. All existing equipment refused by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor in a timely manner and disposed of in a legal manner.

U. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

V. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

W. Terminate services and utilities in accordance with local laws, ordinances, rules and regulations.

1.16. DRIVE GUARDS

A. Provide safety guards on all exposed belt drives, motor couplings, and other rotating machinery. Provide fully enclosed guards where machinery is exposed from more than one direction.

B. When available, guards shall be factory fabricated and furnished with the equipment. Otherwise fabricate guards of heavy gauge steel, rigidly braced, removable, and finish to match equipment served. Provide openings for tachometers. Guards shall meet local, State and O.S.H.A. requirements.

1.17. VIBRATION ISOLATION

A. Furnish and install vibration isolators, flexible connections, supports, anchors and/or foundations required to prevent transmission of vibration from equipment, piping or ductwork to building structure. See Division 23 Section, “Vibration Control for HVAC, Plumbing and Fire Protection Equipment”.

1.18. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

1.19. REFRIGERANT SYSTEM CAPS

A. For all exterior grade equipment containing refrigerant install lockable caps on service valves to prevent tampering. Lockable caps shall be Model NPR as manufactured by Rector Seal or approved equal. Provide Model NPR Novent screwdriver tool with swiveling tip. Caps shall be suitable and specific for the refrigerant type utilized.

1.20. DEFINITIONS

A. Approve - to permit use of material, equipment or methods conditional upon compliance with contract documents requirements.

B. Furnish and install or provide means to supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.

C. Contractor means the mechanical contractor and any of his subcontractors, vendors,

suppliers, or fabricators.

D. Piping includes pipe, all fittings, valves, hangers, insulation, identification, and other accessories relative to such piping.

E. Ductwork includes duct material, fittings, hangers, insulation, sealant, identification and other accessories

F. Concealed means hidden from sight in chases, formed spaces, shafts, hung ceilings, embedded in construction or in crawl space.

G. Exposed means not installed underground or concealed as defined above.

H. Invert Elevation means the elevation of the inside bottom of pipe.

I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.

J. Review - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

K. ECM: Electronically Commutating Motor.

L. Building Line: Exterior wall of building.

1.21. MINIMUM EFFICIENCY REQUIREMENTS

A. All heating, ventilating, and air conditioning equipment shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

B. All piping, ductwork, and equipment insulation shall comply with ASHRAE Standard 90.1, latest edition.

C. All mechanical devices, controls, accessories, and components shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

D. Where Energy Star certification exists for equipment utilized on this project, the equipment must be Energy Star certified. Provide Energy Star certification with submittals.

1.22. SYSTEM INTEGRATION

A. For all HVAC equipment specified to be provided with packaged controls and interfaced with the automatic temperature control system, provide system integration between the equipment manufacturer and the automatic temperature control subcontractor.

B. HVAC equipment submittals requiring system integration as defined above must identify all required system integration points.

C. HVAC equipment manufacturers must coordinate with ATC subcontractor regarding system integration prior to submitting on the equipment.

D. A system integration meeting must be arranged by the Mechanical Contractor and include, but not be limited to the systems integrator for the HVAC equipment manufacturer and the ATC Subcontractor. This portion of systems integration must occur prior to HVAC equipment being delivered to the project.

E. Once the HVAC equipment is on site, a second systems integration meeting must be arranged by the Mechanical Contractor to coordinate the packaged controls with the ATC system. The HVAC equipment manufacturer's representative familiar with system integration and the ATC subcontractor familiar with programming must be present.

F. A final system integrations meeting shall occur once all equipment is in place and ready for operation. The Mechanical Contractor, the HVAC equipment systems' integrator, and the ATC Subcontractor shall meet on site to jointly program, schedule, verify points, interlock devices, and fully set up all systems integration components.

G. All systems integration coordination, programming, and graphics must be completed prior to requesting commissioning and/or inspections by the Engineer of Record.

1.23. COORDINATION WITH WORCESTER COUNTY I.T. DEPARTMENT

A. All equipment that interfaces with the internet shall be coordinated with the Worcester County I.T. Department to verify that the same is suitable for use on the Worcester County I.T. infrastructure. Coordinate with the Worcester County I.T. Department regarding the allowable frequency bands to avoid interference with the Worcester County I.T. infrastructure.

1.24. VFD BYPASSES

A. When VFD's are specified with integral bypasses and the equipment manufacturer is not able to provide bypasses due to equipment space constraints, then the manufacturer must provide spare VFD's for each fan.

1.25. A2L REFRIGERANT REQUIREMENTS

A. All refrigerants utilized on this project shall be lower flammability and lower toxicity refrigerants as defined by ASHRAE Standard 34-Designation and Safety Classification of refrigerants. Per ASHRAE 34-2019, this project shall only utilize A2L refrigerants in HVAC equipment such as R-32 and R-454B.

B. Refrigerants classified as B-1, B2i, A2, B2, A3, and B3 shall not be utilized.

C. All scroll compressor products shall be manufactured in compliance with UL-60335-2-40.

D. All equipment including installations shall comply with ASHRAE 15-2022 requirements and International Mechanical Code requirements whichever is more stringent.

E. The installing contractor shall submit a declaration to the authority having jurisdiction that the refrigerant systems have been installed and tested per ASHRAE 15-2022.

F. Provide equipment with U.L listed refrigerant mitigation controls per ASHRAE 15-2022 requirements.

G. HVAC equipment manufacturer shall submit calculations indicating compliance with ASHRAE 15-2022.

PART 2. ELECTRICAL REQUIREMENTS

2.1. GENERAL MOTOR AND ELECTRICAL REQUIREMENTS

A. Furnish and install control and interlock wiring for the equipment furnished. In general, power wiring and motor starting equipment will be provided under Division 26. Carefully review the contract documents to coordinate the electrical work under Division 23 with the work under Division 26. Where the electrical requirements of the equipment furnished differ from the provisions made under Division 26, make the necessary allowances under Division 23. Where no electrical provisions are made under Division 26, include all necessary electrical work under Division 23.

B. All electrical work performed under Division 23 shall conform to the applicable requirements of Division 26 and conforming to the National Electrical Code. All wiring, conduit, etc., installed in ceiling plenums must be plenum rated per NFPA and the International Building Code.

C. Provide wiring diagrams with electrical characteristics and connection requirements.

D. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than five (5) horsepower.

E. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

F. All motors shall be furnished with visible nameplate indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor and efficiency.

G. Motors located in exterior locations, wet air streams, air cooled condensers, and outdoors shall be totally enclosed weatherproof epoxy-treated type.

H. Nominal efficiency and power factor shall be as scheduled at full load and rated voltage when tested in accordance with IEEE 112.

I. Brake horsepower load requirement at specified duty shall not exceed 85 percent of nameplate horsepower times NEMA service factor for motors with 1.0 and 1.15 service factors.

J. All single phase motors shall be provided with thermal protection: Internal protection shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature ratings of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.

K. Where a motor disconnect is indicated downstream of a variable frequency drive (VFD) provide interlock wiring from the auxiliary contacts on the disconnect to the VFD to de-energize when the disconnect is turned "off".

L. Where equipment under this Division is specified with integral disconnecting means, the same shall be a single disconnecting means for disconnecting all ungrounded main power supply conductors that is capable of being locked in the open ("off") position in accordance with the National Electrical Code and the local electrical inspector.

2.2. MOTORS AND CONTROLS

A. Motors and controls shall conform to the latest requirements of IEEE, NEMA, NFPA-70 and shall be UL listed. Motor sizes are specified with the driven equipment. Motor starting and control equipment is specified either with the motor which is controlled or in an electrical specification section. The Contractor is advised to consult all specification sections to determine responsibility for motors and controls.

B. Motors shall be designed, built and tested in accordance with the latest revision of NEMA Standard MG l.

C. Motors used with variable-frequency controllers shall have ratings, characteristics, and features coordinated with and approved by the variable frequency controller (drive) manufacturer. As a minimum the following shall apply to variable frequency controlled motors:

1. Motors shall be manufactured to withstand peak voltages of 1600 volts with .1 microsecond rise time per NEMA MG-1.

2. Critical vibration frequencies of motor shall not be within operating range of variable frequency controller output.

3. Temperature rise: Match rating for Class B insulation.

4. Insulation: Class F.

5. Thermal Protection: Conform to MG1 requirements for thermally protected motors.

D. Motors shall be suitable for use under the conditions and with the equipment to which applied, and designed for operation on the electrical systems specified or indicated.

1. Motor capacities shall be such that the horsepower rating and the rated full-load current will not be exceeded while operating under the specified operating conditions. Under no condition shall the motor current exceed that indicated on the nameplates.

2. Motor sizes noted in the individual equipment specifications are minimum requirements only. It is the responsibility of the equipment manufacturers and of the Contractor to furnish motors, electrical circuits and equipment of ample capacity to operate the equipment without overloading, exceeding the rated full-load current, or overheating at full-load capacity under the most severe operating

service of this equipment. Motors shall have sufficient torque to accelerate the total WR2 of the driven equipment to operating speed.

3. Motors shall be continuous duty type and shall operate quietly at all speeds and loads.

4. Motors shall be designed for operation on 60 hertz power service. Unless otherwise specified or shown, motors less than ½ horsepower shall be single phase, and motors ½ horsepower and larger shall be 3 phase unless otherwise noted.

5. Motors shall be mounted so that the motor can be removed without removing the entire driven unit.

E. Single phase motors, smaller than 1/20 horsepower shall be ball or sleeve bearing; drip-proof, totally enclosed or explosion proof, as specified; 120 volts; permanent-split capacitor or shaded pole type. These motors shall not be used for general power purposes, and shall only be provided as built-in components of such mechanical equipment as fans, unit heaters, humidifiers and damper controllers. When approved by the Engineer, deviations from the specifications will be permitted as follows:

1. Open motors may be installed as part of an assembly where enclosure within a cabinet provides protection against moisture.

2. Motors used in conjunction with low voltage control systems may have a voltage rating less than 115 volts.

F. Single phase motors, greater than 1/20 horsepower and less than ½ horsepower shall be ball bearing; drip-proof, totally enclosed or explosion proof, as specified, with Class A or B insulation, as standard with the motor manufacturer; 115 or 120/208/240 volts as required; capacitor start-induction run, permanent split capacitor, or repulsion start-induction run type with minimum efficiency of 70 percent and a minimum full load power of 77 percent.

G. Except as otherwise specified in the various specification sections, 3 phase motors 60 horsepower and smaller shall be NEMA design B squirrel cage induction type meeting the requirements of this paragraph. Motors shall be drip-proof, totally enclosed or explosion proof, as specified or indicated. Insulation shall be Class B or F, at 40 degrees C ambient temperature. Drip-proof motors shall have a 1.15 service factor and totally enclosed and explosion proof motors shall have a service factor of 1.00 or higher. Motors specified for operation at 480, 240, and 208 volts shall be nameplated 460, 230, 200 volts, respectively. Efficiencies and percent power factor at full load for three phase motors shall be not less than the values listed below for premium efficiency motors:

MOTOR NAMEPLATE	MINIMUM PERCENT EFFICIENCY AT NOMINAL SPEED AND RATED LOAD	MINIMUM PERCENT POWER FACTOR
1HP and above to	85.5 percent	84 percent
1-½ HP	86.5 percent	85 percent
2HP	86.5 percent	85 percent
3HP	89.5 percent	86 percent
5HP	89.5 percent	87 percent
7½ HP	91 percent	86 percent
10HP	91.7 percent	85 percent
15HP	93.0 percent	85 percent
20HP	93.0 percent	86 percent
25HP	93.6 percent	85 percent

H. Three phase motors ½ HP or greater shall be the Duty Master XE by Reliance Electric Company, Super-E Premium Efficiency of Baldor Motor and Drives, E-plus Efficient Standard Duty Motor of the Electric Motor Division of Gould, Inc., the MAC II High Efficiency motor of Westinghouse Electric Corp., the equivalent product of General Electric, or approved equal.

I. For motors serving equipment being controlled by a variable speed drive, motor shall be premium efficiency inverter duty rated.

J. Motor frames shall be NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast-iron or aluminum with steel inserts.

K. Control of each motor shall be manual or automatic as specified for each in the various mechanical sections. In general, and unless otherwise specified for a particular item in the various mechanical sections of the specifications, motor starters and controls shall be specified and provided under the various electrical sections of these specifications.

L. Provide manufacturer's warranty for all motors for minimum of 5 years including all labor and materials.

2.3. MOTOR INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors to support shaft regardless of shaft position.

C. Check line voltage and phase and ensure agreement with nameplate. Check that proper thermal overloads have been installed prior to operating motors.

D. Use adjustable motor mounting bases for belt-driven motors.

E. Align pulleys and install belts.

F. Tension belts according to manufacturer's written instructions.

2.4. WIRING DIAGRAMS

A. The Contractor is responsible for obtaining and submitting wiring diagrams for all major items of equipment.

B. Wiring diagrams shall be provided with shop drawings for all equipment requiring electric power.

C. Provide wiring diagrams for all major mechanical items of equipment to electrical contractor and ATC subcontractor for coordination.

2.5. VARIABLE FREQUENCY DRIVE MOTOR BEARING PROTECTIVE RINGS:

A. For all motors driven by a variable frequency PWM drive include a maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents. Grounding rings shall be manufactured by AEGIS SGR or approved equal.

B. Furnish units with two (2) year warranty.

C. Size and select Bearing Protective Rings per the manufacturer requirements based on the motor size, shaft diameter, and shaft shoulder length. For motors with slingers furnish and install NEMA /IEC kit as required.

D. Furnish and apply Colloidal silver shaft coating to all shafts with Bearing Protective Rings to improve shaft voltage discharge capability.

2.6. ENCLOSURES

A. Electrical enclosures including factory provided enclosures, field provided and installed enclosures, and automatic temperature control system enclosures shall be as follows:

1. Dry Interior Locations: NEMA 1.

2. Damp/Wet Locations, Including Exterior Locations: NEMA 3R.

3. Corrosive Locations, Including Janitor's Closets, Chemical Storage Rooms and Similar Space: NEMA 4X.

PART 3. EXECUTION

3.1. EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to Engineer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Do not install equipment, ductwork, or piping over electrical gear, electrical panels, motor controllers, and similar electrical equipment. Install equipment, ductwork, and piping to maintain clear space above and in front of all electrical components per the National Electric Code.

3.2. SUPPORTS, HANGERS AND FOUNDATIONS

A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workman-like manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.

B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. For un-insulated copper piping provide copper hanger to prevent contact of dissimilar metals. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

C. Concrete housekeeping pads and foundations shall be not less than 4 inches high and shall extend a minimum of 6 inches beyond equipment bases. Provide wire-mesh reinforcement; chamfer exposed edges and corners; and finish exposed surfaces smooth.

3.3. PAINTING AND FINISHES

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 23 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed.

F. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces. Do not paint manufacturer's labels or tags.

G. All exposed ductwork, piping, equipment, etc. shall be painted. Colors shall be as stated in this division or as selected by the Owner and conform to ANSI Standards.

H. All exterior ductwork, equipment, piping, and vents shall be painted to match wall in color as selected by Owner.

I. All exposed ductwork, piping, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Owner and conform to ANSI Standards.

3.4. CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior surfaces are free of foreign matter.

B. Maintain strainers and dirt pockets in clean condition.

C. Clean fans, ductwork, enclosures, flues, registers, grilles, and diffusers at completion of work.

D. Install filters of equal efficiency to those specified in permanent air systems operated for temporary heating during construction. Replace with clean filters as specified prior to acceptance and after cleaning of system.

E. Pay for labor and materials required to locate and remove obstructions from systems that are clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

F. Leave systems clean, and in complete running order.

3.5. COLOR SELECTION

A. Color of finishes shall be as selected by the Owner.

B. Submit color of factory-finished equipment for acceptance prior to ordering.

3.6. PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.

B. Cover temporary openings in piping, ductwork, and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver pipes and tubes with factory applied end caps.

C. Cover or otherwise protect all finishes.

D. Replace damaged materials, devices, finishes and equipment.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

F. Provide moisture protection for ductwork in areas which are not under roof or where ductwork would be exposed to rainwater.

3.7. OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing, balancing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.

B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.

C. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the commencement of testing and balancing work. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

D. Do not use mechanical systems for temporary services or temporary conditioning during construction, unless approved by Owner in writing. Refer to Division 01 Section "Temporary Facilities and Controls" for temporary heating/cooling during construction.

E. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items such as filters.

3.8. DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record demonstration and training video recordings. Record each training module separately.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Engineer

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

E. Transcript: Provide a transcript of the narration. Display images and running time captured

from videotape opposite the corresponding narration segment.

3.9. IDENTIFICATIONS, FLOW DIAGRAMS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS

A. All items of equipment, including motor starters, disconnects and ATC panels shall be furnished with white on black plastic permanent identification cards. Lettering shall be a minimum of ¼ inch high. Identification plates shall be secured, affixed to each piece of equipment, starters, disconnects, panels by screw or adhesive (tuff bond #TB2 or as approved equal).

B. Provide three (3) copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the Record and Information Booklet as hereinafter specified.

C. All lines piping and ductwork installed under this contract shall be stenciled with direction of flow arrows and with stenciled letters naming each pipe and ductwork and service. Refer to Division 23 Section, "HVAC Piping, Fittings, Valves, Etc." and Division 23 Section, "HVAC Air Distribution". Color-code all direction of flow arrows and labels. In finished spaces omit labeling and direction of flow arrows. Paint in color as selected by Owner.

D. Submit list of wording, symbols, letter size, and color coding for mechanical identification. Submit samples of equipment identification cards, piping labels, ductwork labels, and valve tags to Engineer for review prior to installation.

E. Provide at least 8 hours of straight time instruction to the operating personnel. Time of instruction shall be designated by the Owner. Additional instruction time for the automatic temperature control (ATC) system is specified in Division 23 Section, "Instrumentation & Controls of HVAC & Plumbing Systems".

F. Contractor shall demonstrate Sequences of Operation of all equipment in presence of Owner's representative, Engineer, and ATC subcontractor.

3.10. WALL AND FLOOR PENETRATION

A. All penetrations of partitions, ceilings, and walls by ducts, piping or conduit under Division 23 shall be sleeved, sealed, and caulked airtight for sound and air transfer control.

B. All penetration of fire rated assemblies shall be sleeved, sealed, caulked and protected to maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized. See Division 07 Section, "Fire Protection, HVAC & Plumbing Penetration Firestopping".

C. Where piping extends through exterior walls or below grade, provide waterproof pipe penetration seals, as specified in another division of these specifications.

D. Provide pipe escutcheons and duct flanges for sleeved pipes and ducts in finished areas.

E. Piping sleeves:

1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and

concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.

2. Twenty-two (22) gauge galvanized steel elsewhere.

F. Ductwork sleeves: 20 gauge galvanized steel.

3.11. RECORD DRAWINGS

A. Upon completion of the mechanical installations, the Contractor shall deliver to the Engineer one complete set of prints of the mechanical contract drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.

B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering to Engineer.

3.12. WARRANTY

A. Contractor's attention is directed to warranty obligations contained in the GENERAL CONDITIONS.

B. The above shall not in any way void or abrogate equipment manufacturer’s guarantee or warranty. Certificates of equipment manufacturer’s warranties shall be included in the operations and maintenance manuals.

C. The Contractor guarantees for a two (2) year period from the time of final acceptance by the Owner.

1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That the contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The contractor shall also make good all damages caused to their work or materials in the process of complying with this section. Contractor shall repair and/or replace any/all damage to finishes and furniture resulting from their corrective work.

4. That the entire work shall be water-tight and leak-proof.

3.13. LUBRICATION

A. All bearings, motors, and all equipment requiring lubrication shall be provided with accessible fittings for same. Before turning over the equipment to the Owner, the Contractor shall fully lubricate each item of equipment, shall provide one year's supply of lubricant for each, and shall provide Owner with complete written lubricating instructions,

together with diagram locating the points requiring lubrication. Include this information in the Record and Information Booklet.

B. In general, all motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal accessible or extended grease fittings and drain plugs.

3.14. OPERATIONS AND MAINTENANCE MANUALS

A. The Contractor shall have prepared three (3) hardcopies and one (1) electronic copy of the Operations and Maintenance Manuals and deliver these copies of the booklet to the Owner. The booklet shall be as specified herein. The booklet must be approved and will not be accepted as final until so stamped.

B. The booklet shall be bound in a three ring loose-leaf binder similar to National No. 3881 with the following title lettered on the front: Operations and Maintenance Manuals – Worcester County Recreation Center – HVAC System Replacements - HVAC. No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out. Provide divider tabs and table of contents for organizing and separating information.

C. Electronic copies of the manual shall be saved on USB flash drives, and shall be in searchable PDF format with interactive index tabs. Approved electronic copies shall be stored in flash drive zipper cases in front of Volume 1 (if applicable) of hard copies of the manual.

D. Provide the following data in the booklet:

1. As first entry, an approved letter indicating the starting/ending time of Contractor’s warranty period.

2. Maintenance, operation, and lubrication instructions on each piece of equipment furnished.

3. Complete catalog data on each piece of heating and air conditioning equipment furnished including approved shop drawing.

4. Manufacturer's extended limited warranties on equipment including but not limited to single zone VAV units, variable frequency drives, and air conditioning compressors, heat pumps.

5. Chart form indicating frequency and type of routine maintenance for all mechanical equipment. The chart shall also indicate model number of equipment, location and service.

6. Provide sales and authorized service representatives names, address, and phone numbers of all equipment and subcontractors.

7. Provide supplier and subcontractor’s names, address, and phone number.

8. Catalog data of all equipment, valves, etc. shall include wiring diagrams, parts list and assembly drawing.

9. Copy of the approved balancing report including duct leakage data.

10. ATC systems including as-built ATC drawings of systems including internal of all panels.

11. Approved HVAC Inspector and Electrical Inspector Certificates.

12. Start-up reports for equipment.

13. Provide and install in locations as directed by Owner, filter charts, including filter type, size, model number, manufacturer, quantity and size for each filter utilized on the project. Filter charts shall be enclosed in a durable polymer based frame with a cover safety glass.

14. Insert color graphic with embedded parameters for ATC system into record and information booklet.

15. Filter charts indicating equipment served, size, and type of filter required.

16. Certificate of ASHRAE 15 compliance for A2L refrigerants.

E. Electronic copies of the manual shall be saved on USB flash drives, and shall be in searchable PDF format with interactive index tabs. Approved electronic copies shall be stored in flash drive zipper cases in front of volume 1 (if applicable) of hard copies of the manual.

F. Submit Record and Information Booklets prior to anticipated date of substantial completion for Engineer review and approval. Substantial completion requires that Record and Information booklets be reviewed and approved.

3.15. PIPING SYSTEMS TESTING

A. The entire new HVAC piping systems shall be tested and proven tight under the following gauge pressures for a duration of twenty-four (24) hours. Testing to be witnessed by Owner's representative and documented in writing.

B. Ductwork pressure testing shall be as specified in another division of these specifications.

C. Testing and acceptance thereof shall be in accordance with local requirements and shall meet approval of authority having jurisdiction. Submit certificates and approved permits and insert one (1) copy in the Operations and Maintenance Manuals.

D. Refrigerant piping shall be tested utilizing nitrogen per equipment manufacturer’s requirements.

E. All testing shall be witnessed by the Owner’s representative.

F. All refrigerant piping shall be installed and tested per ASHRAE 15-Safety Standard for Refrigerant Systems.

3.16. EQUIPMENT BY OTHERS

A. This Contractor shall make all system connections required to equipment furnished and installed under other divisions or furnished by the Owner. Connections shall be complete in all respects to render this equipment functional to its fullest intent.

B. It shall be the responsibility of the supplier of this equipment to furnish complete instructions for connections. Failure to do so will not relieve this contractor of any responsibility for improper equipment operation.

3.17. ADDITIONAL FILTERS AND BELTS

A. One complete set of additional filters and belts shall be turned over to the owner upon final acceptance of the building by the owner. Provide correspondence to the Engineer (copy) documenting that additional filters and belts have been turned over to Owner.

B. All filters and belts shall be tagged and identified for equipment served. Furnish filters in protection wrap.

C. Belts refer to energy recovery wheel belts.

3.18. OUTAGES

A. Provide a minimum of fourteen (14) days notice to schedule outages. The Contractor shall include in their bid outages and/or work in occupied areas to occur on weekends, holidays, or at night. Coordinate and get approval of all outages with the Owner.

B. Submit Outage Request form, attached at end of this Section, to Owner for approval.

END OF SECTION

OUTAGE REQUEST

DATE APPLIED: _____ BY: _____

DATE FOR OUTAGE: _____ FIRM: _____

START OUTAGE-TIME: _____ DATE:_____

END OUTAGE -- TIME: _____ DATE:_____

AREAS AND ROOMS: _____

FLOOR(S): _____

AREA(S): _____

ROOM(S): _____

WORK TO BE PERFORMED: _____

SYSTEM(S): _____

REQUEST APPROVED BY: _____

(FOREMAN OR OTHER PERSON IN CHARGE)

(FOR OWNER'S USE ONLY):

APPROVED: _____

YES ____ NO ___ BY: _____DATE: _____

DATE/TIME-AS REQUESTED: _____ OTHER : _____

OWNER'S PRESENCE REQUIRED: _____

YES: ____ NO: ___ NAME: _____

POINT OF CONTACT: _____ PHONE: _____

DIVISION 23 SECTION 230505
HVAC PIPING, FITTINGS & VALVES
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SECTION 230505 - HVAC PIPING, FITTINGS AND VALVES

PART 1. GENERAL

1.1. SUMMARY

A. The conditions of the contract and other general requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 23 Section, Common Work Results for HVAC and Division 01, General Requirements.

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

1.2. SYSTEM DESCRIPTION CONDITIONS

A. Provide all labor and materials necessary to furnish and install all piping systems on this project as herein specified and/or shown on the drawings. Final connections to equipment furnished in other sections of the specifications shall be included under this section.

B. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

D. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

E. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.

F. At all runout piping serving equipment, use swing joints with elbows to prevent excessive movement of piping due to expansion.

1.3. QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Maintain one copy of each document on site.

1.4. DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under as hereinbefore specified.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed systems.

1.5. ALTERNATES

A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

PART 2. PRODUCTS

2.1. PIPE MATERIALS

A. All materials, unless otherwise specified, shall be new and of the best quality of their respective kinds, and shall conform to the requirements and ordinances of local, state and insurance authorities having jurisdiction.

1. Cooling Coil A/C Condensate Drain Piping that is Collecting A/C Condensate Piping:

a. Pipe & Fittings: All A/C condensate drain piping, shall be constructed of Type L copper tubing, with sweat fittings made with 95-5 solder. Washout plugs (cleanouts) shall be strategically located to allow periodic flush out of system. At a minimum, provide washout plugs at equipment connections and at direction changes of 90 degrees F or greater. Also install cleanout at all equipment traps for cleaning and service.

B. Copper pipe shall be Revere, Anaconda or Chase with approved solder fittings.

2.2. PIPE HANGERS, ROLLER SUPPORTS, ANCHORS, GUIDES, AND SADDLES

A. All hangers for metallic piping shall be adjustable, wrought clevis type, or adjustable malleable split ring swivel type, having rods with machine threads. Hangers shall be Grinnell Company's Figure 260, Victaulic, or Shurjoint for pipe ¾-inch and larger, and Figure 65 for pipe 2-inches and smaller, or approved equal Victaulic, Shurjoint, Carpenter Patterson, or approved equal. Adjustable pipe stanchion with U-bolt shall be Grinnell Company's Figure 191. Pipe roller supports shall be Grinnell's Figure 181 or Figure 271 Victaulic or Shurjoint. Exterior pipe hangers shall be galvanized or stainless steel construction. For copper piping in direct contact with the hanger, hanger construction shall be copper coated to prevent contact of dissimilar metals similar to Grinnell's Figure CT-65. Hanger spacing and rod sizes for steel and copper pipe shall not be less than the following:

NOMINAL PIPE SIZE IN	MAXIMUM SPAN FT. COPPER TUBE	MINIMUM ROD DIAMETER INCHES OF ASTM A36 STEEL THREADED RODS
3/4 & 1	5	3/8
1 - ½	8	3/8
2	8	3/8
2 – ½	9	½
3	10	½
4	12	5/8
5	12	5/8
6	14	3/4
8	16	7/8
10	18	7/8
12	18	7/8

B. Anchors, guides, and roller supports shall be installed in accordance with the contract drawings and manufacturer's recommendations to provide pipe support and control pipe movement for all piping systems. Anchors and guides shall be securely attached to the pipe support structure. Submit shop drawing for proposed pipe support structure for guides and anchors for approval of the Structural Engineer. Pipe alignment guides shall be Fig. 255 Grinnell, or as approved equal. Guides shall be sized to accommodate the pipe with insulation. Guides shall be steel factory, fabricated, with bolted two section outer cylinder and base for alignment of piping and two section guiding spider for bolting to pipe.

C. Hangers for pipe sizes ½ to 1 ½ inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.

D. Multiple or Trapeze hangers: Steel channels with welded spacers and hanger rods.

E. Vertical Support: Steel riser clamp.

F. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

G. Copper pipe support: Carbon steel ring, adjustable, copper plated.

H. Hanger rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

I. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

J. For exterior pipe supports provide stainless steel, supports, brackets, hardware and anchors.

2.3. UNIONS, FLANGES, AND COUPLINGS

A. Unions in steel pipe 2-inches and smaller shall be malleable iron with brass inserted seats designed for a working pressure of 150 psig.

B. Unions in copper pipe 2-inches and smaller shall be sweat fittings with bronze seats designed for a working pressure of 125 psig.

C. Unions in stainless steel pipe 2-inches and smaller shall be hexagonal threaded type stainless steel unions, with VicPress ends. Basis of Design: Victaulic Style P584.

D. Flanges for steel pipe over 2 inches shall be 150 psig, forged steel, slip on. Gaskets shall be 1/16 inch thick pre-formed neoprene.

E. Flanges for copper pipe over 2 inches shall be bronze. Gaskets shall be 1/16 inch thick preformed neoprene.

2.4. ESCUTCHEONS

A. Provide chromium plated escutcheons properly fitted and secured with set screws on all exposed piping which passes through walls, floors or ceilings of finished spaces.

B. All escutcheon plates shall be chrome plated spun brass of plain pattern, and shall be set

tight on the pipe and to the building surface. Plastic escutcheon plates will not be accepted.

2.5. SLEEVES

A. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, roof structure members or other building parts. Sleeves shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.

B. Sleeves through walls and floors shall be sealed with a waterproof caulking compound.

C. Firestop at sleeves that penetrate smoke barriers smoke partitions and/or rated walls/floors.

PART 3. EXECUTION

3.1. GENERAL PIPING INSTALLATION REQUIREMENTS

A. All pipes shall be cut accurately to measurements established at the building, and shall be worked into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted. All pipes shall be so installed as to permit free expansion and contraction without causing damage. All open ends of pipe lines, equipment, etc., shall be properly capped or plugged during installation to keep dirt or other foreign material out of the system. All pipes shall be run parallel with the lines of the building and as close to walls, columns and ceilings as may be practical, with proper pitch. All piping shall be arranged so as not to interfere with removal of other equipment on devices not to block access to doors, windows, manholes, or other access openings. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment, coils, etc., and installed so that there will be no interference with the installation of the equipment, ducts, etc. All valves and specialties shall be placed to permit easy operation and access and all valves shall be regulated, packed and glands adjusted at the completion of the work before final acceptance. Ends of pipe shall be reamed so as to remove all burrs.

B. All piping shall be run to provide a minimum clearance of 2-inches between finished covering on such piping and all adjacent work. Group piping wherever practical at common elevations.

C. All valves, strainers, caps, and other fittings shall be readily accessible.

D. Unions shall be installed on all bypasses, ahead of all traps, at all connections to equipment, where shown on drawings or where required to facilitate removal of equipment whether shown or not.

E. Spring clamp plates (escutcheons) shall be provided where pipes are exposed in the building and run through walls, floors, or ceilings. Plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface.

F. If the size of any piping is not clearly evident in the drawings, the Contractor shall request instructions for the Engineer as to the proper sizing. Any changes resulting from the

Contractor's failure to request clarification shall be at his expense. Where pipe size discrepancies or conflicts exist in the drawings, the larger pipe size shall govern.

G. Install all valves with stem upright or horizontal, not inverted.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, weld and apply one coat of zinc rich primer.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.2. PIPE JOINTS INSTALLATION REQUIREMENTS

A. Brazed Joints and Copper Piping: Joints in copper piping shall conform to the following minimum standards.

1. The pipes shall be cut to a length making certain that the ends are square, using a fins hacksaw blade or tube cutter. The ends of all pipes shall be reamed and all burrs removed.

2. The outside end of the pipe and the cut end of the fitting shall be cleaned with steel wool, sand cloth, or steel wire brush. All dark spots shall be removed.

3. The flux shall be applied evenly and sparingly to the outside end of the pipe and the inside of the outer end of the fitting until all surfaces to be jointed are completely covered. The piping and fitting shall be slipped together and reworked several times to insure an even distribution of the flux.

4. The correct amount of brazing material per joint for each size pipe shall be used in accordance with the manufacturer's recommendations.

5. Brazed joints shall be made by using a direct flame from a torch.

6. On pipe sizes larger than ¼-inch, the fittings and valves in the pipe shall be moved or tapped with a hammer when the brazing material starts to melt to insure an even distribution of the brazing material.

7. The excess brazing material shall be removed while it is still in the plastic state leaving a fillet around the cup of the fitting.

8. Brazed joints shall be suitable for working pressure of 550 psig and for working temperature of not less than 250 degrees F. The type of brazing material and flux used will be submitted for approval. Type 95-5 shall be the minimum standard.

9. Lead and antimony-based solders shall not be used for potable water systems. Brazing and silver solders are acceptable.

B. Prohibited Connections: No direct weld or brazed connections without unions or flanges, shall be made to valves, strainers, apparatus, or related equipment. Right and left couplings, long threads, or caulking of pipe threads or gasket joints will not be permitted.

3.3. HANGERS, SUPPORTS, ANCHORS, GUIDES INSTALLATION REQUIREMENTS

A. General: All hangers shall be of an approved type arranged to maintain the required grading and pitching of lines to prevent vibration and to provide for expansion and contraction. Provide protection saddles between hangers and insulation on heating water insulated pipe. Saddles shall be Grinnells Figure 173/273 or approved equal. Provide approved spacers between saddles and pipe where flexible insulation is specified. Provide insulation protection shields for insulated piping without saddles. Shield shall be Grinnell Figure 167 or as approved equal.

B. Spacing: Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping.

C. Vertical Lines: Shall be supported at their bases, using either a suitable hanger placed in a horizontal line near the riser, or a base type fitting set on a pedestal, foundation or support. All vertical lines extending through more than one floor level shall be supported at each floor with a riser clamp. Riser clamp shall be Grinnell Co.'s Figure 261, or approved equal. All vertical drops to pump suction elbows shall be supported by floor posts.

D. Racks and Brackets: All horizontal piping on vertical walls shall be properly supported by suitable racks securely anchored into the wall construction. Where not practical to obtain ceiling anchorage, all piping near walls shall be supported by approved brackets securely anchored into the wall construction. Washer plates (Fib. 60, 60L) and other miscellaneous attachments, fasteners, etc., shall be Grinnell or as approved equal. All exterior hanger and bracket systems in their entirety shall be galvanized.

E. Pipe Hangers and supports shall be attached to the panel point at the top chord of bar joist or at a location approved by the structural engineer.

F. Select hangers and components for loads imposed. Secure rods with double nuts.

G. Support of horizontal piping shall allow for vertical adjustment after installation of piping.

H. Support overhead piping with clevis hangers.

I. Do not support all parallel piping from the same joist. Stagger all supports in accordance with the engineer's recommendations.

3.4. PIPING IDENTIFICATION INSTALLATION REQUIREMENTS

A. All piping shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color code and system identification shall comply with ANSI Standards and piping identification system shall comply with ASME A13.1-81., scheme for the identification of piping systems and ASHRAE Fundamentals Handbook, latest edition.

B. Markings shall be plain block letters, stenciled on pipes, and shall be located near each branch connection, near each valve, and at least every 10 feet on straight runs of pipe. Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor. Pipe identification schedule shall be as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
½ to 1 ¼	8	½
1-½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
Over 10	32	3 ½

END OF SECTION

DIVISION 23 SECTION 230593
TESTING, ADJUSTING & BALANCING FOR HVAC & PLUMBING
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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC AND PLUMBING

PART 1. GENERAL

1.1. GENERAL

A. This section covers performance testing, adjusting and balancing of heating, ventilating, air conditioning systems as specified in Division 23 Section, Heating, Ventilating, and Air Conditioning Equipment.

B. For Common Work Results of HVAC, See Division 23. See Division 01 for General Requirements.

C. The mechanical contractor shall select and employ an impartial, independent balancing agency to provide testing and balancing services for the heating, ventilating and air conditioning (HVAC) systems, and other specified systems of this project.

D. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.

1. Perform all work required to prepare the building HVAC systems for testing, adjusting, and balancing indicated by the Contract Documents as follows:

    a. Verify the air systems are ready for balancing.
    b. Verify the control systems are ready for balancing.
    c. Notify appropriate parties the system is ready for balancing.

2. Scope of work.

    a. Testing, adjusting, and balancing (TAB) of the HVAC systems, Plumbing Systems, and related ancillary equipment will be performed by an independent, third party, AABC Certified Agency, selected and employed directly by the Contractor. The preparation and corrections necessary for the testing and balancing of these systems, as described herein, are the responsibility of the Contractor.
    b. As part of the project Construction Contract, the Contractor shall make any changes or replacements to the sheaves, belts, dampers, valves, or other components required for correct balance as advised by the TAB Agency, at no additional cost to the Owner.
    c. The Contractor shall provide and coordinate the services of qualified, responsible subcontractors, suppliers and personnel as required to correct, repair, and/or replace any and all deficient items or conditions found during the course of this project, including the testing, adjusting, and balancing period.
    d. In order that all systems may be properly tested, adjusted and balanced as required herein by these Specifications, the Contractor shall operate the systems at their expense for the length of time necessary to properly verify their completion and readiness for TAB, and the entire duration required

for the TAB process.

e. Project Contract completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The Contractor shall allow adequate time for the testing and balancing activities of the Owner-provided services during the construction period and prior to Substantial Completion, as defined in the AIA General Conditions and Supplementing Condition of this Construction Document.

f. The Drawings and Specifications indicate dampers, and miscellaneous adjustment devices to be adjusted to obtain optimum operating conditions. It is the responsibility of the Contractor to install these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access, as requested by the TAB Agency. Any malfunction encountered by TAB personnel and reported to the Contractor shall be corrected by the Contractor immediately so that the balancing work can proceed with a minimum of delays.

g. The scope of work, as defined herein, is to advise the Contractor of the coordination, adjustment, and system modifications that will be required under the project work to complete Owner requirements for final TAB. The Contractor's original bid shall allow for the costs of all work which may be required in the TAB phases, and which may be necessary for the completion of the TAB work as defined by the TAB Agency.

3. Submittals. The TAB Agency shall submit an agenda that will include:

a. Field observation reports.
b. An overview of system TAB procedures.
c. System testing which will include where ducts will be traversed, which instrumentation will be used, how correction factors for grille and diffuser will be obtained, how measurements will be verified at maximum and minimum, and how control components will be verified.
d. Report forms with each system's components identified and numbered.

E. The items requiring testing, adjusting, and balancing include, but are not limited to, the following:

<u>Air Systems</u>:

1. Air Flow Monitoring Stations

2. Coils (Air Temperatures & Static Pressure Drops)

3. Duct Smoke Detectors

4. Duct Sox

5. Exhaust Fans

6. Fans

7. Gas Furnaces

8. Hot Gas Re-heat Coils
9. Heat Recovery Systems
10. Heat Pumps
11. Registers
12. Relief Air Dampers
13. Single Zone VAV Units
14. Static Pressure Sensors
15. Supply Fan AHU
16. Zone Branch and Main Ducts

1.2. ALTERNATES

A. Refer to Division 01 Section, Alternates for description of work under this section affected by alternates.

1.3. GENERAL COMMISSIONING REQUIREMENTS

A. Refer to Division 01 Section, "General Commissioning Requirements" for description of work under this Division affected by General Commissioning.

1.4. PRELIMINARY EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and connected.

11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of exiting conditions.

1.5. QUALIFICATIONS OF THE BALANCE AGENCY

A. The balancing agency shall be a member of the Associated Air Balance Council (AABC).

B. The certified test and balance engineer shall be responsible for supervision and certification for the total work herein specified.

C. All final reports shall be signed by the certified test and balance engineer.

D. All personnel used on the project will be employees of an AABC Certified Agency. All work will be performed under the direct supervision of the AABC Certified Test and Balance Engineer (TBE). All work will be performed with AABC Certified Test and Balance Technicians (TBT) Resumes including education, experience, and certification of each person on the project shall be submitted.

E. Warranty. The AABC Agency shall submit a National Project Performance Guaranty.

1.6. PERSONNEL

A. All personnel used on the project will be employees of an AABC Certified Agency. All work will be performed under the direct supervision of the AABC Certified Test and Balance Engineer (TBE). All work will be performed with AABC Certified Test and Balance Technicians (TBT). Resumes including education, experience, and certification of each person on the project shall be submitted as informational submittals.

1.7. WARRANTY

A. The AABC Agency shall submit a National Project Performance Guaranty.

1.8. PRE-BALANCING CONFERENCE

A. Convene a conference one week prior to commencing work of this Section with all appropriate individuals.

1.9. STANDARDS

A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council's National Standards, including revisions, to the date of the contract.

B. All terms in this specification shall have their meaning defined as stated in the National Standards.

C. ADC: Test Code for grilles, registers, and diffusers.

D. ASHRAE III: Practice for measurement, testing, adjusting and balancing of building heating, ventilation, air conditioning, and refrigeration systems.

E. NEBB: Procedure standards for testing, adjusting, and balancing of environmental systems.

F. SMACNA: HVAC systems testing, adjusting, and balancing.

G. AABC: Associated Air Balance Council

1.10. COORDINATION

A. It will be necessary for the balancing agency to perform its services in close coordination with the mechanical contractor.

B. The plans and specifications have indicated meters, valves, dampers, and other devices for the purpose of adjusting the system to obtain optimum operating conditions. It will be the responsibility of the mechanical contractor to install these devices in a manner that will leave them accessible and readily adjustable. The balancing agency shall provide guidance if there is a questionable arrangement of a control or balancing device.

C. The general contractor, mechanical contractor, temperature control contractor and suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components.

D. For heat pumps, the manufacturer's start-up agency and Test and Balance Engineer shall assist each other with obtaining proper air flow rates and refrigerant pressures.

1.11. INSTALLATION TOLERANCE

A. Unless otherwise indicated, all air devices shall be adjusted to within plus or minus 10 percent of design. All fans shall be adjusted to within plus or minus 5 percent of design.

1.12. RESPONSIBILITIES OF THE TAB AGENCY

A. Liaison and Early Inspection. The following reviews, observations, and tests shall be performed by the TAB Agency:

1. Review the mechanical drawings and specifications for balanceability and provide commentary. Verify proper types and locations of all Test and Balance devices.

2. During construction, review all approved HVAC submittals such as control diagrams, air handling devices, hydronic devices, and other components that pertain to TAB work and balanceability. Assist the commissioning agent with all Functional Performance Testing.

3. Perform construction observations and submit a written report:

a. On the ductwork prior to insulation and/or ceiling cover-up.

4. Witness duct pressure test as defined in the specifications, and submit a written report.

5. Perform a pre-balance site review, and submit a written report.

6. During the balancing process, abnormalities and malfunctions of equipment or components may be discovered by the TAB personnel. The Construction Inspector, Engineer, and Owner shall be advised in writing so that the condition(s) can be corrected by the Contractor. The written document need not be formal, but shall be understandable and legible. The TAB Agency shall not instruct or direct the Contractor in any of the work, but will make reports to the appropriate parties.

B. Final Air Balance. When systems are complete and ready for operation, the TAB Agency will perform a final air balance for all air systems and record the results. The volume of air for the supply, return, exhaust, and outside air equipment and terminals will be tested and balanced within the tolerances of the AABC Standard, or as specified, whichever is more stringent. Air handling unit and fan volumes shall be adjusted by changing fan speed. Air distribution device volumes shall be adjusted using the duct dampers and not the grille face. Air distribution devices shall be balanced with air patterns as specified. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown. The general scope of balancing by the TAB Agency will include, but is not limited to, the following:

1. Filters: Check air filters and filter media. Balance systems with essentially clean filters and filter media.

2. Fan Speed: Measure and record RPM for each fan. Provide Controls Contractor with drive parameters for variable speed drives.

3. Voltage and Amperage Readings: Measure and record the final operating voltage and amperage for each motor.

4. Static Pressure Profile: Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, heat of rejection equipment fans, return air fan, air handling unit filter, exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device.

5. Equipment Air Flow: Adjust and record supply, return, outside and exhaust air CFM and temperatures, as applicable, at each fan and coil.

6. Coil Temperatures: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb (cooling only) temperatures at each cooling coil and gas furnace.

7. Zone Air Flow: Adjust each HVAC terminal unit and each air-handling unit for design CFM.

8. Outlet Air Flow: Adjust each duct sox, register and grille, and each exhaust inlet to within the tolerance per the AABC Standard.

9. Pitot Tube Traverses: For use in future troubleshooting by maintenance personnel,

all main supply, return, outside air, and exhaust ducts shall have air velocity and volume measured and recorded by the Pitot tube traverse method shown in the AABC Standard. Locations of these traverse test stations shall be described on the sheet containing the data. All Pitot tube traverses shall be clearly identified on the outside of the duct insulation with the traverse identified and duct size. Submit half scale drawings showing the locations of all duct traverses.

C. Testing of Temperature Control Systems as applicable to the project.

1. Single Zone VAV Units

a. Start each single zone VAV units; verify and document:
- Dampers modulate properly and in the correct sequence.
- Fan(s) VFD ramps to design speed or proper controlled speed.
- All interlocked fans and/or devices energize.
- All alarms and safeties are operational and will alarm or shut down the unit.
- All operating scenarios are tested; e.g.: economizer cycle, minimum/maximum airflows, outside airflows at unit minimum/maximum volume, and special sequences.
- All end switches and positioners are properly set.
- All pressure controllers respond to increases or decreases in system pressure.
- All temperature and pressure sensors are calibrated.
- Airflow monitors report the correct airflow and control devices respond correctly to a change in airflow; e.g.: outside air control.
- Reset control sequences operate in response to changes in system temperatures, flows, or pressures.
- Correct operation of fan sequences when multiple fans are installed.
- Test all static pressure sensors and controls and calibrate the same.

b. Shut down each single zone VAV unit; verify and document:
- Dampers respond properly (open, close, or modulate), and in the correct sequence.
- All fan systems ramp down and stop.
- Correct operation of fan sequences when multiple fans are installed.
- Interlocked devices turn off.
- System starts for setback temperature control.
- System starts on a temporary occupancy override.
- All alarms and safeties remain operational.

2. Fan Systems

a. Start each fan or fan system; verify and document:
- Interlocks and lockouts operate in accordance with the sequence.
- Fan(s) VFD ramps to design speed or proper controlled speed.
- All alarms and safeties are operational and will alarm or shut down the fan.
- Dampers modulate properly and in the correct sequence.
- All interlocked fans and/or devices energize.

- All end switches and positioners are properly set.
- All pressure controllers respond to increases or decreases in system pressure.

b. Shut down each fan or fan system; verify and document:
- Dampers respond properly (open, close, or modulate) and in the correct sequence.
- All fan systems ramp down and stop.
- Correct operation of fan sequences when multiple fans are installed.
- Interlocked devices turn off.
- All alarms and safeties remain operational.

3. Component Calibration

All temperature, airflow, and pressure components shall be measured and compared to the control system readout; verify and document:

- The air temperature sensors for each coil. If the temperature is not reading within tolerance, the sensor will be reported to the control contractor for calibration.
- The room temperature, relative humidity, duct CO sensors, and $C0_2$ sensors. If the sensors are not reading within tolerance, the sensors shall be reported to the control contractor for calibration.
- All air pressure sensor readouts. If the pressure is not reading within tolerance, the sensor shall be reported to the control contractor for calibration.

4. Point Verification

- Point verification for the digital control system documents that every point is operational and the setpoint, flow, temperature, or pressure is reporting correctly to the graphic interface. Verify and document all points.

5. Dynamic Testing

- Dynamic testing involves making a change of value at the sensor in order to observe the system's reaction and how it regains the original setpoint. Verify and document the system's response.

1.13. REPORTS

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. The report summary is a project narrative describing the outcome of the testing and balancing and shall include a list of items that document all system variations deviating from design tolerances. Information can also be included that suggests possible resolutions.

B. All measurements and recorded readings that appear in the reports shall be certified by the

Agency's Test and Balance Engineer.

C. Submit reports on forms approved by the Engineer. Hard and/or electronic copies of the final report shall be submitted in accordance with the Contract Requirements. The report shall indicate a summary of actual operating data and any abnormal operating conditions. The report shall contain all required information as described within this specification, including the information formatted and shown in the AABC Standard.

D. When the Engineer reviews TAB reports and provides comments, address each comment in writing for all re-submitted TAB reports.

1.14. TAB FINAL ACCEPTANCE INSPECTION

A. At the time of TAB final acceptance inspection, the TAB agency shall recheck, in the presence of the Owner's representative, specific and random selections of data recorded in the certified test and balance report.

B. Points and areas for recheck shall be selected by the Owner's representative.

C. Measurements shall be verified at the same test conditions as the submitted and approved test and balance agenda.

D. Selections for verification shall not exceed 10% of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.

E. If 10% of the random verification tests demonstrate a measured flow deviation of 10%, or more from that recorded in the certified test and balance report, the report shall be automatically rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance submitted, and a new inspection test made. There shall be no additional cost to the Owner for this work.

F. Final acceptance shall occur after successful completion of the TAB verification process.

1.15. RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

A. The mechanical contractor shall sufficiently complete the installation and start all HVAC and plumbing systems to insure they are working properly and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC system.

B. Record equipment manufacturer's standard start-up information and submit to Engineer for review. Testing and balancing work shall not commence on any equipment until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

C. The Contractor shall:

1. Have the building, air conditioning systems, and heating systems in complete operational readiness for TAB work to begin.

2. The Contractor shall allow sufficient time for the TAB Agency to perform their

contracted work within the construction schedule. The Contractor shall complete work by systems or floors, whichever is the most efficient for testing systems. After award of the contract and the completion of the construction schedule by the Contractor, a TAB coordination meeting shall be held with the TAB Agency, the Contractor and primary subcontractors, including but not limited to mechanical, electrical, and building automation subcontractors to develop a testing schedule for the project. The Contractor shall submit copies of the proposed schedule to the TAB Agency two weeks prior to this meeting.

3. Promptly correct deficiencies of materials and workmanship identified as delaying completion of TAB work.

4. Be responsible for any added costs to the Owner resulting from the Contractor's failure to have the building air conditioning systems ready for TAB when scheduled, or from the Contractor's failure to correct deficiencies promptly.

D. Air Distribution Systems

1. Verify installation for conformity to design.

2. Terminate all supply, return, outside air, exhaust air, relief air, ventilation air ducts, and pressure test them for leakage. Test pressure and leakage rate shall be as specified in Division 23 Section, HVAC Air Distribution System under Leakage Tests. Pressure testing shall be performed by mechanical contractor and witnessed by Test and Balance Engineer.

3. Ensure that all splitters, extractors, volume dampers, are properly located and functional. Dampers serving requirements of minimum and maximum outside - return - relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.

4. Verify that all supply - return - exhaust and transfer grilles; registers, and diffusers are installed, operational, and sealed tightly.

5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.

6. Ensure that all fans are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating. Record thermal overload ratings for all motors in the Test and Balance Report.

7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the owner.

8. Install clean filters.

9. Coils shall be clean with fins straightened, bearings shall be properly greased, belts shall be aligned and tightened, and the system shall be completely operational. The

Contractor shall verify that all systems are operating within the design pressure limits of the piping and ductwork.

10. All fans shall be operating and verified for: freedom from vibration, proper fan rotation and belt tension; heater elements in motor starters to be of proper size and rating, as the as per the starter manufacturer. Record motor amperage and voltage on each phase at start-up, verifying they do not exceed nameplate ratings.

11. All units shall be installed and functional. Controls commissioning shall be complete.

12. For heat pumps provide refrigerant suction and discharge pressure to Test and Balance Engineer for inclusion in the final TAB Report.

E. Notification of System Readiness

1. After completion of the work, the Contractor shall notify the Owner and TAB Agency, in writing, certifying that the work has been accomplished and that the building, air conditioning, and plumbing systems are ready for testing, adjusting, and balancing. The Contractor shall include a copy of the tabulated data of the start-up reports.

2. The Contractor shall notify the TAB Agency of the readiness for balancing and forward copies of the Contractor's certification and the tabulated data.

3. Should the TAB Agency be notified as described above and the inspection reveal the TAB services notification to have been premature, all costs of the inspection by the TAB Agency shall be reimbursed by the Contractor.

1.16. CONTRACTOR SUPPLIED ITEMS

A. As a requirement of the TAB contract, the Contractor's Project Manager shall compile and provide the TAB Agency the following:

1. One set of mechanical specifications.

2. All pertinent change orders.

3. All Request(s) for Information (RFI).

4. One complete set of MEP Drawings.

5. One copy of approved submittal data on equipment installed and controls submittal with sequences of operation.

6. All HVAC Control Communications software with the appropriate licenses and hardware interfaces.

7. All Addendums and RFI's (Requests for Information).

1.17. RESPONSIBILITIES OF THE TEMPERATURE CONTROL CONTRACTOR

A. The temperature control contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The temperature control contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, freeze stats, high and low temperature thermostats, safeties, and duct smoke detectors.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Calibrate temperature sensors after installation, and before the temperature sensors control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditional space for each separately controlled zone.

4. The temperature control contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

5. The Control Contractor shall schedule a meeting with the Mechanical Contractor, TAB Agency, and Owner's representative for a pre-submittal review to establish that their interpretation of the control sequence is correct.

6. The Control Contractor shall verify that all controlling instruments are calibrated and set for design operating conditions, with the exception of components that require input from the TAB Agency. A default shall be set for such components. The Control Contractor shall cooperate with the TAB Agency and provide all software and interfaces necessary to communicate with the system.

7. The Automatic Temperature Control Contractor shall thoroughly check all controls, sensors, operators, and sequences before notifying the TAB Agency that the Energy Management System is operational. The Energy Management System Contractor shall provide technical support in the form of technicians and necessary computers to the TAB Agency for a complete check of those systems.

8. The Fire Alarm (FA) Contractor shall thoroughly check all detection devices, sequences, interlocks, and other components before notifying the TAB Agency that the system is operational, including the Fireman's Override Panel. The FA Contractor shall provide all documentation that identifies all fire and smoke detection devices, all smoke zones, and all alarm and event chart devices. The FA Contractor shall certify to the Contractor that the systems are totally operational prior to the start of TAB.

B. All control sequences, software, equipment, and components shall be started-up by a

qualified technician. Start-up report shall be submitted to Engineer prior to the commencement of testing and balancing work. Testing and balancing shall not commence until start-up reports are completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

1.18. NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

A. The mechanical contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The mechanical contractor shall attest that he has completed all items as herein described.

B. The following must be completed prior to start of system balancing:

1. All duct work and associated grilles/registers/diffusers installed and completed.

2. Equipment properly started by qualified personnel or start-up technicians.

3. Ceiling tiles installed.

4. Automation system (temperature controls) installed and completed for air and gas systems.

5. All equipment controlled in automatic (“Auto”) mode.

6. Access granted to the balancing contractor to the automation/controls system provided.

C. Mechanical Contractor shall notify the General Contractor of the start date of this portion of the work.

1.19. DEFICIENCIES

A. Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the appropriate responsible person.

B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected Contractor before the TAB Agency returns to retest. Unresolved deficiencies shall be noted in the final report.

C. TAB Agency shall notify General Contractor of all deficiencies found during initial survey.

1.20. ADJUSTING

A. Ensure recorded data represents actual measured observed conditions.

B. Permanently mark settings of dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing

doors to electrical switch boxes, and restoring all sensors to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

G. Permanently mark the locations of all duct traverses on the exterior surface of the duct insulation. For exterior ductwork, the duct traverse locations must be identified with waterproof labels.

PART 2. PRODUCTS (NOT APPLICABLE)

PART 3. EXECUTION

3.1. GENERAL

A. Perform all testing and balancing in complete accordance with AABC National Standards for Field Measurements and Instrumentation.

B. Furnish all test instruments and equipment. All instruments must have been calibrated within twelve (12) months prior to use and shall be checked for accuracy prior to and during the work. Submit certificate for calibration of all equipment utilized on project with date of calibration clearly identified.

C. Review all systems designs and equipment, manufacturers' data, and be completely familiar with the work before proceeding.

D. Report all malfunctions or deficiencies to the contractor so that corrective action can be taken. Test and Balance Report shall not be submitted for review until all malfunctions or deficiencies are corrected. Repeat tests where required until design conditions are achieved.

E. Where systems or equipment cannot be balanced or adjusted to design conditions, determine the cause and submit a complete report to the Engineer.

F. Retest or rebalance the system as required during the warranty period.

G. Test and balance all systems under adequate load condition. If, in the opinion of the Engineer, there is insufficient load to properly test and balance the systems, perform sufficient preliminary balancing and adjustment to permit operation of the systems until such time as final testing and balancing can be done. Provide in writing the future date when systems shall be tested under sufficient load.

H. At project completion provide a complete set of ½ scale drawings indicating the locations of all duct traverses.

3.2. EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and

equipment.

B. Examine systems for installed balancing devices, such as test ports, thermometer wells, flow-control devices, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC/plumbing system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems – Duct Design". Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, and verify that they are accessible and their controls are connected and functioning.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3. AIR SYSTEM PROCEDURES

A. The balancing agency shall perform the following testing and balancing functions in accordance with the Associated Air Balance Council's National Standards:

1. Fan Speeds - Test and adjust fan RPM to achieve design CFM requirements.

2. Current and Voltage - Measure and record motor current and voltage. Check and record thermal overload ratings for all motors.

3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply, return and exhaust ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation why a traverse was not made must appear on the appropriate data sheet.

4. Outside Air - Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat of compression and motor heat where applicable.

5. Static Pressure - Test and record system static pressures, including suction and discharge static pressure of each fan. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make fan RPM allowances for 50 percent loading of filters.

6. Air Temperature - Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil and/or heat recovery coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil and gas furnace.

7. Zone Ducts - Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.

8. Main Ducts - Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.

9. Branch Ducts - Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

10. Tolerances - Test and balance each diffuser, grille, and register to within 10 percent of design requirements. Test and balance all fans to within 5 percent of design requirements.

11. Identification - Identify the location and area of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

12. Description - Record the size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.

13. Minimizing Drafts - Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

14. Test and Balance Engineer shall witness and record all leakage testing of ductwork. Leakage test data shall be included in final Test and Balance Reports.

15. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable air volume systems at maximum air flow rate, full cooling, and at minimum airflow rate, full heating.

16. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

17. For heat pumps assist start-up organization or manufacturer's representative with start-up. Record air flow rates, and electrical characteristics prior to refrigerant pressure measurement and settings.

18. For all equipment specified with condensate overflow safety switches/floats test operation of such device and record results. Verify interlock with ATC system.

19. Outside air and exhaust/relief air measurements must be measured and submitted in all modes of operation including the following:

    a. Min Min Outside Air/Exhaust mode (square footage outside air).
    b. Min Max Outside Air/Exhaust mode (square footage and people outside air).
    c. Maximum outside air/exhaust/relief mode (full 100% economizer mode).

20. For all outside air modes of operation record and submit full static pressure profiles, amperage, BHP, air flow rates, external static pressure, and internal static pressure. Verify airflow rates with air flow monitoring stations and record results.

3.4. TESTING AND BALANCING OF EXISTING SYSTEMS

A. The balancing agency shall perform testing and balancing of existing fan systems to the extent indicated. Existing air devices and terminals shall be re-tested and balanced where effected by new ductwork modifications.

B. Test and Balance Agency shall assist the mechanical contractor in selection of new sheaves and belts, if required. Re-sheaving of existing air handling units or fans shall be done at no additional cost to owner. Where required, new sheave and belt size calculations shall be forwarded to the Engineer for review and approval.

C. The Test and Balance Agency shall perform air system procedures (here-in before specified) on the following existing systems.

    1. Refer to schedule on Contract Drawings.

3.5. LIFE SAFETY CONTROLS TESTING PROCEDURES

A. The TAB agency shall test and record life safety control operation on the HVAC equipment. It shall verify the installation of required smoke detectors in air handling equipment (AHE), and shall verify operation of the smoke detector by activating the smoke detector and observing air handler shutdown. With the controls and alarm contractors, the TAB agency shall verify the operation of interconnected systems such as the AHU smoke detector’s activation of the fire alarm system and the alarm system’s activation of the life safety control sequences. Record results of tests within TAB report.

3.6. VERIFICATION OF TEMPERATURE CONTROL

A. The balancing agency shall be assisted by the temperature control contractor in verifying

the operation and calibration of all temperature control systems. The following tests shall be conducted:

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

4. Test and calibrate all air flow monitoring stations for proper air flow.

5. Test and calibrate all static pressure sensors for proper set point and control.

6. Test and calibrate all differential pressure sensors. Record set point in Record and Information Books.

3.7. BUILDING STATIC PRESSURE MEASUREMENTS

A. The balancing agency shall adjust supply, return and exhaust air systems to provide required static pressure relationships between spaces.

B. The balancing agency shall test, record, and adjust space pressurization by setting the design flows to meet the required flow direction and pressure differential.

C. The balancing agency shall measure and record static pressure differentials between spaces and relative to outside. The design static pressure and actual static pressure for each space shall be recorded.

D. Re-sheave or adjust variable frequency drives and exhaust fans as required to obtain required room pressures.

E. Calibrate and verify room differential static pressure as reported by space mounted static pressure gauges, and sensors.

3.8. TEST AND BALANCE REPORTS

A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the balancing agency's certified test and balance engineer.

B. Three (3) hardcopies and one (1) electronic copy of the test and balance report are required and shall be submitted to the Engineer. If, in the opinion of the Engineer, test results or portions thereof are incomplete or inconclusive, repeat necessary portions of the work to the satisfaction of the Engineer.

C. The report shall contain the following general data in a format selected by the balancing agency:

1. Project Number
2. Contract Number
3. Project Title
4. Project Location
5. Project Mechanical Engineer
6. Test & Balance Agency
7. Test & Balance Engineer
8. General Contractor
9. Mechanical Contractor
10. Commissioning Agent
11. Dates tests were performed
12. Certification
13. Duct Leakage Tests
14. Phone Numbers of all Individuals Listed Above

D. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards.

E. The test and balance report shall include a table of contents with numbered pages.

3.9. TEST REPORT FORMS

A. Air Moving Equipment and Fan Test Forms - Submit fan curve showing design and operating points of operation. Also, record the following on each air-handling equipment test form:

1. Manufacturer, model number, serial number, arrangement.
2. All design and manufacturer-rated data.
3. Total actual CFM by traverse if practical. If not practical, the sum of the outlets may be used, or a combination of each of these procedures. For specific systems, such as ones with diversity, see the AABC National Standards.
4. Suction and discharge static pressure of each fan, as applicable. Include pressure drops across coils, dampers, filters, mixing boxes, and similar devices.
5. Outside-air, return-air, relief air, and exhaust air total CFM.

6. Actual operating current, voltage and brake horsepower of each fan motor. For packaged equipment, this includes supply fans, relief air fans, and condenser fans.

7. Final RPM of each fan.

8. Fan and motor sheave manufacturer, model, size, number of grooves, bore, and center distance.

9. Belt size, quantity and make.

10. Static-pressure controls final operating set points (if applicable).

11. Total and external static pressure.

B. Heating and Cooling-Coil Test Forms - Record the following items on each test form:

1. Manufacturer, location, service.

2. All design and manufacturer's rated data.

3. Rated and actual static pressure drop across each coil.

4. Wet-bulb and dry-bulb temperatures entering and leaving each cooling coil; dry-bulb temperatures entering and leaving each heat pump heating coil and gas furnace.

5. Air flow (Design and Actual).

6. For DX-coil, provide design and actual saturated suction temperature.

7. For DX-Coil, provide design and actual discharge pressures.

C. Airflow Monitoring Station Test Forms:

1. Identification /location.

2. Manufacturer.

3. Systems.

4. Size and Model Number.

5. Area.

6. Design Velocity.

7. Design Airflow.

8. Test Velocity.

9. Test Airflow.

10. Static Pressure Drop and Velocity Pressure.

11. Station Calibrated Setting.

D. Electric Motors Test Forms: (Applies to all motors, including fans and HVAC equipment)

1. Manufacturer.

2. Model/Frame.

3. HP/BHP.

4. Phase, voltage, amperage; nameplate, actual, no load.

5. RPM.

6. Service factor.

7. Starter size, rating, heater elements.

8. Sheave Make/Size/Bore.

9. Thermal overload settings

E. V-Belt Drive Test Forms:

1. Identification/location.

2. Required driven RPM.

3. Driven sheave, diameter and RPM.

4. Belt, size and quantity.

5. Motor sheave diameter and RPM.

6. Center to center distance, maximum, minimum, and actual.

F. Duct Traverse Test Forms:

1. System zone/branch.

2. Duct size.

3. Area.

4. Design velocity.

5. Design air flow.

6. Test velocity.

7. Test airflow.

8. Duct static pressure.

9. Air temperature.

10. Air correction factor.

G. Duct Leakage Test Forms:

1. Description of ductwork under test.

2. Duct design operating pressure.

3. Duct design test static pressure.

4. Duct capacity, air flow.

5. Maximum allowable leakage duct capacity times leak factor.

6. Test apparatus.

   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.

7. Test static pressure.

8. Test orifice differential pressure.

9. Leakage.

H. Air Distribution Test Forms:

1. Air terminal number.

2. Room number/location.

3. Terminal type.

4. Terminal size.

5. Area factor.

6. Design velocity.

7. Design air flow.

8. Test (final) velocity.

9. Test (final) air flow.

10. Percent of design air flow.

I. Gas Furnace Test Forms:

1. Manufacturer.
2. Identification/number.
3. Location.
4. Model number.
5. Phase, voltage, amperage.
6. Test voltage
7. Test amperage
8. Air flow, specified and actual.
9. Temperature rise, specified and actual.
10. Pressure drop, specified and actual.
11. Delivered Gas Pressure, Specified and Actual.

J. Air Cooled Heat Pump Test Forms:

1. Manufacturer
2. Model Number
3. Location
4. Size/Capacity
5. Fan RPM (Min and Max)
6. Compressor and Heat Pump Fan Electrical Characteristics
7. Heat Pump Fan RPM
8. Amp Draw of all Components
9. Refrigerant Suction/Discharge Pressures
10. Thermal Overload Sizes

K. Gas Furnace Test Forms

1. Manufacturer, Model Number, Service Number

2. Location

3. All design and actual capacity information.

4. Electrical Characteristics

5. Entering and Leaving Air Temperature

6. Gas Pressure Design and Actual

L. Condensate Over Flow Switches/Floats Test Forms

1. Manufacturer

2. Type

3. Location

4. Equipment shut down verification

5. ATC interlock verification

M. Single Zone VAV Unit Test Forms: Submit fan curve showing design and operating points of operation. Also, record the following on each air-handling equipment test form:

1. Manufacturer, model number, serial number, arrangement.

2. All design and manufacturer-rated data.

3. Total actual CFM by traverse if practical. If not practical, the sum of the outlets may be used, or a combination of each of these procedures. For specific systems, such as ones with diversity, see the AABC National Standards.

4. Suction and discharge static pressure of each fan, as applicable. Include pressure drops across coils, filters, energy wheels, and similar devices.

5. Outside-air, and exhaust air total CFM.

6. Actual operating current, voltage and brake horsepower of each fan motor.

7. Final RPM of each fan.

8. Fan and motor sheave manufacturer, model, size, number of grooves, bore, and center distance.

9. Belt size, quantity and make.

10. Total and external static pressure.

11. Rated and actual static pressure drop across each energy wheel.

12. Wet-bulb and dry-bulb temperatures entering and leaving each cooling coil and

energy wheel. Dry-bulb temperatures entering and leaving each heat pump heating coil and gas furnace.

13. For DX-coil, provide design and actual saturated suction temperature.

14. Record carbon dioxide set points and actual readings for exhaust air stream at each single zone VAV unit and global CO2 sensor.

15. Entering and leaving air temperatures at hot gas re-heat coils.

16. Record the supply fan and exhaust fan maximum hertz/speed, and minimum hertz/speed. Provide measurements to ATC subcontractor for fan tracking control.

17. Test minimum air flow rate, maximum/minimum air flow rate and economizer air flow rate.

18. Submit amperage, air flow rates, RPM, hertz, and static pressure profile in all modes of operation.

END OF SECTION

DIVISION 23 SECTION 230600
HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT
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SECTION 230600 – HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT

PART 1. GENERAL

1.1. GENERAL

A. The Conditions of the Contract and other General Requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 23 Section, Common Work Results for HVAC and Division 01 Section General Requirements.

1.2. SUBMITTALS

A. Shop Drawings: Indicate assembly, equipment dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature which indicates dimensions, weights, capacities, ratings, performance, gages and finishes of materials, and electrical characteristics and connection requirements.

2. Provide data of filter media, filter performance data, filter assembly, and filters frames.

3. Provide fan curves with specified operating point clearly plotted.

4. Submit sound power level data for both fan outlet and casing radiation at rated capacity. Submit sound power levels by octave band or sound pressure levels by octave band for all equipment.

5. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.3. OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.4. DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of General Requirements.

B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

C. Store all equipment in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

D. Comply with manufacturer's installation instructions for rigging, unloading and transporting equipment.

E. Protect all motors, shafts, and bearings from weather and construction dust.

1.5. ENVIRONMENTAL REQUIREMENTS

A. Do not operate any equipment for any purpose, temporary or permanent, until ductwork/piping is clean, filters/strainers are in place, bearings lubricated, and equipment has been test run under observation.

1.6. ALTERNATES

A. Refer to Division 01 Section, “Alternates” for description of work under this section affected by alternates.

1.7. EXTRA MATERIALS

A. Provide spare set of filters for all units.

1.8. SHORT CIRCUIT CURRENT RATINGS

A. Unless otherwise noted, all HVAC equipment shall include a nameplate that identifies the short circuit current rating (SCCR). Unless otherwise noted the SCCR rating for all HVAC equipment shall be a minimum of 65 KA.

1.9. PACKAGED EQUIPMENT BACNET CARDS

A. For all packaged units, furnish and install Bacnet cards for interface to the automatic temperature control system. Map over all Bacnet points and alarms and show on ATC system graphics. All alarms must be identified on ATC graphic.

PART 2. PRODUCTS

2.1. EXTERIOR PIPE ROLLER SUPPORTS

A. Furnish and install pipe roller supports for all exterior piping as indicated on contract drawings. Pipe roller supports shall be constructed of heavy gauge galvanized steel, continuous welded corner seams, 2 x 4 treated wood nailer, heavy gauge galvanized steel counterflashing with galvanized steel channel track attached.

B. Roller assembly shall consist of galvanized steel channel track, galvanized steel fittings, washers, nuts, and painted cast iron roller. Installation shall permit both vertical and horizontal adjustment. Units shall be Pate Model RAC, RTS, or approved equal.

2.2. VARIABLE SPEED DRIVES

A. Provide variable speed drive controllers for single zone VAV units as indicated on contract drawings.

B. The single zone VAV air handling units shall be factory furnished with variable frequency drives for the supply and exhaust air fans, and shall comply with this

specification section.

C. The adjustable frequency controller (AFC) shall convert three phase 60 Hertz utility power to adjustable voltage and frequency, three phase, AC power for stepless motor control from 5 percent to 110 percent of base speed.

D. The AFC shall be a voltage source type with a PWM output utilizing power transistor semi-conductors.

E. The AFC together with all options and modifications shall mount within a standard NEMA 1 enclosure suitable for continuous operation at ambient temperature of 0 to 40 degrees C. with relative humidity to 95 percent non-condensing. All high voltage components within enclosure shall be isolated with steel covers. The complete unit shall be UL approved and UL labeled.

F. Circuits shall provide DV/DT and DI/DT protection for semi-conductors. AFC shall be capable of starting into a rotating load without delay. Protective circuits shall cause instantaneous trip (IET) should any of the following faults occur:

1. Motor overload.

2. Short circuit.

3. Motor overtemperature fault.

4. Reverse phase.110 percent of controller maximum sine wave current rating is exceeded.

5. Output phase to phase and phase to ground short circuit condition.

6. High input line voltage.

7. Low input line voltage.

8. Loss of input phase.

9. External fault. This protective circuit shall permit, by means of the terminal strip, wiring of remote NC safety contacts such as duct dectors, etc., to shut down the drive.

G. The following adjustments shall be available in the controller and retained in non-volatile memory:

1. Maximum frequency (15 to 400 Hz) factory set at 60 Hz.

2. Minimum frequency (3 to 60 Hz) factory set at 6 Hz.

3. Acceleration (.1 to 360 seconds) factory set at 20 seconds.

4. Deceleration (.1 to 360 seconds) factory set at 20 seconds.

5. Volts/Hertz ratio factory set for 460V at 60 Hz.

6. Voltage offset or boost factory set at 100 percent torque.

7. Current limit (50 percent to 110 percent sine wave current rating) factory set at 100 percent current.

H. The AFC shall have the following basic features:

1. Door-mounted operators controls consisting of a membrane command center which allows manual stop/start and speed control, local/remote indication and manual/or automatic speed control selection. In addition, the command center shall serve as a means to configure controller parameters such as min speed, max speed, acceleration and deceleration times, Volts/Hz ratio, torque boost etc. Potentiometers shall not be allowed for these settings.

2. Main input disconnect to provide a positive disconnect between the controller and all phases of the incoming A-C line. This disconnect shall be mounted inside the controller enclosure and have through-the-door interlocking toggle with provisions for padlocking.

3. Electronic motor overload relay.

4. Automatic restart after power outage, drive fault or external fault, with drive in automatic mode. The circuit shall allow the user to select up to (10) restart attempts as well as the dwell time between attempts. The reset time between fault occurrences shall also be selectable. All settings shall be via the membrane command center.

5. Door-mounted LED display for digital indication of:

a. Frequency output

b. Voltage output

c. Current output

d. First fault indication

e. Equipment Speed (RPM)

6. Relay contacts for remote indication of drive fault and motor finning.

7. Three critical frequency avoidance bands, field programmable via the membrane command center. Each critical frequency avoidance band shall have a bandwidth adjustable via keypad entry of up to 10 Hz.

8. Three programmable preset speeds which shall force the AFC to a preset speed upon a user contract closure.

9. Isolated process follower to enable VFC to follow a 4-20 mA signal.

10. The AFC shall have the capability to ride through power dips up to 500 msec without a controller trip depending on load and operating condition.

11. Line reactor to minimize line surges, line notching, and voltage distortions.

I. Manual bypass-to-line with magnetic contactors to transfer motor from the variable frequency controller to full speed operation on utility supplied input power while the motor is at any speed. Two motor contactors, electrically interlocked shall be utilized, one contactor between the controller output and the motor and the other between the bypass power line and the motor, providing across-the-line starting.

J. Motor protection per National Electrical Code shall be provided in both the "controller" mode and the "bypass" mode by a motor overload relay. The 115 volt A-C relay control logic, allowing common start/stop commands in the "controller" mode and the "bypass" mode shall also be included within the enclosure.

K. The bypass shall include a door interlocked, main power input circuit breaker providing positive shutdown of all power to both the bypass circuitry and the VFC. The bypass circuit shall also include a second input disconnect to the VFC. This disconnect shall provide the ability to safely troubleshoot and test the controller, both energized and de-energized, while operating the bypass mode.

L. The VFC and all components shall be supplied within a single NEMA 1 enclosure, and shall be U.L. Listed as a single unit. Furnish all components necessary to provide a minimum lead length between motor and drive of 400 ft. The VFC shall not generate damaging transistor pulses greater than the limits set by NEMA MG-1 at 400 Ft lead length.

M. The VFC manufacturer shall maintain and staff nationwide service centers. These service engineers shall be employed by the manufacturer and provide start-up service including physical inspection of drive and connecting wiring and final adjustments to meet specified performance requirements.

N. The VFC shall carry a full parts and labor warranty for two (2) years from date of substantial completion.

O. The variable speed drive manufacturer shall be the manufacturer of the motors supplied with the associated equipment. Coordinate with equipment manufacturers.

P. The variable speed drive shall be Reliance VTAC V, or approved equal of Accutrol, Cutler Hammer, Graham, York, Baldor, AC Tech, ABB, Emerson, Yaskawa, Toshiba, or as approved equal.

Q. The variable speed drive manufacturer shall coordinate with the ATC contractor and provide all necessary devices whether optional or not to perform complete and automatic operation as described in the sequence of operation. All safeties, including freezestats, duct smoke detectors, shall be enabled when variable speed drives are in manual or bypass.

R. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.

2. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet; protocols accessible via the communications ports.

S. Variable speed drives shall be carefully selected for the duty required. Variable speed drives shall be specifically designed for the specified equipment to be controlled. Pump drives shall be selected for pumps and fan drives shall be selected for fans.

2.3. SINGLE ZONE VAV UNITS

A. New Products: Furnish and install, where shown on the plans, Single Zone VAV Units with design features as specified within this specification. The units shall be provided and installed in strict accordance with the specifications. All units shall be complete with all components and accessories as specified. Any exceptions must be clearly defined. The Contractor shall be responsible for any additional expenses that may occur due to any exception made.

B. Manufacturers

1. Manufacturer List

a. Venmar/Nortek - basis of design
b. Daikin
c. Aaon

2. Substitution Limitations: Other Equipment manufacturers shall be considered provided the construction specifications, capacities and performance criteria are met.

3. Description

a. Provide factory fabricated Air Handling Units with capacity as indicated on the schedule. The units consist of factory assembled components as shown on drawings and outlined on schedule, enclosed in a single or multiple piece casing as shown on the mechanical drawings.
b. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service as determined by the Engineer. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams and Installation, Operation and Maintenance Instructions Manual shall be attached to the control panel access doors within each unit.
c. Units shall be shipped in one piece or multiple pieces as shown on mechanical drawings to accommodate freight as required, or to allow for reduced size building access or load limitations (specify maximum dimensions and or weight).
d. Regulatory Requirements
i. Each unit shall bear an ETL or UL label under UL Standard 1995 indicating the complete unit is listed as an assembly. ETL or UL listing of individual components, or control panels only, is not acceptable.

ii. Additional Testing and Quality Assurance as explained in individual component / item sections in the following paragraphs of this specification.
iii. Units shall carry the label of a Nationally Recognized Testing Laboratory (NRTL), or a Standards Council of Canada (SCC) approved lab (Testing Organization and Certifying Body).
iv. Units shall comply with NFPA 70, National Electrical Code, as applicable for installation and electrical connections of ancillary electrical components of Air Handling Units.
v. All electrical components and assemblies shall comply with NEMA standards.

4. Performance / Design Criteria

a. Capacities: The attached schedules, tables and specifications are to be used as the selection criteria for the air handling equipment to include Air Flow Rates, External Static Pressures and Gas Inputs.
b. The air handling units' sound power data shall be submitted for approval. The submittal shall include a complete description of the methods and procedures used to develop the sound power levels being submitted.

5. Unit Base and Floor

a. General: Base frame shall be attached to the unit casing at the factory.
b. Perimeter Base Rail
i. Unit perimeter base shall be completely welded and constructed from 6 in Steel Tube structural tubing. Bolted or riveted bases are not acceptable.
c. Base Paint/Coating: The unit base frame shall be corrosion protected.
d. Base internal Structure: Intermediate structural members as required to support all internal components.
e. Floor Material: Internal walk-on floor shall be 14Ga HR. Floor seams shall be sealed to create leak-free joints.
f. Floor Coating
i. Pure Polyurea Elastomer : Unit base and floor shall be factory covered with topcoat industrial grade membrane to ensure air- and watertightness as well as walk-on grip. Floor membrane shall be high-performance, sprayed, plural-component pure polyurea elastomer, based on amine-terminated polyether resins, amine chain extenders and prepolymers. Floor membrane shall be flexible, tough, resilient monolithic membrane with good water and chemical resistance and shall resist to temperatures up to 250°F. Floor membrane materials shall be free of solvents and VOC's, shall be suitable for use in compartments handling conditioned air and shall comply with the requirements for the Standard for Heating and Cooling Equipment, ANSI/UL 1995, third edition, dated 02/18/2005, Section 5.10 and Section 18. Floor constructions which are not air- and water-tight are not acceptable.
g. Thermal Break: Unit floor construction shall include two-stage thermal break, using gasket between base floor framing and liners underneath

and floor membrane on top.

h. Base insulation: The floor cavity shall be insulated for air and water-tight construction with Polyurethane Foam at a minimum R-value of 20.

i. The outer sub-floor of the unit shall be made from 24Ga Galv to protect the insulation from external environment.

j. Deflection / Load: When rigging, base frame deflection shall be less than 1/360 of the unit length. The minimum floor design load is 150 pounds / square foot (distributed load), and the maximum point load on floor shall be 300 pounds (over 1 square foot).

k. Limitations: Bolted, riveted or formed channel bases are not acceptable. Single wall floors with glued and pinned insulation and no sub floor are not acceptable.

l. Lifting Lugs: Base shall be provided with lifting lugs, minimum (4) per section, and properly located to assure uniform loading. Lifting lugs shall be designed in accordance with unit weight and rigging requirements.

m. Grating for Floor Openings: Floor openings shall be provided with protective grating.

n. Recessed Floor

i. 1 in Recessed: Contact factory for description.

o. Unit Mounting: Unit shall be designed to be Mounted on an Insulated Plenum Base.

6. Cabinet

a. Environment

i. Outdoor: Units shall be designed for outdoor installation as indicated on the schedule. Indoor units weatherized for outdoor use are not acceptable. Outdoor units shall have a sloped roof with a 1/4" per foot minimum roof pitch to prevent water accumulation, with roof joint seams of the T-shape construction, with minimum height of 1", metal strip sealed and encapsulated. Outdoor units shall be provided with rain gutters or drip edges above all access doors. Outdoor units shall be designed to resist snow, ice and wind loads.

b. Construction

i. ITF - EnergyPack: The construction of the air handling unit shall consist of a (1" x 2") roll-formed steel frame with formed double wall casing panels. The exterior casing panels shall be attached to the gasketed (1" x 2") steel frame with corrosion resistant fasteners. All casing panels shall be completely removable from the unit exterior without affecting the unit's structural integrity. The double wall panel shall be removable from the outside of the unit without affecting the structural integrity of the unit.

c. Deflection

i. ITF - EnergyPack: The maximum deflection of walls and roof shall be L/200 at +/- 8" w.c. (L= span in inches). Deflection is measured at panel seams at the center of the span. If panels cannot meet this deflection, additional internal reinforcing is required.

d. Load: The minimum roof and wall load is 75 pounds / square foot (distributed load such as wind and snow). The maximum point load on

the roof shall be 300 pounds (over 1 square foot).

e. Leakage: Air handlers shall be designed to meet maximum leakage of SMACNA class 3.
f. Exterior Material: 18Ga Galv Pre-Paint.
g. Interior Material: 24Ga Galv.
h. Thermal Break
    i. Modified Thermal Break: Casing shall be of the "no-through-metal" design. The casing shall incorporate insulating thermal breaks as required so that, when fully assembled, there's no path of continuous unbroken metal to metal conduction from inner to outer surfaces.
i. Caulking (Internal): Internal Calking shall be of Silicone - Urethane type.
j. Caulking (External): External Calking shall be of Silicone - Urethane type.
k. Exterior Finish
    i. Pre-Paint: Coating shall be baked on Polyester Coating, Sandstone gray. The paint system is a dual primer/topcoat with clear coat for added surface hardness. Color: Sandstone The completed coating must have passed the Salt Spray Resistance Test of 1000 Hours, per ASTM B117-90. The manufacturer shall be able to provide test results upon request.
l. Interior Finish
    i. None: Unpainted.
m. Insulation (Based on Liner Material Type)
    i. Solid Liner Insulation = Insulation shall be 1.5 lb./cu. ft. non-compressed fiberglass insulation. Insulation shall meet the erosion requirements of UL 181 facing the airstream and fire hazard classification of 25/50 (per ASTM-84 and UL 723 and CAN/ULC S102-M88) - see drawing for locations.
    ii. Exposed insulation edges in the airstream are not acceptable.

7. Access Doors

a. Full size access door(s) allowing for periodic maintenance and inspections shall be provided for all serviceable components as shown on the plans. Removable panels are not acceptable. Doors shall be solid double wall insulated construction. The door frame shall be extruded aluminum with a built-in thermal break barrier and full perimeter gasket. There shall be a minimum of two heavy duty latches per door. Latches shall be operable from both the interior and exterior of the unit.
b. Doors shall open against pressure or as shown on drawings.

8. Drain Pans

a. IAQ style drain pans shall be provided as shown on the drawings. All pans are to be pitched for complete drainage with no standing water in the unit. Drain pans shall be fabricated from 18Ga 304 SS with solid welded seams and equipped with a stainless-steel MPT drain connection diameter of 1.25 in. Pans shall be insulated between the liner and the main pan.

C. Components

1. FANWALL TECHNOLOGY® (FWT)

a. Impeller
   i. Wheel Type - ZA Cpro-ECblue:
   Fans shall be polymer direct drive arrangement and shall be individually housed. Fans shall be certified by AMCA for performance.

b. Fan housing or "cell" shall be painted with N/A.

c. Fan/motor assembly: Fan/motor shall be mounted within the housing on an adjustable slide rail base. Fan/motor assembly must be capable of either horizontal or vertical application.

d. Balancing
   i. Wheel Type - ZA Cpro-ECblue:
   Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, for fan application class BV-4 to meet or exceed a rotational imbalance Grade 2.5 producing a maximum rotational imbalance of 1.0 per second peak, filter in. "Filter in" measurement indicates that the specified balance grade must be achieved at the submitted design operating speed for the fan(s).
   ii. Electronically Commutated Permanent Magnet Motors:

      a) All ECM motors shall be UL listed with brushless permanent magnet motors.
      b) All bearings shall be permanently lubricated.
      c) Motors shall have a design life of L10 100,000 hours.
      d) Motors shall have a means of shaft isolation to prevent electrical arcing across bearings.
      e) Motors shall be complete with electronic motor overload protection, locked rotor protection and thermal management.
      f) Motors shall meet IP54 protection and thermal class THCL 155.
      g) Modbus communication option available.

e. Backdraft Dampers:

Each fan applied in multiple fan applications shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan, or multiple fans, becomes disabled. The system effect for the submitted back flow prevention device shall be included in the calculation to determine the fan TSP for fan selection purposes and shall be indicated as a separate line-item SP loss in the submitted fan selection data. Manufacturers other than the basis of design being submitted must provide independent lab certification of fan testing that indicates the system effects attributed to the submitted back flow prevention device in the submitted close-coupled mounting arrangement at the inlet of the fan. Fans submitted with discharge dampers will not be approved. Back Draft Damper performance data that is based on an AMCA ducted

inlet and ducted discharge mounting configuration will not be accepted. Submitted Back flow prevention device data must be reflective of close-coupled mounting at the intake of the fan(s) per the project design documents. Motorized dampers or other motorized devices submitted for back flow prevention are not acceptable.

AHU Manufacturers that do not manufacture the fans being submitted must provide tested and certified performance data for fans as installed in the AHU unit including the back draft damper system effects introduced by close-coupled back draft dampers at the fan inlet.

f. Fan Arrays
   i. Fan and motor assemblies shall be designed for application in multiple fan arrays.
   ii. The fan array shall consist of multiple housed fans or "cells", spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air tunnel cross section and components therein.
   iii. Each fan and motor assembly shall be removable through an access door located on the discharge side of the fan wall array without removing the fan wheel from the motor.
   iv. Fan system power requirements or sound power levels that fail to meet specified performance levels shall be corrected to meet specified performance levels at no additional cost to the owner. Any proposed corrections for power or sound deviations from the specified values must be submitted to the engineer for approval prior to implementation of any proposed corrective procedure.
   v. Submittals for units providing less than the scheduled quantity of fans and/or spacing of fans for multiple fan arrays shall submit CFD modeling of the air flow profile for approval that indicates uniform velocity and flow across all internal components without increasing the length of the unit or changing the aspect ratio of the unit casing as designed.
   vi. Manufacturers that do not manufacture their own fans for the specific purpose of use in multiple fan arrays, shall provide a letter guaranteeing submitted AHU performance for flow, pressure, and acoustics at the perimeter boundary of the unit signed by an officer of the OEM fan manufacturer being submitted. Any corrective acoustical treatment, added airway tunnel lengths, increased electrical service, and any structural modifications necessary to meet the specified and scheduled performance shall be provided at no additional cost to the owner to meet the specified performance criteria. All proposed corrective actions, when required, must be submitted for approval and shall include a guarantee of performance, as listed above, at no additional cost to the owner.
   vii. It shall be the option to have the airflow performance tested. All tests shall be in accordance with AMCA Standard 210: Laboratory Methods for Testing Fans for Rating and AMCA Standard 203-90: Field Performance Measurement of Fan

Systems.

g. Acoustical Performance
   i. The AHU unit shall provide the specified acoustical performance as scheduled for the unit supply discharge opening(s), RA opening(s), and the Outside air and Exhaust air opening(s).
   ii. Listed or alternate manufacturers, other than basis of design, providing fan arrays that incorporate fans which are not manufactured by the AHU manufacturer, must provide modeled acoustical performance of the AHU unit.
   iii. Sound and performance data for approval showing only single fan performance for multiple fan array supplication will be returned without review.
   iv. Any proposed remedy for deviations in submitted sound power levels shall be approved by a registered acoustical consultant as selected by the owner or architect. Costs for review of the proposed changes shall be borne by the contractor.

h. Electrical System: Provide a complete electrical and control system required to run the FANWALL system including all equipment, material, electrical enclosures, electrical components and electrical labor. As defined below:
   i. Drives to be provided with Modbus communication.
   ii. ECMi: All motors in the FANWALL array shall be wired to a main enclosure for power and signal distribution.
   iii. All fans shall include shaft grounding rings.

i. Direct Expansion Coils - Nortek Air Solutions
   i. AHRI Certified Performance.
   ii. Piping Connections: Same end of coil.
   iii. Tube Material: Round Seamless Copper 0.017 in wall.
   iv. Tube Diameter: 0.500 in O.D. tube.
   v. Fin Type: Sine Wave plate with full drawn collar for accurate spacing.
   vi. Fin Material / Thickness: Aluminum 0.006 in.
   vii. Fin Spacing: 8 through 14 FPI on 1/2" tube.
   viii. Fin and Tube Joint: Tubes are mechanically expanded.
   ix. Coil Headers: Type L Seamless copper with 5% silver brazed joints.
   x. Connection Material: Copper.
   xi. Connection Type: Sweat.
   xii. Distributors: Interchangeable (removeable) nozzle type with Optional auxiliary side connections (asc) for hot gas bypass.
   xiii. Coil Casing: 14Ga Galv.
   xiv. Leak Testing: Entire coil assembly submerged in water and filled with Nitrogen at 315 psig.
   xv. Coil Working-Pressure Rating: 250 psig at 300 deg F.

j. Hot Gas Reheat Coils
   i. AHRI Certified Performance.
   ii. Piping Connections: Same end of coil.
   iii. Tube Material: Round Seamless Copper 0.016 in wall.
   iv. Tube Diameter: 0.375 in O.D. tube.
   v. Fin Type: Sine Wave plate with full drawn collar for accurate spacing.

vi. Fin Material / Thickness: Aluminum 0.0075 in.
vii. Fin Spacing: 8 through 14 FPI on 3/8" tube.
viii. Fin and Tube Joint: Tubes are mechanically expanded.
ix. Coil Headers: Type L Seamless copper with 5% silver brazed joints.
x. Connection Material: Copper.
xi. Connection Type: Sweat.
xii. Distributors: Interchangeable (removeable) nozzle type with Optional auxiliary side connections (asc) for hot gas bypass.
xiii. Coil Casing: 16Ga Galv.
xiv. Leak Testing: Entire coil assembly submerged in water and filled with Nitrogen at 315 psig.

2. Coil Working-Pressure Rating: 250 psig at 300 deg F.

a. Refrigerant Circuits
i. Entire unit, including all refrigeration circuits, shall be manufactured as one single system, at the same time and location, by the unit Manufacturer.
ii. Systems where the unit Manufacturer is purchasing a condensing unit from another Manufacturer and integrating it to the unit, are not acceptable.
iii. Refrigeration section shall be designed for full and easy access for maintenance. Entire refrigerant piping circuit shall be leak tested at 450 psig (R454B refrigerant) or 200 psig air pressure (R513a refrigerant).
iv. Capacity modulation shall be provided by modulation capacity compressor and/or by hot gas bypass on lead compressor(s).
v. Refrigerant circuit components shall include thermal expansion valve.
vi. Refrigerant circuit components shall include distributor.
vii. Refrigerant circuit components shall include liquid line filter drier.
viii. Refrigerant circuit components shall include charging valve.
ix. Refrigerant circuit components shall include high and low pressure side gauge ports.
x. Hot Gas Reheat

a) Modulating On Lead Circuit - On / Off Others: Modulating hot gas re-heat valves on lead circuits, On/Off on remaining circuits.

b. Refrigerant Piping
i. All refrigerant piping shall be of K, L or ACR copper type. The complete system shall be factory dehydrated, and pressure tested at 450 psig (for R454B refrigerant) or 200 psig air pressure (for R513a); the system shall then be factory charged.
ii. Suction lines shall be insulated with 3/8" [10 mm] thick elastomeric pipe insulation. Pipe insulation exposed to UV light radiation shall be protected with aluminum tape.
iii. Safety controls shall include a high and low refrigerant pressure

switch on each circuit for protection against loss of charge.

iv. Each refrigerant circuit shall include DDC controlled compressor anti-cycling.

v. Each refrigerant line present in other compartments than only the compressor compartment shall be clearly identified with the use of labels showing both the refrigerant line's duty (suction, liquid, discharge, hot gas bypass, hot gas re-heat) along with the circuit number (i.e. Suction 1, Liquid 3, etc.). This labeling shall be repeated in each compartment of the unit (else than the compressor compartment) where refrigerant lines are present, in such a way that all refrigerant lines in any other compartment can easily be identified.

vi. Equipment utilizing A2L refrigerants shall be equipped with a Refrigerant Leak Detection system in conformance with UL 60335-2-40 Annex GG.

c. Integrated Air Cooled Heat Pump

i. Each refrigerant circuit shall include moisture indicating site glass, filter drier, liquid line isolation valve and externally equalized thermostatic expansion valve. Safety controls shall be manual-reset on both low pressure and high- pressure sides. The complete refrigerant piping shall be factory tested.

ii. Heat pump coils shall be tested to be leak-free with nitrogen or helium at 500 psig underwater in an illuminated tank. After testing, coils shall be evacuated, thoroughly dried and capped.

iii. Coils shall be constructed of high-performance aluminum microchannel tubes, fins and manifolds.

iv. Tubes shall be flat and contain multiple, parallel-flow microchannels and span between aluminum headers.

v. Full depth louvered aluminum fins shall fill spaces between the tubes.

vi. Tubes, fins and aluminum headers shall be oven-brazed to form a complete refrigerant-to-air heat exchanger coil.

vii. Copper stub pipes shall be electric resistance welded to aluminum coils and protected to seal joints from corrosive environmental elements.

viii. A 10°F sub-cooling section shall be an integral part of the condenser coil.

ix. Standard construction fluid connections are sweat-soldered and made of copper.

x. Modulation on heat pump fans for head pressure control and low ambient operation down to 20°F shall be provided.

xi. Reversing valve.

d. Compressors

i. Scroll: Compressor shall be hermetically sealed scroll type with a forced-feed lubrication system and oil charge. Compressor motor shall be suction-cooled motor windings with inherent internal line break protection and mounted on RIS vibration isolators. Compressor shall include internal pressure relief valve, gas sensor and device to limit the shut-down noise caused by scroll reversal. Each compressor shall have a crank case heater that is independently fused and will remain energized at all times

unless unit is disconnected at the main power source.

a) Compressor Modulation – inverter variable speed compressors shall be capable of seamless capacity modulation from 10% to 100% of its nominal capacity, without the use of hot gas bypass.

3. Filters

a. Provide filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the unit. The filters shall be manufactured by AAF, Filtration Group or equal. Filters shall be in compliance with ANSI/UL 900 – Test Performance of Air Filters. Filter sections shall be designed for a maximum of 500 fpm, or meet or exceed the area specified in the mechanical schedule.

b. Filter Frames and Racks
   i. Filter frames and racks shall be completely factory assembled and designed for industrial applications.
   ii. Filter frames and racks shall be applied in low efficiency filter applications and will be either upstream or side accessible.
   iii. Side accessible filter racks shall have an oversized access door on the exterior of the air handler, centered on the filter rack for easy filter removal.
   iv. Filter racks shall be designed for a maximum of 500 fpm, or meet or exceed the area specified in the mechanical schedule.
   v. Filter Frames to be fabricated from no less than 16 gauge Galvanized material.
   vi. Filter racks/blank-offs shall be fabricated from 18Ga Galv material.
   vii. All filter holding frames must be caulked in between them to minimize bypass air through the frames.
   viii. Furnish spare set of filters.

c. Filter Frame Sizes (MERV-13): standard sizes.

d. Pleated Type
   i. The filter shall consist of a pleated media, media support grid, and enclosing frame.
   ii. The media shall be non-woven cotton fabric and shall be designed to consistently increase efficiency throughout service life of filter with an initial Merv rating as listed in schedule.
   iii. The media support shall be a welded wire grid with an effective open area of not less than 90%.
   iv. The grid shall be bonded to the filter media to eliminate media oscillation and pull away.
   v. The enclosing frame shall be constructed of rigid, heavy duty, high wet strength beverage board.
   vi. The frame shall be bonded to the filter pack.

e. Filter Gage(s)
   i. Each Filter bank shall be furnished with: Magnehelic Filter Gage with a 4 ¾" OD white static pressure dial with black figures and zero pointer adjustment.

4. Multi-tubular High Modulation Indirect Fired Gas Heaters

   a. Provide Heatco Inc. indirect gas-fired HD Furnace models listed by Intertek Testing Services (ITS / ETL), a Nationally Recognized Testing Laboratory (NRTL), to the current edition of ANSI Z83.8 / CSA 2.6 Standard for Gas-Fired Duct Furnaces for installation on the positive pressure side of the circulating air blower only and provide a minimum combustion efficiency of 81%.
   b. Furnaces shall be listed for outdoor installation in accordance with Category I and Category III venting systems without need for additional power venting.
   c. Gas-fired furnace(s) provided shall have a tubular heat exchanger constructed of Type 316 stainless tubes (.047 Min. Wall thickness) produced to ASTM A249. Heat exchanger tubes shall be mechanically secured to vestibule panels and design shall be suitable to withstand 3.0" w.c. total external static pressure.
   d. Furnaces shall be Listed for application downstream of refrigeration and cooling systems and shall provide means for removal of condensate that occurs in the heat exchanger tubes during cooling operation. Heat exchanger tubes shall have (integral formed dimpled restrictors; formed turbulators) to provide for an unobstructed drainage path and tubes shall be formed to provide a positive pitch to promote condensate drainage. Drainage shall be configured so that burners are not exposed to condensate.
   e. The Furnace shall include:
      i. A 20-gauge galvanized steel cabinet.
      ii. 1 inch thick, minimum 1 ½ lb./ft.^{3} density thermal insulation for exterior cabinets.
      iii. Patented inshot gas burners, with integral carryovers, capable of operation at 12:1 turndown with modulating controls.
      iv. An induced-draft combustion air blower to provide for positive venting of flue gases.
      v. Provision for attachment of a factory furnished and installed vent system to exhaust flue gases to outdoors.
      vi. Combustion air pressure switch to prove air supply for combustion.
      vii. Direct spark ignition of the gas burners with remote flame sensor to prove carryover across all burners.
      viii. Listed Combination Gas Valve incorporating redundant (two) electric safety shut-off valves, manual shut-off, and gas regulator which regulates gas pressure to burner supply manifold.
      ix. A 1/8" NPT tapped test gauge connection in the gas manifold for measuring gas pressure.
      x. A union fitting downstream of gas control to facilitate installation and service.
      xi. An automatic reset type high limit switch to limit maximum outlet air temp to less than 250°F.
      xii. Manual reset flame rollout switch(es).
      xiii. A Class II step down transformer to provide 24 VAC control voltage at selected supply voltage.
   f. Furnace shall incorporate a Direct Spark Ignition control module that is

design certified by a NRTL to ANSI Z21.20 and CAN/CSA-C22.2. The control shall provide:

i. 100% safety shut-off.
ii. A minimum 15-second pre-purge to provide a minimum of four (4) air changes.
iii. A maximum 0.8 second flame failure response time.
iv. Two additional ignition retrials preceded by an inter-purge period.
v. A minimum 30 second post-purge.
vi. An automatic reset after one hour should a lockout occur.
vii. A LED indicator light to provide a flash code to identify operating condition of control.
viii. An Alarm capable contact.

g. All electrical components shall be listed or recognized by a NRTL (ETL, UL, CSA, etc.).
h. Furnace and burners provided are listed for use on Propane gas as specified at the time of order.
i. Ratings listed in Submittal Tables are for installations between 0 and 2000 feet (0 to 610m). For installations above 2000 feet, unit must be de-rated in accordance with National Standards. Consult Factory.
j. The fully assembled Furnace shall be factory fire tested prior to shipment.
k. Furnace shall be accompanied by wiring diagrams for the control system supplied and printed instructions for proper installation, start-up, operation and maintenance.
l. Burner and components shall be warranted for two (2) years. Heat exchanger shall be warranted for ten (10) years on a pro-rated basis.
m. Initial on sight start-up must be completed by qualified installation and service agency. A Start-up data sheet is provided for recording operating data and the final heater adjustments. The indicated portion of the Start-up data sheet must be returned to Heatco to validate factory warranty.

5. Wheel Heat Exchangers

a. General
i. Wheel Type

a) Total: The energy recovery wheel shall transfer both sensible and latent energies between outgoing and incoming air streams in a counter flow arrangement.

b. Novelaire:
i. Quality Assurance

a) The energy recovery wheel shall bear the AHRI 1060 Certified Product Seal. Wheels tested in independent laboratories, whether according to AHRI Standard 1060 or not, are not acceptable unless certified by AHRI. Wheel manufacturer membership in AHRI is not an acceptable substitute for AHRI certified product.

b) The media shall be in accordance with NFPA or UL guidelines.
c) The energy recovery wheel shall be a UL Recognized component and bears the UR label. In accordance with UL1995 standard, all electrical components and wires shall be UL Recognized.

ii. Performance

a) Supplied air temperatures shall be no higher (cooling mode) or lower (heating mode) than the scheduled values.

iii. External static pressure drops shall be as scheduled.
iv. Rotor and Media

a) Wheel Type - Total:

1) The enthalpy wheel shall be constructed of corrugated synthetic fibrous media, with desiccant infused and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccant coated, bonded, or synthesized onto the media are not acceptable due to delamination or erosion of the desiccant material.

2) Media shall be synthetic to provide corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Coated aluminum is not acceptable.

3) Face flatness of the wheel shall be maximized (+/- 0.032 in) to minimize wear on inner seal surfaces and to minimize cross leakage.

4) Rotor shall be constructed of alternating layers of flat and corrugated media.

5) Wheel layers should be uniform in construction forming uniform aperture sizes for air flow.

6) Wheel construction shall be fluted or formed honeycomb geometry to eliminate internal wheel bypass. Wheel layers that can be separated or spread apart by air flow are unacceptable due to the possibility of channeling and performance degradation.

7) The desiccant material shall be a molecular sieve, and specifically a 4A or smaller molecular sieve to

minimize cross contamination.

8) The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub.

9) The wheel construction should allow for post fabrication wheel alignment.

v. Seals

a) Wheel Type - Total: The wheel seals shall be a contact brush seal on both the periphery of the wheel and the face. Seals should be easily adjustable.

vi. Frame/Cassette

a) Cassettes shall be fabricated of heavy duty reinforced galvanized steel or welded structural box tubing.
b) Wheel Type - Total: Cassettes shall have a built-in adjustable purge section minimizing cross contamination of supply air.
c) Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged bearings or pillow block.

vii. Drive System

a) Wheel Type - Total: Drive systems shall consist of fractional horsepower A.C. drive motors with multilink drive belts.
b) Furnish with spare belts.

c. Controls
i. The frost prevention method will be VFD at 33°F DB.
ii. A rotation sensor shall be supplied.

d. Electrical System
i. Electrical Panel: Provide a Variable Frequency Drive to start and run the heat wheel. The Variable Frequency Drive shall be sized accordingly to start and hold the heat wheel motor.
ii. Variable Frequency Drive

a) Drives to have NEMA Rating: N/A.
b) Drives shall be supplied by Factory.
c) Drives shall be installed by Factory.
d) As required by electrical design, when using variable frequency drives where distance and filtering is an issue, provide output line reactors as required. Size output filter according to manufacturer's recommendations.

6. Dampers

a. Furnish and install, at locations shown on drawings, or in accordance with schedules, Dampers with published leakage data certified under the AMCA certified ratings program.
b. Standard for Acceptance
    i. Standard for acceptance for Outside Air Openings shall be TAMCO 9000 (Aluminum), except SZVAV-1, SZVAV-2 - OSA Opening: TAMCO 1000 (Aluminum).
    ii. Standard for acceptance for Exhaust Air Openings shall be TAMCO 9000 (Aluminum), except SZVAV-1, SZVAV-2 - EXH Opening: TAMCO 1000 (Aluminum).
    iii. Standard for acceptance for Recirculation Openings shall be TAMCO 1000 (Aluminum).
c. Actuators
    i. Actuators shall be furnished by Factory.
    ii. Actuators shall be mounted by Factory.
    iii. Actuators shall be wired to Electrical Panel.
d. Furnish units with motor operated minimum O.A. damper, economizer O.A. damper, return air dampers, exhaust air dampers, and ERV wheel bypass dampers.

D. Electrical Power and Controls

1. General

a. All electrical and automatic control devices not previously called out or listed in this section are to be furnished and installed in the field by others.
b. The unit shall feature a mounted permanent nameplate displaying, at a minimum, the Manufacturer, serial number, model number, date of manufacture and current and voltage readings.
c. The unit must have an ETL or UL Listing and bear the appropriate mark.
d. An interlocking mechanism is furnished on the fan section access door. The de-energizing switch is compliance with CAL-OSHA, ETL and the mechanical protection requirements of UL 1995.
e. Control enclosures shall be equipped with an electrical cabinet heater.

2. Wiring and Conduits

a. All wiring and electrical connections shall be of (75°C) insulated copper wires, copper bus bars and copper fittings throughout. Power supply terminals shall be identified with permanent markers.
b. Wiring Type
    i. Flexible / Non-Watertight: In dry environments, high-voltage wiring shall be installed using flexible metal conduit and NEMA 1 junction boxes. Low-voltage and signal wiring shall be carried out using FT4-rated cables and NEMA 1 junction boxes.
c. When unit section splits are present, low voltage wiring shall be split using quick connectors for quick and easy field installation.
d. Additionally, for each set of quick connectors, the male branch in one unit section and the corresponding female branch in the next unit section shall be identified with the use of a color coded or numbered label.

e. At each high voltage line split, a junction box shall be provided in one of the sections; the wiring in the section where the junction box is located and the matching wiring in the next section shall be identified with the use of a color coded or numbered label.
f. Control enclosure shall be provided with a fused disconnect mounted within and a door interlocked weatherproof handle mounted on the exterior.
g. All control panels shall have a short circuit current rating of 65 KA.

3. Controls

a. An integral electrical control compartment shall be furnished on the unit.
b. The unit is equipped with an electrical compartment featuring a hinged access door and a locking mechanism; however, it is not NEMA certified. NEMA-certified enclosures are available upon request.
c. All components, except those not mounted directly in the unit, shall be factory mounted and wired to a labeled terminal strip.
d. All components shall be identified using printed self-adhesive labels, consistent with the numbering used in the wiring diagrams.
e. Control components shall include, but are not limited to, single-point connection power distribution block, sub and control circuit fuses or circuit breakers, control transformers, motor starters and overloads for single-speed operation.
f. A flow schematic with sensor and component identification and location, interlocks and sequence of operation shall be included with submittals.
g. A wiring schematic and a bill of materials shall be completed in ladder/logic format, with component labeling according to line numbers, once a release for production has been received.
h. The wiring schematic, bill of materials and flow schematic shall be included within the unit's control compartment.
i. Refrigeration mitigation controls and refrigeration leak detection shall be U.L. listed and factory furnished. Leak detection shall be monitored on the ATC system.

4. Control Systems

a. All Controls by Others:
i. The control system with necessary sensors and interfaces shall be field supplied, programmed, mounted, wired and run tested by the Control Contractor.
ii. The Control Contractor shall coordinate sensors, interfaces, mounting locations and logic with the unit Manufacturer.
iii. The control system shall be separately mounted.

E. Plenum Curb:

1. Curb shipped welded, one piece.

2. Curb must be installed square and level.

3. Material shall be galvanized 12ga steel.

4. Factory installed pressure treated 2 x 4 wood nailer.

5. Supplied with 1-1/2 x 1/4” closed cell neoprene gasket.

6. Allow for 1” long connecting hardware as needed.

F. Service Platform:

1. Platform shipped in welded sections for field assembly.

2. Material shall be aluminum.

3. Platform may be bolted or welded to support structure.

4. Furnish with stairs, railings, and chains.

5. Walking surface shall be aluminum with 1-1/2” pipe stands and shall be fully removable.

6. Handrails and ladders shall be shipped loose for field installation.

PART 3. EXECUTION

3.1. EXAMINATION

A. Verify all dimensions by field measurements. Verify that all equipment may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify structure, mounting supports and membrane installations are completed to the proper point to allow installation of roof mounted equipment, where applicable.

C. Examine rough-in requirements for all piping systems to verify actual locations of piping connections prior to installation.

D. Verify that electrical work installation is in accordance with manufacture's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment installer. Coordinate sizes of all thermal overloads with Division 26.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Provide wiring diagrams of all equipment as specified in Division 23 Section, Common Work Results for HVAC.

3.2. GENERAL INSTALLATION REQUIREMENTS

A. Install all equipment in accordance with manufacturer's installation instructions, in accordance with state and local code requirements, and in accordance with the contract drawings. Install all equipment plumb and level, to tolerances as required by the manufacturer of each item of equipment. Maintain manufacturer recommended clearances around and over all equipment.

B. Coordinate vibration isolation requirements with all equipment in accordance with Division 23 Section, Vibration Controls for HVAC, Plumbing and Fire Protection Equipment.

C. Coordinate all electrical requirements with Division 26.

D. Coordinate all indoor and outdoor equipment pad locations and sizes with approved shop drawing submittals. Provide operating weights of equipment to Structural Engineer for review. Coordinate equipment pad locations and sizes with the Concrete Contractor or General Contractor. Furnish anchor bolts which are to be inserted in concrete pads to concrete installer.

E. Verify piping arrangements of all equipment with the contract drawings. Piping details shall be strictly adhered to concerning valves, fittings, components, etc. At coils, where a rebuildable and repairable autoflow valve is installed in the line without the need for draining or shutting of the water, the same may be utilized as the isolation valve and additional shut-off valve is not required.

F. Connect all equipment, devices and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

G. Testing: After installing HVAC equipment, devices and components and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

H. Remove and replace malfunctioning units with new units and retest.

I. All mechanical penetrations or terminations in exterior walls shall be flashed and caulked watertight. Furnish and installed lintels as required.

J. Arrange for equipment such as single zone VAV units to be shipped to project in modules where space constraints require the same. Field erect components as required.

3.3. FIELD QUALITY CONTROL

A. Where indicated provide the services of a factory authorized service representative to examine the field assembly of components, installation, piping, electrical connections, controls, and clearances. Submit factory start-up check list to Engineer for information purposes. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

B. Where factory start-up of equipment is not specified, provide field start-up by qualified technician to examine the field assembly of components, installation, piping, electrical connections, controls and clearances. Record equipment manufacturers standard start-up information and submit to Engineer for review. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

C. Charge all refrigerant systems with refrigerant and oil and test for leaks. Repair leaks and replace lost refrigerant and oil.

D. Verify proper motor sizes, voltages, thermal overloads, nameplate data, etc. All equipment voltages and current shall be recorded to insure that motors are operating below their service factors. Test and Balance Engineer shall record electrical data before continuous or permanent operation.

E. Verify refrigerant mitigation controls including fan interlocks, control interlocks, and refrigerant leak detectors.

3.4. DEMONSTRATION

A. Provide the services of a factory authorized service representative to provide start-up and to demonstrate and train the Owner's maintenance personnel.

B. Place equipment into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.

C. Training:

1. Train the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, lubrication, servicing procedures and preventative maintenance schedules/procedures. Review with the Owner's personnel, the contents of the operation and maintenance data specified in Division 23 Section, Common Work Results for HVAC.

2. Submit operation and maintenance data as soon as possible prior to project close-out. Operations and maintenance data shall be submitted to the Owner for review and comment prior to submission to the Engineer.

3. Schedule training with the Owner through the Engineer with at least seven (7) days prior notice.

D. Contractor shall demonstrate removal and replacement of filters at all pieces of equipment with filters in the prescence of the Owners representative.

3.5. CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan and equipment interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils' entering air face.

3.6. FAN INSTALLATION REQUIREMENTS.

A. Install fans with resilient mounting and flexible electrical leads.

B. Install flexible connections and vibration isolators as specified in Division 23 Section, Common Work Results for HVAC and Division 23 Section Vibration Controls for

HVAC, Plumbing and Fire Protection Equipment. Ensure metal band of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide safety screens/guards on all fans and permanently mount after final testing and balancing.

D. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fans have been test run under operation.

E. Provide sheave required for final air balance.

F. Install fans according to manufacturer's written instructions.

G. Adjust damper linkages for proper damper operation.

H. Adjust belt tension.

I. Lubricate bearings.

J. Replace fan and motor pulleys and belts as required to achieve design conditions.

3.7. FILTRATION EQUIPMENT INSTALLATION REQUIREMENTS

A. Where filter housing are not factory insulated, externally insulate to prevent surface condensation.

B. Install static pressure gauges, tubing, vents, etc., across all filter banks.

C. Install air cleaning devices in accordance with manufacturers instructions.

D. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

E. Do not operate fan system until filters are in place. Replace temporary filters used during construction and testing, with clean set.

F. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

G. Coordinate filter installations with duct and air handling unit installations.

H. After completing system installation and testing, adjusting, and balancing air handling and air distribution systems, clean filter housings and install new filter media.

3.8. SINGLE ZONE VAV UNITS INSTALLATION REQUIREMENTS

A. Examine areas and conditions for compliance with requirements for installation tolerances, other specific conditions, and other conditions affecting performance of single zone VAV units. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine piping and electric rough installations for single zone VAV units to verify actual locations of piping connections before installation.

C. Install single zone VAV units according to manufacturer's written instructions.

D. Install units level and plumb, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances. Coordinate with plenum curbs and service platforms.

E. Piping Connections: Drawings indicate the general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect cooling coil drain pan to nearest indirect waste connection, roof drain, air conditioning condensate pump or as indicated.

2. For gas fired units connect gas piping to furnace. Install valve, union, pressure regulator, strainer, and dirt leg.

F. Duct Connections: Connect supply, return, exhaust and outside air ducts to single zone VAV units with flexible duct connections. Provide transitions to match unit duct-connection size. Completely seal and insulate where ductwork connects to unit and filter rack.

G. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

H. Connect low voltage safety switch wiring to units where air conditioning condensate pumps are indicated.

I. Ground equipment.

1. 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.

J. Replace filters used during construction. Seal all return air ducts to filter racks. Seal air tight all filter racks.

K. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation of heat pumps, including piping and electrical connections. Report results in writing.

1. Test and adjust controls and safeties.

2. Replace damaged and malfunctioning controls and equipment.

3. Test and record refrigerant pressures, air flow rates, gas pressure, electrical characteristics. Start-up company and Test and Balance Engineer must both be present during start-up to simultaneously record the above data.

L. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

2. Review data in the maintenance manuals specified in Division 01.

3. Schedule training with Owner, through Engineer, with at least 7 days' advance notice.

M. Maintain minimum of 24 inches clear space at unit filter access. Provide manufacturer required clearances for service at ATC control panel, fan section, compressor section and electrical section. Maintain sufficient clear space below units to allow lowering and raising of units in the future.

N. All single zone VAV units shall be provided with auto-restart in the event of a power outage. Units shall automatically be enabled to re-start when power is restored.

O. Install CO2 sensor/control/interlock wiring to variable frequency drives and to ATC system. Install global CO2 sensor to monitor ambient outside air CO2 level.

P. Install and interlock space CO2 and relative humidity sensors.

Q. Install and interlock outside air flow monitoring stations and exhaust air flow monitoring station.

R. Startup Services: Engage a factory-authorized service representative to commission units as specified below:

1. Energize and verify correct rotation of heat wheels and fans.

2. Adjust seals and purge.

3. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

4. Test refrigerant circuit and controls

5. Record refrigerant pressures.

6. Verify sequence of operation.

7. Verify and record minimum and maximum air flow rates for the supply and exhaust air fan.

8. Verify and record the minimum and maximum supply/exhaust fan speeds/ hertz and incorporate into the fan tracking sequence of operation.

9. Test hardwired interlock between supply air fan and heat pump unit.

S. Install and interlock outside air flow monitoring stations. Interlock with ATC system.

T. Install and interlock exhaust air flow monitoring station. Interlock with exhaust fan variable frequency drive and ATC system.

U. Install CO2 sensor/control/interlock wiring to variable frequency drives and to ATC system.

V. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

W. Test all gas fired equipment.

X. For gas heaters, install heaters according to manufacturer's written instructions. Provide clearances to combustibles per units listing and approval.

Y. For gas heaters, install and connect gas fired heaters and associated fuel and vent features and systems, installed and connected according to NFPA 54, applicable local codes and regulations, and manufacturer's printed installation instructions.

Z. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

AA. Install piping adjacent to machine to allow service and maintenance.

BB. For Gas Heaters, Gas Piping: Conform to applicable requirements of Division 23 Section, HVAC Piping, Fittings, & Valves. Connect gas piping to gas train inlet; provide union with sufficient clearance for burner removal and service. Provide AGA approved flexible connections.

CC. Condensate drain piping: Conform to applicable requirements of Division 23 Section, HVAC Piping, Fittings, & Valves. Pipe as indicated on contract drawings.

DD. Electrical: Conform to applicable requirements of Division 26 Sections.

EE. Install electrical devices furnished with heaters but not specified to be factory mounted.

FF. For gas heaters, connect heaters and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

GG. For gas heaters, adjust burner and other unit components for optimum heating performance and efficiency. Adjust heat distribution features, including louvers, vanes, shutters, dampers, and reflectors, to provide optimum heat distribution for objects, personnel, and spaces served.

HH. For gas heaters, after completing system installation, inspect heaters and associated components. Repair scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

II. Test refrigeration mitigation controls and interlocks to the ATC system.

END OF SECTION

DIVISION 23 SECTION 230701
HVAC INSULATION
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SECTION 230701 – HVAC INSULATION

PART 1. GENERAL

1.1. REFERENCE

A. The Conditions of the Contract and other General Requirements apply to the work specified in this Section. All work under this Section shall be subject to the requirements of Division 23 Section, Common Work Results for HVAC.

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

1.2. DESCRIPTION

A. All ductwork installed under this Contract shall be covered as specified.

1.3. SCOPE

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to all piping, equipment, and duct systems, in accordance with applicable project specifications and drawings, subject to the terms and conditions of the contract.

1.4. STANDARDS

A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or use:

1. American Society for Testing of Materials Specifications:

   a. ASTM C 55, "Standard Specification for Mineral Fiber Blanket and Felt Insulation".
   b. ASTM E 96, “Standard Test Methods for Water Vapor Transmission of Material”.
   c. ASTM C 585, "Recommended Practice for Inner and Outer Diameters of Rigid Pipe Insulation for Nominal Sizes of Pipe and Tubing (NPS System)".
   d. ASTM C 612, "Standard Specification for Mineral Fiber Block and Board Thermal Insulation".
   e. ASTM C 1136, "Standard Specification for Barrier Material, Vapor, "Type 1 or 2 (Jacket only).

2. ASHRAE 90.1 "Energy efficient design of new buildings except low-rise residential buildings", latest edition.

3. International Energy Conservation Code, latest edition.

B. Insulation materials, including all weather and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict

accordance with project drawings, plans, and specifications.

1.5. SYSTEM PERFORMANCE

A. Insulation materials furnished and installed hereunder should meet the minimum economic insulation thickness requirements of the North American Insulation Manufacturers' Association (NAIMA) (formerly known as TIMA), to ensure cost-effective energy conservation performance. Alternatively, materials should meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1, (latest edition) and "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), latest edition. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor. As minimum, all insulation thicknesses shall be as hereinafter specified.

B. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of any one of the following specifications:

1. American Society for Testing of Materials ASTM E 84

2. Underwriters' Laboratories, Inc. UL 723

3. National Fire Protection Association NFPA 255

4. ASTM E 96, “Standard Test Methods for Water Vapor Transmission of Materials”.

1.6. QUALITY ASSURANCE

A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications listed in Section 1.4 above.

B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

1.7. DELIVERY AND STORAGE OF MATERIALS

A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

B. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.

C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is

equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer in writing for technical assistance.

D. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements. Protect all insulation from water, construction traffic, dirt, chemical and mechanical damage.

1.8. ALTERNATES

A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

PART 2. PRODUCTS

2.1. GENERAL

A. All materials to be insulated shall be thoroughly cleaned, after completion of successful tests, and shall be covered as specified below. Fiberglass insulation shall be Owens-Corning, Manville, Armstrong, or P.P.G, or as approved equal.

2.2. DUCTWORK INSULATION MATERIALS AND THICKNESSES

A. Insulate all supply, return, exhaust, relief, plenums, and outside air intake ductwork with fiberglass exterior duct insulation with factory-applied foil facing. All exposed fiberglass duct insulation shall be 2-inch rigid or non-flexible board type 3.0 pcf minimum density, 0.23 max. "K" factor at 75 degrees F mean temperature, with white vinyl A.S.J. max, polymer coating vapor barrier facing. All concealed fiberglass duct insulation shall be 2-inch flexible blanket type, 1.0 pcf minimum density. All concealed insulation shall be 0.27 max. "K" factor at 75 degrees F mean temperature with reinforced foil-scrim Kraft vapor barrier facing. Unless otherwise noted, the minimum installed R-value shall be 6.0 HR x ft2 x ºF/btu.

B. Refer to Division 23 Section, HVAC Air Distribution System and contract drawings for location of all sound-lined ductwork. Sound-lined ductwork from the discharge or supply side of all single zone VAV unit shall require external insulation in addition to internal lining specified hereinafter. All other ducts indicated to be provided with interior lining shall not require additional exterior insulation.

C. Where a vapor barrier is required, all joints, seams, tears, punctures, and other penetrations shall be closed with 3-inch (7.5cm) pressure-sensitive tape matching the facing or with vapor barrier coating reinforced with 3-inch (7.5cm) glass scrim tape.

D. Exposed dual wall ductwork located in finished areas shall not require additional exterior insulation. Exposed dual wall supply ductwork located in mechanical room, fan rooms, penthouse, mezzanines and boiler rooms shall require additional rigid exterior insulation as hereinafter specified.

E. Contractor-applied internal linings shall be as specified and installed as hereinafter specified.

F. For exposed Fiberglass duct insulation, tightly butt all edges and seams. Secure insulation

with flush mechanical fasteners spaced not less than one per square foot. Insulation may be secured with 100 percent coverage of adhesive with mechanical fasteners on the underside of the duct only, in addition to adhesive. Adhesive shall be water based Foster 85-60 or Childers CP-127. Cover all seams, joints and fasteners with not less than 3-inch wide tape matching the insulation facing. Pre-finished white fastener caps may be left exposed if the spacing and pattern is uniform in appearance. Staples will not be permitted.

G. All dual wall exterior ductwork shall be insulated with 2-inch rigid type 6.0 pcf minimum density, .25 max "K" factor with white vinyl A.S.J. vapor barrier facing. Insulation shall be sandwiched between inner galvanized ductwork and exterior aluminum ductwork.

H. All airflow monitoring stations shall be externally insulated similar to adjacent ductwork as hereinbefore specified.

2.3. ACCESSORY MATERIALS

A. Accessory materials installed as part of insulation work under this section shall include, but not be limited to:

1. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.

2. Field-applied jacketing materials - sheet metal, plastic, canvas, fiber glass cloth, insulating cement; PVC fitting covers, PVC jacketing.

3. Support Materials - Hanger straps, hanger rods, saddles.

4. Fasteners, weld pins/studs, speed clips, insulation washers.

5. Metal mesh or expanded metal lagging.

B. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

2.4. EXTERIOR MOUNTED DUCTWORK INSULATION SYSTEM

A. Insulate all exterior mounted ductwork with an interlocking, four-piece, Techna-Duc insulation panel system as manufactured by P.T.M. Manufacturing, L.L.C., Fabrite as manufactured by County Group, or Flex Clad – 400 jacketing system as manufactured by Tri-State Insulation, Foster Vapor Fas 62-05 as manufactured by MFM Building Products, Weatherguard as manufactured by MKT Metal Manufacturing, or an approved equal. Insulation system shall be constructed of glass-reinforced polyisocyanurate foam insulation encased in 1.25 mil aluminum foil vapor barrier facing. All insulation shall be a combined minimum thickness of 2-inch rigid or non-flexible board type, 2.0 pcf minimum density, .25 max "K" factor at 75 degrees Fahrenheit mean temperature. Exterior weather barrier shall be fabricated of embossed aluminum sheeting, minimum 0.032-inches in thickness, and laminated to insulation foil facing. Total installed R-value shall be R-16 at 2 inch thickness.

B. Refer to Division 23 Section, HVAC Air Distribution and contract drawings for location of all exterior mounted ductwork.

C. All exterior mounted ductwork shall meet the specifications set forth in Division 23 Section, HVAC Distribution before installation of the insulation system, to include sealing of joints, testing and duct leakage and installation of duct accessories.

D. All vapor barrier joints, seams, tears, punctures, and other penetrations shall be closed with 3-inches by 1.25 mil minimum aluminum foil faced tape, and/or non-setting vapor barrier coating as applicable. Material shall be fitted so that the vapor barrier seal is continuous and does not allow for water vapor infiltration.

E. Insulation panel system shall be fitted into place on the ductwork. Each insulation panel shall be constructed so that all vertical and horizontal insulation seams shall have an interlocking and overlapping shiplap style joint to provide a thermal seal. The overlap shall be a minimum of 2-inches thick. Fasten panel system together at overlapping joints using #10 self tapping, stainless steel, vapor seal screws with weather seal washers on a maximum of 12-inches center. For ducts wider than 48-inches, a bottom fastener should be utilized.

F. At all circumferential joints, apply butyl compound putty using a laminate roller. The butyl compound shall be covered with a 3-inch wide cap of embossed aluminum sheeting, minimum 0.032-inches in thickness. All seams of the aluminum cap and all weather barrier abutments shall be sealed with a bead of RTV caulk, colored to match the panel system.

G. Insulation and jacketing shall cover all duct flanges to prevent collection of water or leaks.

H. All exterior access doors shall be covered with removable insulation system and shall be labeled.

I. All exterior air flow monitoring stations, duct access doors, and duct smoke detectors shall be installed so as to be waterproof.

J. At all static pressure measurement points and pitot tube traverse points install inspection plugs as manufactured by Inspection Plug Strategies. Inspection plugs shall be installed in ductwork per manufacturer's requirements and shall be located where indicated by the Test/Balance Engineer. The inspection plugs shall comply with the following:

1. 50 Durometer EPDM Rublen rated for 340°F.

2. Temperature resistant range= -67°F to 340°F.

3. U.V. resistant.

4. Ozone resistant.

5. Comply with ASTM D470 0624 D2132 D865 D395. Furnish each inspection plug with EPDM sealing flange, EPDM cap, and stainless steel attached lanyard.

6. Provide waterproof label identifying all inspection plugs.

2.5. FIELD-APPLIED JACKET

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: High gloss white.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, and mechanical joints.

PART 3. EXECUTION

3.1. WORKMANSHIP

A. The Contractor shall take special care to prevent soiling equipment below or adjacent to areas being insulated. He shall be completely responsible for removing insulation cement splashes and smears and all surfaces that he mars or otherwise soils or defaces, and he will be totally responsible for restoring these damaged surfaces to their like-new condition when delivered to the site.

3.2. SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.

C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.3. PREPARATION

A. Ensure that all pipe and equipment surfaces over which insulation is to be installed are clean and dry.

B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of duct systems has been completed prior to installing insulation.

3.4. INSTALLATION

A. Ductwork Insulation:

1. General:

a. Before installing insulation, ensure that all seams and joints in ductwork have been sealed and leak tested by the contractor responsible for the duct system. Before applying duct insulation, air ducts shall be clean and dry.
b. Install insulation in accordance with manufacturer's published instructions and recognized industry practice to ensure that it will serve its intended purpose.
c. Install insulation materials with smooth and even surfaces. Butt joints firmly together to ensure complete and tight fit over surfaces to be covered.
d. Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage. All staples used on ductwork insulation shall be coated with suitable sealant to maintain vapor barrier integrity and covered with pressure sensitive vapor barrier tape and vapor barrier coating as specified.
e. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and exposed joints. All portions of duct designated to receive duct wrap shall be completely covered with duct wrap.
f. To ensure installed thermal performance, duct wrap insulation shall be cut to "stretch-out" dimensions. Maintain specified duct insulation thickness and vapor barrier at all fittings, obstructions, and duct flanges.
g. A 2-inch (50mm) piece of insulation shall be removed from the facing at the end of the piece of duct wrap to form an overlapping stapling and taping flap.
h. Install duct wrap insulation with facing outside so that the tape flap overlaps the insulation and facing at the other end of the piece of duct wrap. Adjacent sections of duct wrap insulation shall be tightly butted with the 2-inch (50mm) stapling and taping flap overlapping. If ducts are rectangular or square, install so insulation is not excessively compressed at corners. Seams shall be stapled approximately 6-inches (150mm) on center with 2-inch (13mm) (min) steel outward clinching staples.
i. Seams, joints and staples shall be sealed with pressure-sensitive tape matching the insulation facing (either plain foil or FRK backing stock) and glass fabric and vapor barrier coating. Cloth duct tape of any color or finish using reclaimed rubber adhesives shall not be utilized on duct wrap

insulation. Adjacent sections of duct wrap shall be tightly butted with the 2-inch (50mm) tape flap overlapping.

j. Where rectangular ducts are 24-inch (600mm) in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18-inch (425mm) centers (maximum) to prevent sagging of insulation.

k. Seal all tears, punctures and other penetrations of the duct wrap facing using one of the above methods to provide a vapor tight system.

l. Upon completion of installation of duct wrap and before operation is to commence, visually inspect the system and verify that it has been correctly installed.

m. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means for removal of such material.

n. Check the duct system to ensure that there are no air leaks through joints.

o. No ductwork insulation shall be supported utilizing tie wire or bailing wire. Penetrations of ductwork insulation vapor barrier are prohibited.

p. Bevel and terminate insulation at access doors. Paint edges with vapor barrier mastic.

q. Install insulation board between volume dampers and sheet metal standoffs.

r. Provide removable insulation section at all pitot tube traverse points. Insulation section shall contain tether that attaches to adjacent ductwork.

2. Penetrations: Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise specified.

3. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor weather barrier mastic or jacketing as recommended by the insulation manufacturer.

4. Rigid Insulation:

   a. Rigid duct insulation may be impaled over welded pins and secured with insulation caps and washers matching the color of the vapor barrier facing. All seams shall be firmly butted and sealed with pressure-sensitive vapor barrier tape matching the facing and vapor barrier coating.

   b. Corner angles shall be installed on all external corners of rigid duct insulation in exposed finished areas before jacketing, except oven and hood exhaust duct insulation, which shall have no corner angles.

5. Duct Wrap Insulation: Duct wrap insulation shall be applied with all joints butted firmly together. All joints in the insulation covering shall be sealed with adhesive. Duct wrap insulation shall be secured to bottom of rectangular or oval ducts over 24inches (60cm) wide with mechanical fasteners on 16-inch (40 cm) (approx.) centers to prevent sagging.

6. Duct Lining Insulation: Duct liner insulation shall be applied with all joints tightly butted using 90 percent coverage of adhesive meeting the requirements of ASTM C 916 plus mechanical fasteners spaced according to the liner manufacturer's schedule for the interior width of the plenum, housing, or air shaft. (Also refer to

Division 23 Section, HVAC Air Distribution System.)

3.5. FIELD QUALITY ASSURANCE

A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.6. PROTECTION

A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.7. SAFETY PRECAUTIONS

A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.

B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.8. INSULATION COVERING

A. Unless otherwise noted, all exposed interior duct insulation shall have a field applied PVC jacket cover neatly cut and pasted over ductwork insulation. PVC shall be high gloss white and shall be 20 mils thick.

B. Exposed areas include, but are not limited to, all mechanical equipment rooms/fan rooms, and ductwork exposed in an occupied space.

C. Where PVC jackets are indicated, install with 1 inch overlap at longitudinal seams and end joints, for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

END OF SECTION

DIVISION 23 SECTION 230900
INSTRUMENTATION AND CONTROLS OF HVAC AND PLUMBING SYSTEMS
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SECTION 230900 - INSTRUMENTATION AND CONTROLS OF HVAC AND PLUMBING SYSTEMS

PART 1. GENERAL

1.1. SUMMARY

A. For General Mechanical Requirements, see Division 23 Section, Common Work Results for HVAC, and Division 01 Sections.

B. Comply with all code requirements and fire safety requirements as specified in Division 23 Section, Common Work Results for HVAC.

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

D. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory wired controls.

E. The automatic temperature control system ATC and central control and monitoring system (CCMS) shall be electric/electronic direct digital control (DDC), Alerton as installed by Albireo Energy, Johnson Controls (Metasys), Johnson Controls FX (Facility Explorer) as installed by Modern Controls, Honeywell, Siemens, Automated Logic Corporation, Reliable Controls, Advanced Power, Trane, and TAC Controls by Schneider Electric installed by Automation and Control Concepts or Niagara. All work associated with the automatic temperature control system shall be performed by personnel regularly and directly employed by the Automatic Temperature Controls Contractor. Control System shall be web based, allowing the client access via a standard web browser.

F. Coordinate controls with controlled equipment. Upon completion of the work, calibrate and adjust all controls for proper function. Electric wiring, including interlock wiring for all equipment shall be furnished and installed under this section. All electrical work shall conform to the applicable requirements of Division 26.

G. All automatic temperature control dampers and separable wells for immersion elements furnished by the Control Manufacturer shall be installed by the Mechanical Contractor or his sheet metal subcontractor under the Control Manufacturer's supervision.

H. Reference is hereby made for this contractor to become familiar with Division 26 of these specifications. Familiarization is for coordination purposes only. The control contractor shall provide all necessary relays, contactors, interlock wiring etc. not provided under Division 26 for the automation of the ATC and CCMS systems as required by the sequence of operation and input/output schedule. The control contractor shall coordinate all requirements with the building Fire Alarm System. The control contractor shall provide all additional devices and interlock wiring required for the automation of the ATC system and monitoring of the CCMS system.

I. Furnish all labor, materials, software, equipment and services necessary for and incidental to furnishing and installing a complete direct digital control, automatic temperature control system to meet the requirements of the sequence of operation described on the Drawings.

J. Unless the necessary items are specified to be provided with mechanical equipment by Division 23, the ATC contractor shall coordinate with Division 23, Mechanical, and shall furnish and install all items necessary to meet the requirements of the Sequence of Operation and the Central Control and Monitoring System (CCMS) indicated on the drawings and as required in this specification.

K. The control system shall include all necessary and specified control equipment properly installed in accordance with the specifications and drawings and shall include, but not be limited to the automatic temperature control and energy management system of the following:

1. Airflow Monitoring Stations
2. Building Facilities
3. Carbon Monoxide Sensors
4. Carbon Dioxide Sensors
5. Condensate Overflow Safety Switches
6. Dampers and Actuators
7. Duct Detector Fan Interlocks
8. Economizer Systems
9. Energy Recovery Ventilators
10. Emergency Generator Interlock with Single Zone VAV Unit #2 for load shedding.
11. Gas Furnaces
12. General Exhaust Systems
13. Hot Gas Re-heat Coils
14. Heat Pumps
15. Miscellaneous interlocks required for gas systems, ventilation systems, etc.
16. Refrigerant Mitigation Controls
17. Relief Air Dampers
18. Relative Humidity/Temperature Sensors
19. Sensors (i.e., temperature, relative humidity, carbon monoxide, CO_2, CO, etc.)
20. Differential Static Pressure Controllers
21. Variable Speed Drives

L. All labor, material, equipment and software to meet the functional intent of the system, as specified herein and as shown on the drawings, shall be included. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, that are required to meet the functional intent, shall be provided without additional cost to the owner.

M. Where equipment is specified to be provided by equipment manufacturer or where packaged controls are specified map out all points provided by the manufacturer so the same can be viewed by ATC system. As a minimum all points indicated in the point list and control diagram must be viewable and adjustable from the ATC system. Coordinate with equipment manufacturer.

1.2. DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Main tracking/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

H. UPS: Uninterruptible Power Supply.

I. NAE: Network Automated Engine.

1.3. SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.

2. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.

3. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.

4. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

5. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.

6. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.

7. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

   a. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
   b. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
   c. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
   d. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
   e. Relative Humidity: Plus or minus 5 percent.
   f. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
   g. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
   h. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
   i. Carbon Monoxide: Plus or minus 5 percent of reading.
   j. Carbon Dioxide: Plus or minus 50 ppm.
   k. Electrical: Plus or minus 5 percent of reading.

1.4. DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.5. COORDINATION

A. Coordinate location of temperature sensors, relative humidity sensors, CO_2 sensors, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 28 Section, “Fire Alarm System” to achieve compatibility with equipment that interfaces with that system.

C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

D. Coordinate equipment with Division 26 Section, Panelboards to achieve compatibility with starter coils and annunciation devices.

1. Coordinate equipment with Division 26 Section, Motor-Controllers to achieve compatibility with motor starters and annunciation devices.

1.6. WORK BY OTHERS

A. Automatic temperature control valves, air flow stations, and separable wells for immersion elements furnished by the control manufacturer shall be installed by the mechanical contractor under the control manufacturer's supervision. The control contractor shall deliver to the mechanical contractor valves and wells for installation within the various systems.

B. All automatic dampers furnished by the control manufacturer shall be installed by the mechanical contractor under the control manufacturer's supervision.

1.7. QUALITY ASSURANCE

A. Supplier shall have an in-place support facility with technical staff, spare parts inventory and all necessary test and diagnostic equipment. The fully staffed and equipped office shall be within a 60 mile radius of the job site.

B. The systems shall be complete in all respects, and shall be installed by skilled personnel. The Control Contractor shall have a successful history in the installation and maintenance of automatic temperature control systems similar in size and performance to that specified herein.

C. Refer to Contract Drawings for sequences of operations, control diagrams, and points lists.

D. All electrical wiring in connection with the Automatic Temperature Control System shall be furnished and installed by the ATC Contractor. This shall include all interlock wiring between the air handling units, fans, gas furnaces, dampers, heat pumps, energy recovery ventilators, static pressure controllers, gas fired units, single zone VAV units, airflow monitoring stations, etc.

E. Bids by wholesalers, contractors or franchised dealers or any other firm whose principal business is not that of manufacturing or installing automatic temperature control systems, shall not be acceptable. Bid documents that are not complete in their response to these documents or take exception to any of the capabilities defined within these documents shall not be acceptable.

F. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

G. 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.

H. Comply with ASHRAE 135 for DDC system components.

1.8. GUARANTEE AND INSTRUCTION

A. The control system including all components, system software, parts and assemblies herein specified shall be free from defects in workmanship and materials under normal use and service. After completion of the installation, the Control Manufacturer shall regulate and adjust all thermostats, control valves, control motors, and other equipment provided under this contract. If within two (2) years from the date of acceptance by Owner any of the equipment herein described is proved to be defective in workmanship or materials, it will be replaced or repaired at no additional cost to the Owner. The Control Manufacturer shall, after completion, provide any service incidental to the proper performance of the Control System under guarantees outlined above for a period of two (2) years. Normal maintenance of the system is not to be considered part of the guarantee. All corrective modifications made during warranty service periods shall be updated on all user documentation including

"as-built" shop drawings and on user and manufacturer archived software disks.

B. The control contractor shall completely check out, calibrate and test all connected hardware to insure that the system performs in accordance with the approved specifications and sequences of operation submitted.

C. Upon completion of the work, the control drawings encased in heavy plastic shall be provided where directed. Layout shall show all control equipment and the function of each item indicated.

D. The temperature control contractor's office shall be within a 100 mile radius of the job site.

E. The contractor shall respond to the job site with qualified technicians within a 4 hour period for any emergency relating to the control system or energy management systems.

F. This agreement shall include emergency service during normal working hours.

1.9. SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.

3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.

2. Schematic flow diagrams showing equipment, fans/sensors, pumps, dampers, and control devices.

3. Wiring Diagrams: Power, signal, and control wiring.

4. Details of control panel faces, including controls, instruments, and labeling.

5. Written description of sequence of operation.

6. Schedule of dampers including size, leakage, and flow characteristics.

7. DDC System Hardware:

   a. Wiring diagrams for control units with termination numbers.
   b. Schematic diagrams and floor plans for field sensors and control hardware.
   c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

8. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.

9. Controlled Systems:

   a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
   c. Written description of sequence of operation including schematic diagram.
   d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks or Bacnet.

D. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.

2. Program Software Backup: On a magnetic media or compact disc, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

5. Software license required by and installed for DDC workstations and control systems.

E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

F. Qualification Data: For Installer and manufacturer.

G. Field quality-control test reports.

H. Submit screen shots of ATC system graphics at substantial completion.

I. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section, Operation and Maintenance Data, and Division 23 Section,

Common Work Results for HVAC include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.

2. Interconnection wiring diagrams with identified and numbered system components and devices.

3. Keyboard illustrations and step-by-step procedures indexed for each operator function.

4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

5. Calibration records and list of set points.

J. Upon completion of the work, provide a complete set of “as-built" drawings and application software on CD, USB, or other type of electronic storage device. Drawings shall be provided in format as acceptable to the Owner’s files. Submit as-built drawings and specification to Owner's representative for review and approval prior to final project closeout.

1.10. SOFTWARE LICENSE AGREEMENT

A. The owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. All software and hardware upgrades shall be included in two (2) year warranty period.

B. Software license agreement shall not apply on projects where existing ATC system is being extended.

C. Minimum of four (4) software license seats shall be provided. Storage of all software shall be coordinated with the Worcester County’s IT Manager.

1.11. ELECTRICAL SURGE PROTECTION

A. It is the responsibility of the ATC/FMS contractor to provide adequate surge protection for all wall mounted control panels required for this project.

1. Devices under surge protection shall be of design that loss of memory will not occur in the event of the surge protection device being activated due to surge/spike conditions.

2. Surge protection devices will be required to be hard wired, with the exception of peripheral devices that use standard 110VAC plugs for connections (i.e. Modems).

3. Surge protection devices are to be rated for 120 VAC single phase, 20 (or greater) amps capacity.

4. Surge Protection devices to include internal fuse protection, audible surge alarm & LED indicators.

5. Surge protectors to have clamping voltage of 480V peak, maximum surge current rating of 50,000 amps. Unit to have NEMA 12 enclosure with wall mounting bracket and conduit connection.

1.12. TRAINING

A. The Automatic Temperature Controls (ATC) Contractor shall include in his bid, provisions for additional computer training at the company's regular school or training center. The ATC contractor shall include in his bid all costs associated with sending one (1) individual to the ATC contractors school for a period of not less than one (1) day. This training is in addition to the aforementioned training required under the General Provisions.

B. The training time period shall be coordinated with the school system's facility Engineer. The schedule training period shall be arranged at the owner's convenience.

C. Cost shall include all training material, instruction books, and two copies of video tape with sound DVD of training session.

D. Upon completion of the work, the Control Contractor shall have completely adjusted the entire control system. He shall arrange to instruct the Owner's representative on the operation of the control system for a period of not less than 8 hour days. All training shall be by the control contractor and shall utilize specified manuals and as-built documentation.

E. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 8 hours' dedicated instructor time on-site.

3. Review data in maintenance manuals. Refer to Division 01 Section, Contract Closeout.

4. Review data in maintenance manuals. Refer to Division 01 Section, Operation and Maintenance Data.

5. Schedule training with Owner, with at least seven days' advance notice.

6. Control Contractor shall also attend and participate in separate HVAC equipment systems training in addition to ATC training.

1.13. ALTERNATES

A. Refer to Division 01 Section, Alternates for description of work under this section affected by alternates.

1.14. WORCESTER COUNTY SPECIFIC REQUIREMENTS

A. The ATC Subcontractor shall include in his bid all costs associated with incorporating the following specific requirements:

1. All holiday schedules shall incorporate a 12 month block. Coordinate exact holidays, schedules, calendars, occupied, unoccupied periods with Owner prior to writing software. All schedules shall be reviewed and approved by the Owner.

2. Relays for ATC equipment shall not be located in ceilings. All relays shall be located in equipment control panels and/or mechanical rooms.

3. All exhaust fans shall be assigned a designated point. Utilizing relays to provide digital point for exhaust fans shall not be acceptable.

4. Graphics on ATC computer shall in addition to basic requirements indicate the percentage open or closed on all dampers.

5. The ATC Computer Graphics shall incorporate the final room numbers actually utilized in the recreation center. All room names utilized in the graphic display shall be reviewed and approved by the Owner.

6. The ATC Computer Graphics shall indicate for each item of equipment the “on” or “off” status and command shall be “run” or “stop”.

7. The ATC Computer Graphic shall indicate for each duct smoke detector the “on” or “off” status and command.

8. All temperature sensors, equipment, relative humidity sensors, current sensors, CO2 sensors, CO sensors, differential pressure sensors, etc. indicated on ATC Control Diagrams and point list shall be displayed on the ATC Computer Graphic. Measured value or status shall be displayed.

9. For any multi-stage HVAC units, the quantity of compressor stages and the modulating gas heat stages shall be displayed on the Computer Graphics.

10. The exact space temperature set points, relative humidity set points, changeover set points. etc., shall be coordinated with Owner prior to final data entry. All items indicated in sequences of Operation as “adjustable” shall be reviewed and approved by Owner prior to implementation of the same.

11. The outside air relative humidity and outside air temperature shall be monitored on ATC system and reported on ATC Computer Graphics. See Floor plans for exact locations.

12. Provide a graphic of all floor plans indicating location of all equipment interlocked with ATC System including all control panels.

13. Graphic shall also indicate area of building served by each item of equipment. Graphics shall indicate all global sensor readings.

14. All equipment shall be labeled with name of equipment, area served, and area location (room name/number).

15. Scheduling of HVAC equipment/zones shall be such that for afterhours use the ATC system shall allow a temporary override of the pre-set occupied/unoccupied schedule by zone and for specific equipment in a zone. This must allow the recreation center staff the ability to operate as few or many zones as desired without operating entire portions of the building.

16. Provide "Loss of Heat" monitoring and alarm on ATC system if any space temperature sensor in the building drops below 50 degrees Fahrenheit (Adjustable).

17. Provide additional software package and license so that Owner can install software on Owner provided laptop. Assist owner with installation of software.

18. For gas furnaces, the percent output and firing mode shall be displayed on the computer graphic.

19. Provide a "demand toggle control" switch on ATC system to automatically reduce HVAC electric demand (power) by automatically modifying setpoints to pre-determined values. Coordinate pre-determined setpoint values with Owner and document in the As-Built Documents.

20. Scheduling of HVAC equipment/zones shall be such that for afterhours use the ATC system shall allow a temporary override of the pre-set occupied/unoccupied schedule by zone and for specific equipment in a zone. This must allow the Recreation Center the ability to operate as few or many zones as desired without operating entire portions of the building.

21. Alarms shall be delayed during optimal start stop to avoid nuisance alarm triggers.

22. Global unoccupied setpoints shall be 70 degrees F in heating mode and 74 degrees F in cooling mode. Coordinate/confirm with Owner all setpoints.

23. Position of all H-O-A switches shall be reported on ATC graphic with equipment.

24. All text alarms shall clearly identify what they are within the body of the text. i.e. "SZVAV-XX-", "Duct smoke detector trip", etc. Coordinate all text alarms and verbiage with Owner.

1.15. GLOBAL SENSORS

A. General

1. Furnish and install global sensors and report the same on the automatic temperature control system.

2. Global sensors shall monitor and trend the following conditions:

a. Outside air temperature.

b. Outside air relative humidity.
c. Outside Air CO_2 level in ppm.
d. All fan speeds where variable frequency drives are specified.
e. All fan amperages where variable speed fans are indicated. Graphic shall also indicate area of building served by each item of equipment.
f. Global holiday schedules:
    i. Provide all interlock wiring and programming to allow a global holiday schedule for all equipment except the administration equipment. Global holiday schedule shall allow the Owner to shut down the entire building's HVAC systems if an unscheduled event occurs when school is cancelled.
    ii. System shall also be capable of individual scheduling of equipment as specified or all can be globally modified at once.
g. All equipment interlocked with ATC system shall be able to be turned on/off via ATC system as specified. Changing temperature set point alone is not acceptable method for turning equipment on/off.
h. Where damper position is indicated ATC graphic shall indicate percentage open or percentage closed.

PART 2. PRODUCTS

2.1. BUILDING MANAGEMENT SYSTEM

A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

B. The Building Management System shall consist of the following:

1. Standalone Network Automation Engine(s)

2. Field Equipment Controller(s)

3. Input/Output Module(s)

4. Local Display Device(s)

5. Distributed User Interface(s)

6. Network processing, data storage and communications equipment

7. Other components required for a complete and working BMS

C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network

connection shall not interrupt the execution of control strategies at other operational devices.

E. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.

2. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.

3. Network Automation Engines (NAE) and/or system controllers shall reside on the automation network.

4. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

F. Control Network

1. Network Automation Engines and/or system controllers shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:

   a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
   b. LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
   c. The Johnson Controls N2 Field Bus or equivalent.
   d. Tridium FX-40
   e. Honeywell Webs
   f. TAC Controls by Schneider Electric
   g. Siemens P1/P2 Serial

2. Control networks shall provide either "Peer-to-Peer," Main-Tracking, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.

3. DDC Controllers shall reside on the control network.

4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.

5. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (main or tracking) that will communicate on the BACnet MS/TP Bus.

6. The Conformance Statements shall be submitted with the BAS Submittals.

G. Integration

1. Hardwired

    a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
    b. There will be one separate physical point on each system for each point to be integrated between the systems.

2. BACnet Protocol Integration – BACnet

    a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2003.
    b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
    c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

H. Dedicated Web Based User Interface

1. Where required by the Owner, the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability. Coordinate with Owner to determine computer type (i.e. PC (Windows based) or Macintosh (Apple)).

2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.

    a. Microsoft Edge Internet Explorer for user interface functions
    b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
    c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
    d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.

3. Computer Hardware – The personal computer(s) shall be configured as follows:

    a. Description: A tower or all-in-one computer designed for normal use at a single, semipermanent location.
    b. Performance Requirements:
        i. Performance requirements may dictate equipment exceeding minimum requirements indicated.
        ii. Energy Star compliant.
    c. Personal Computer:

i. Minimum Processor Speed: 3 gigahertz (GHz). Dual Core Processer.

d. RAM:
   i. Capacity: 16GB.
   ii. Speed and Type: 1333 MHz, SDRAM.

e. Hard Drive:
   i. Media: Solid state.
   ii. Number of Hard Drives: One.
   iii. Capacity: 250GB.

f. Optical Read and Write Drive:
   i. Include with at least 2 MB of data buffer.
   ii. Type: SCS1 CD-ROM Drive with Read/Write Capability.
   iii. Average access time of 150 ms or less.

g. At least four expansion slots.

h. Video Card:
   i. Resolution: 1920 by 1200 pixels.
   ii. RAM: 4 GB.
   iii. Controller Speed: 4GHz.

i. Sound Card:
   i. At least 128 voice wavetable synthesis.
   ii. Capable of delivering three-dimensional sound effects.
   iii. High-resolution 16-bit stereo digital audio recording and playback with user-selectable sample rates up to 48,000 Hz.

j. Two (2) Network Interface Cards: Include cards with connection, as applicable.
   i. 10-100-1000 base TX Ethernet with RJ45 connector port.
   ii. 100 base FX Ethernet with SC or ST port.

k. Wireless Ethernet, 802.11 a/b/g/n.

l. Optical Modem: Full duplex link for connection to optical fiber cable provided.

m. I/O Ports:
   i. Two USB 3.0 ports on front panel, six on back panel, and three internal on motherboard.
   ii. One serial port.
   iii. One parallel port.
   iv. Two PS/2 ports.
   v. One RJ-45.
   vi. One stereo line-in and headphone/line-out on back panel.
   vii. One microphone and headphone connector on front panel.
   viii. One IEEE 1394 on front and back panel with PCI-e card.
   ix. One ESATA port on back panel.

n. Battery: Life of at least three years to maintain system clock/calendar and ROM, as a minimum.

o. Keyboard:
   i. 101 enhanced keyboard.
   ii. Full upper- and lowercase ASCII keyset, numeric keypad, dedicated cursor control keypad, and 12 programmable function keys.
   iii. Wireless operation within up to 72 inches (1800 mm) in front of workstation.

p. Pointing Device:

i. Either a two- or three-button mouse.
ii. Wireless operation within up to 72 inches (1800 mm) in front of workstation.

q. Flat Panel Display Monitor:
i. Display:
1. Color display with 21 inches diagonal viewable area.
2. Digital input signal.
3. Aspect Ratio: 16 to 9.
4. Antiglare display.
5. Tilt adjustable base.
6. Energy Star compliant.
7. Resolution: 1920 by 1200 pixels at 60 Hz.
8. Number of Displays: One.

r. Speakers:
i. Two, with individual controls for volume, bass and treble.
ii. Signal to Noise Ratio: At least 65 dB.
iii. Power: At least 4 W per speaker/channel.
iv. Magnetic shielding to prevent distortion on the video monitor.

s. I/O Cabling: Include applicable cabling to connect I/O devices.
t. Uninterruptable Power Supply.

I. User Interface Application Components

1. Operator Interface

a. An integrated browser based client application shall be used as the user operator interface program.
b. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3 or on the drawings, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
c. The user interface software shall provide help menus and instructions for each operation and/or application.
d. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
e. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
i. User access for selective information retrieval and control command execution
ii. Monitoring and reporting
iii. Alarm, non-normal, and return to normal condition annunciation
iv. Selective operator override and other control actions
v. Information archiving, manipulation, formatting, display and reporting
vi. FMS internal performance supervision and diagnostics
vii. On-line access to user HELP menus
viii. On-line access to current FMS as-built records and documentation
ix. Means for the controlled re-programming, re-configuration of FMS operation and for the manipulation of FMS database

information in compliance with the prevailing codes, approvals and regulations for individual FMS applications.

x. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Navigation Trees

a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.

b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.

c. The navigation trees shall be "dockable" to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

3. Alarms

a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:

i. Log date and time of alarm occurrence.

ii. Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.

iii. Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.

iv. Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

v. Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.

vi. Any attribute of any object in the system may be designated to report an alarm.

b. The FMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions

c. The FMS shall annunciate application alarms as required.

4. Reports and Summaries

a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
   i. All points in the BMS
   ii. All points in each BMS application
   iii. All points in a specific controller
   iv. All points in a user-defined group of points
   v. All points currently in alarm
   vi. All points locked out
   vii. All BMS schedules
   viii. All user defined and adjustable variables, schedules, interlocks and the like.
b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.
d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.

5. Schedules

a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
   i. Weekly schedules
   ii. Exception Schedules
   iii. Monthly calendars
b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
c. It shall be possible to define one or more exception schedules for each schedule including references to calendars
d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BACnet Standard.
g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.

6. Password

a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned

password.

b. Each user shall have the following: a user name (24 characters minimum), a password (12 characters minimum), and access levels.
c. The system shall allow each user to change his or her password at will.
d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
e. A minimum of five levels of access shall be supported individually or in any combination as follows:
    i. Level 1 = View Data
    ii. Level 2 = Command
    iii. Level 3 = Operator Overrides
    iv. Level 4 = Database Modification
    v. Level 5 = Database Configuration
    vi. Level 6 = All privileges, including Password Add/Modify
f. A minimum of 100 unique passwords shall be supported.
g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.

7. Screen Manager - The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.

8. Dynamic Color Graphics

    a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
    b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
    c. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
    d. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
        i. All graphics shall be fully scalable
        ii. The graphics shall support a maintained aspect ratio.
        iii. Multiple fonts shall be supported.
        iv. Unique background shall be assignable on a per graphic basis.
        v. The color of all animations and values on displays shall indicate the status of the object attribute.

e. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device
f. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
    i. The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
    ii. In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.
g. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.

9. Historical trending and data collection

    a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
        i. Any point, physical or calculated, may be designated for trending. Two (2) methods of collection shall be allowed:
            1. Defined time interval
            2. Upon a change of value.
        ii. Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
    b. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis. Trend data shall be available for a minimum of twelve (12) months.

10. Trend data viewing and analysis

    a. Provide a trend viewing utility that shall have access to all database points.
    b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
    c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
    d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
    e. Display magnitude and units shall both be selectable by the operator at any

time without reconfiguring the processing or collection of data. This is a zoom capability.

f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.

g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.

J. Network Automation Engine (NAE)/ System Controllers

1. The Network Automation Engine (NAE)/ System Controllers or approved equal shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.

2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.

3. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.

b. The NAE shall support up four (4) concurrent users.

c. The web based user shall have the capability to access all system data through one NAE.

d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.

e. Systems that require the user to address more than one NAE to access all system information are not acceptable.

f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.

g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.

h. The web based UI shall support the following functions using a standard version of Microsoft Edge Internet Explorer:

i. Configuration
ii. Commissioning
iii. Data Archiving
iv. Monitoring
v. Commanding
vi. System Diagnostics

i. Systems that require workstation software or modified web browsers are not acceptable.

j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.

4. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.

5. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

6. Hardware Real Time Clock – The NAE shall include an integrated, hardware-based, real-time clock.

7. The NAE shall include troubleshooting LED indicators to identify the following conditions:

    a. Power - On/Off
    b. Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
    c. Ethernet Connection Speed – 10 Mbps/100 Mbps
    d. FC Bus – Normal Communications/No Field Communications
    e. Peer Communication – Data Traffic Between NAE Devices
    f. Run – NAE Running/NAE In Startup/NAE Shutting Down/Software Not Running
    g. Bat Fault – Battery Defective, Data Protection Battery Not Installed
    h. Fault – General Fault
    i. Modem RX – NAE Modem Receiving Data
    j. Modem TX – NAE Modem Transmitting Data

8. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.

    a. Up to two (2) USB port
    b. Up to two (2) URS-232 serial data communication port
    c. Up to two (2) RS-485 port
    d. One (1) Ethernet port

9. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

10. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

    a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
    b. Upon restoration of normal power and after a minimum off-time delay, the

controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

11. Certification – The NAE shall be listed by Underwriters Laboratories (UL).

12. Controller network – The NAE shall support the following communication protocols on the controller network:

    a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
        i. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (main or tracking) that will communicate on the BACnet MS/TP Bus.
        ii. The Conformance Statements shall be submitted 10 day prior to bidding.
        iii. The NAE shall support a minimum of 100 control devices.
    b. The NAE shall support the Johnson Controls N2, Tridium FX-40, or Honeywell Webs or approved equal Field Bus.
        i. The NAE shall support a minimum of 100 N2 control devices.
        ii. The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
        iii. The Bus shall employ a main/tracking protocol where the NAE is the main.
        iv. The Bus shall employ a four (4) level priority system for polling frequency.
        v. The Bus shall be optically isolated from the NAE.
        vi. The Bus shall support the Metasys Integrator System.

2.2. WIRING

A. The multi-conductor cable for field wiring of electronic analog sensors shall be minimum No. 22 AWG, 300 volt, thermoplastic with stranded copper wire and 100 percent shield coverage. The number of conductors in each sensor cable shall be as determined by the Contractor. 2/c #22 shielded cables shall be Belden Cat. #8451 3/c #20 shielded cables shall be Belden Cat. #9770 or approved equal.

B. Conductors for digital sensors or contact control shall be the same as for the analog sensors, except the grounded shield is not required.

C. Individual conductors shall be color coded and in addition shall be numbered in the field to identify the particular terminal to which attached. Field numbering shall be performed with Brady or approved equal markers wrapped around the wire near the terminal connection. All wires shall be terminated with pressure type connectors suitable for wire size, material and terminal connection.

D. All exposed wiring or wiring concealed in partitions shall be installed in a designated conduit raceway. The conduit shall conform to Division 26 of the specification. Where wiring is installed in an air plenum the same shall be plenum rated cable.

E. All junction boxes shall have covers painted safety green, and be rigid steel.

F. All wiring between static pressure controllers and/or air flow monitoring stations and variable frequency drive fan controllers shall be shielded and grounded at the fan controller end. Directly route the variable frequency drive fan controller to the static pressure controller(s) and/or air flow monitoring stations.

G. Where a motor disconnect is indicated downstream of a variable frequency drive (VFD) provide interlock wiring from the auxiliary contacts on the disconnect to the VFD to de-energize when the disconnect is turned “off”.

2.3. CONTROLLERS

A. Temperature, relative humidity, and CO2 sensor covers shall be stainless steel wire guard type with vandal proof screws. All room relative humidity, CO2, and temperature sensors shall be mounted 4'-0 inches above the finished floor, except in stairways, corridors and toilets, which shall be 7'-0 inches. Provide insulating bases where temperature sensors are located on exterior or unconditioned walls. Each temperature sensor shall have adjustable limit stops and adjustable sensitivity. User adjustment shall be 2 degrees F above and below set points or as determined by the Owner. Room temperature sensors shall include range of 55 degrees F to 85 degrees F set point adjustment. Temperature sensors shall include set-point adjustors, U.L. approved for mounting base in air plenums, and RJ-11 jack for communications. Room temperature sensors shall be fully adjustable and shall display set point and actual temperature.

B. Space sensor wiring shall be installed concealed where possible. Should the Division 23 Contractor be unable to do so then surface metal raceway shall be utilized as specified in Division 26.

C. Room temperature sensors shall be accessible to ADA occupants.

D. All global sensors shall be monitored in accessible locations. Exterior sensors shall be provided with sun shield and be installed to prevent bird nesting.

2.4. DAMPERS

A. Control Dampers

1. The temperature control contractor shall provide all automatic control dampers of the types indicated on the plans and not specified to be integral with other equipment. Frames shall be not less than 16 gauge galvanized steel. Blades shall not be over 6 inches wide airfoil shaped double skin construction of 14 gauge equivalent thickness. Bearings shall be stainless steel sleeves with 2 inch shafts. Blade edge seals shall be vinyl blade with flexible metal compressible jamb seals of the tight-seal spring type. Dampers and seals shall be suitable for temperature ranges of -40 to 250 degrees F.

2. All proportional or modulating control dampers shall be opposed blade type and all two-position dampers shall be parallel blade type.

3. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6 inches.

4. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage and flow characteristic data for all control dampers with the temperature control submittal. Maximum leakage shall be 3 CFM/Sq. Ft. at static pressure of 1 inch W.C. for a damper width of 48 inches.

5. Ultra-low leakage dampers shall have blade edges shall to be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 2 percent at applied static pressure.

6. Low pressure rectangular control dampers shall be Type CD60 airfoil low leakage damper as manufactured by Ruskin or as approved equal of American Warming and Ventilating, Air Balance and Arrow.

7. Round control dampers shall be Type CERS25 with blade edge seals as manufactured by Ruskin or as approved equal.

8. Provide damper end switch for all control dampers where indicated. Damper end switch shall provide "proof of open" prior to allowing fan to energize. Damper end switch shall be Model TS-475 Mechanical Damper Arm Switch (no-mercury) as manufactured by MDI, Inc. or approved equal. Install per manufacturer's recommendations on control damper. End switch shall have the following features:

    a. Housing Material: Glass filled PBT (polybutylene terephthalate).
    b. Bracket Material: Plated steel.
    c. Operation: Steel ball actuated sub-miniature snap action switch.
    d. Operating angle: 15 degrees. (Contact closes at 10 degrees above horizontal and contact opens at 5 degrees below horizontal).

B. Duct Smoke Detectors

1. Duct Smoke detectors shall be provided by the Electrical Contractor and installed by the Mechanical Contractor. All wiring, interlocks, etc., to be provided by Electrical Contractor. Wiring from duct smoke detectors to fans shall be by ATC Contractor. Duct smoke detectors shall be tested by the Test and Balance Engineer as specified in Division 23 Section, Testing Adjusting & Balancing for HVAC and Plumbing.

C. Damper Operators

1. Electric damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range.

2. Use devices which are quiet in operation and which in the event of power failure, will "fail safe" by spring action in either the normally open or normally closed position as required for freeze, moisture, smoke, or fire protection.

3. Electric actuators requiring a 24 VAC power supply will be utilized. Motors shall be specifically designed and sized with proper torque according to requirements of the device it is to be used on (i.e.: valve, damper). Each actuator will accept the proper control input as the system is designed, (i.e.: floating, 0-10VDC, 4-20Ma

etc.) without the need for any additional interface devices.

4. For all exterior damper operators provide NEMA 4X stainless steel corrosion resistant enclosure. Damper operator enclosure shall be model ZS-300 as manufactured by Belimo or approved equal.

2.5. CONTROL PANELS

A. Furnish and install local panels for ATC devices. Control panels shall be fully enclosed cabinets, all steel construction and shall meet the requirements of NEMA 1 enclosures. Cabinet shall have piano hinged door with a locking latch. All cabinet locks shall use common key. Provide means of storing control system instructions and drawings inside cabinet for future reference. Panel shall be wall mounted or free standing and located where directed by the Contract Drawings or Engineer.

1. Each panel shall have all internal devices factory wired to a numbered terminal strip. Controllers and associated devices shall be mounted within the panel, accessible through a hinged door.

2. All ATC panels shall be provided with integral disconnect, wiring, and control transformers.

3. Any ATC control panel that is serving equipment on the emergency generator must be powered by an emergency generator fed circuit/electrical panel. Refer to electrical contract documents for all emergency powered equipment.

2.6. MISCELLANEOUS ELECTRICAL DEVICES

A. Electric Actuators. All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with electric actuators which shall be sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close off as specified.

2.7. UNINTERRUPTIBLE POWER SUPPLY

A. Furnish, size and install uninterruptible power supplies (UPS’s) at all ATC panels.

B. Provide all interlock and power wiring from U.P.S. to control panels as required such that all components are powered via the UPS. For hard-wired equipment furnished with pigtails/wire leads, e.g. control power transformers, splice pigtails/wire leads in junction box to a flexible cord with NEMA 5-15P Plug, which shall be plugged into the UPS.

C. UPS's shall be sized for the ATC panel load and shall provide at least 10 minutes of full load power in the event of a power outage.

D. UPS shall be furnished with plug and cord and shall be powered from power receptacle(s) in ATC panels.

2.8. DESKTOP WORKSTATIONS

A. Description: A tower or all-in-one computer designed for normal use at a single,

semipermanent location.

B. Performance Requirements:

1. Performance requirements may dictate equipment exceeding minimum requirements indicated.

2. Energy Star compliant.

C. Personal Computer:

1. Minimum Processor Speed: 3 gigahertz (GHz).

2. RAM:

a. Capacity: 16GB.
b. Speed and Type: 1333 MHz, SDRAM.

3. Hard Drive:

a. Media: Solid state.
b. Number of Hard Drives: One.
c. Capacity: 250GB.

4. Optical Read and Write Drive:

a. Include with at least 2 MB of data buffer.
b. Type: SCS1 CD-ROM Drive with Read/Write Capability.
c. Average access time of 150 ms or less.

5. At least four expansion slots.

6. Video Card:

a. Resolution: 1920 by 1200 pixels.
b. RAM: 4 GB.
c. Controller Speed: 4GHz.

7. Sound Card:

a. At least 128 voice wavetable synthesis.
b. Capable of delivering three-dimensional sound effects.
c. High-resolution 16-bit stereo digital audio recording and playback with user-selectable sample rates up to 48,000 Hz.

8. Two (2) Network Interface Cards: Include cards with connection, as applicable.

a. 10-100-1000 base TX Ethernet with RJ45 connector port.
b. 100 base FX Ethernet with SC or ST port.

D. Wireless Ethernet, 802.11 a/b/g/n.

1. Optical Modem: Full duplex link for connection to optical fiber cable provided.

2. I/O Ports:

    a. Two USB 3.0 ports on front panel, six on back panel, and three internal on motherboard.
    b. One serial port.
    c. One parallel port.
    d. Two PS/2 ports.
    e. One RJ-45.
    f. One stereo line-in and headphone/line-out on back panel.
    g. One microphone and headphone connector on front panel.
    h. One IEEE 1394 on front and back panel with PCI-e card.
    i. One ESATA port on back panel.

3. Battery: Life of at least three years to maintain system clock/calendar and ROM, as a minimum.

E. Keyboard:

1. 101 enhanced keyboard.

2. Full upper- and lowercase ASCII keyset, numeric keypad, dedicated cursor control keypad, and 12 programmable function keys.

3. Wireless operation within up to 72 inches (1800 mm) in front of workstation.

F. Pointing Device:

1. Either a two- or three-button mouse.

2. Wireless operation within up to 72 inches (1800 mm) in front of workstation.

G. Flat Panel Display Monitor:

1. Display:

    a. Color display with 21 inches diagonal viewable area.
    b. Digital input signal.
    c. Aspect Ratio: 16 to 9.
    d. Antiglare display.
    e. Tilt adjustable base.
    f. Energy Star compliant.
    g. Resolution: 1920 by 1200 pixels at 60 Hz.
    h. Number of Displays: One.

H. Speakers:

1. Two, with individual controls for volume, bass and treble.

2. Signal to Noise Ratio: At least 65 dB.

3. Power: At least 4 W per speaker/channel.

4. Magnetic shielding to prevent distortion on the video monitor.

I. I/O Cabling: Include applicable cabling to connect I/O devices.

2.9. CENTRAL CONTROL AND MONITORING SYSTEM (CCMS) (HARDWARE DESCRIPTION)

A. General

1. The Facilities Management Control System (FMCS) shall be comprised of a network of various independent, Stand-alone Digital Controllers (SDC'S), Air Handler Digital Controllers (AHDC's), Unitary Digital Controllers (UDC's); together with Centralized Control Stations (CCS), and Centralized Host Stations (CHS) as specified, to provide centralized access and facility wide control functions. The SDC's, MSDC's, AHDC's, and UDC's shall be interconnected in a communicating network to provide facility wide access and sharing of information. A Gateway Digital Controller (GDC's) shall be provided to allow interface with third party microprocessor based control systems that are specified for integration within specification. A Local Area Network (LAN) shall be provided to interconnect SDC's for high-speed data transmission.

2. Specification Nomenclature

a.	FMCS	Facility Management Control System
b.	SDC	Stand-alone Digital Controller
c.	MSDC	Mechanical System Digital Controller
d.	AHDC	Air Handler Digital Controller
e.	UDC	Unitary Digital Controller
f.	GDC	Gateway Digital Controller
g.	GP	Graphical Programmer
h.	CHS	Central Host Station
i.	CCS	Central Control Station
j.	RPTR	Communications Repeater

B. Centralized Host Stations (CHS)

1. The FMCS shall include Centralized Host Stations. CHS's shall, in conjunction with the full compliment of Digital Controllers, provide the performance requirements within this specification. Each CHS shall include all hardware and software components to serve as a centralized facility operator station, providing color graphics, facility wide access, operator initiation of global control strategies, and centralized documentation.

The CHS shall be capable of simultaneously interfacing with the following:

a. -mouse pointing device
b. -two parallel printers
c. -high resolution VGA color graphics monitor
d. -seven auto answer/auto dial modems

e. -color inkjet printer
f. -two serial printers
g. -three FMCS LAN interface
h. -Alarm Graphic and Report FAX dial out service interface
i. -Mass storage tape system

As a minimum, the temperature control contractor shall provide the types and quantities of CHS, CCS, SDC, AHDC, GDC, and UDC as required.

2. Computer

a. The existing FMS computer located in the County's Central Maintenance Office shall be utilized with the new CCMS System. Provide modem terminal, and wiring as required to interface this Buildings CCMS system with FMS computer. I/P data drop shall be provided adjacent to the network panels.
b. Coordinate IP address with Owners' I.T. Department for network connection. The CCMS must be fully networkable.
c. Provide fiber optic cable as required.
d. Extend Existing Building Management System (BMS) as required to accommodate all equipment on this project.

3. Operator Workstation: One PC-based microcomputer with minimum configuration as follows:

a. Uninterruptible Power Supply: 2 kVa.
b. Operating System: Microsoft Windows – Latest Version.
i. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
ii. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.

C. Centralized Control Stations (CCS)

1. The FMCS shall include Centralized Control Stations, as required. CCS's shall, in conjunction with the network of SDC's and additional CCS components as required, provide the performance requirements within this section of the specification. Each CCS shall include all hardware and software components to serve as a centralized facility operator station, providing facility wide access, for review and modification of global control strategies, real time system monitoring, controller database editing or creation, and centralized documentation.

D. Local Area Networks

1. The LAN shall utilize packetized transmissions, CRC 16 error checking, and distributed error recovery. Single or multiple SDC failures shall not cause loss of communication between other LAN-connected SDC's.

2. LAN connected SDC's shall be provided with a communications watchdog to

assure that an individual SDC cannot permanently occupy the LAN. If an SDC is determined to be monopolizing communications, it shall be automatically shut down and an exception reported to annunciate this fact.

3. The LAN shall employ a token passing, peer-to-peer convention, same as or similar to the industry standard format IEEE 802.4. The content of messages shall be the manufacturer's standard. The Local Area Network components shall be manufacturer's standard or available from third party vendors which utilize the same chip implementation as used by the manufacturer.

4. Industry standard ANSI, RS-485 Network Communication System, Lon, or Bacnet, or Equivalent shall be utilized.

5. Trunk Wiring Practices - General

   a. The distributed communication network system shall consist of a multi-drop RS-485 bus architecture connecting SDC's, AHDC's, GDC's, and UDC's. The trunk shall consist of:
      i. A twisted pair of wires (24 awg) completely encased in continuous metallic conduit.
      ii. A twisted shielded pair of wires (24awg) with the shield grounded in accordance with the manufacturer's wiring practices.
      iii. Or a dual channel, 62.5 micron fiber cabling system with ST type connectors.

      There shall be no power wiring, in excess of 30 VAC rms voltage, run in conduit with communications trunk wiring. In cases where power or signal wiring is run in conduit with trunk wiring, all communications trunk wiring and power wiring shall be run using separate twisted shielded pairs (24awg) with the shields grounded in accordance with the manufacturer's wiring practices.

   b. Communication Transient Protection
      i. The manufacturer's catalog data sheet shall provide evidence that all FMCS products offered by the manufacturer are tested and comply with the standard for Transient Surge withstand capabilities for electrical devices ANSI C62.41, IEEE-587-1980, Categories A and B. Such testing shall have included power and communication trunk wiring. Compliance with IEEE-587 shall imply conformance with IEEE-472 transient standards based on the stated position of ANSI and IEEE regarding applicability of the rated standards.
      ii. In addition, at each building entry and exit point, the wire communications trunk wiring shall be protected with a transient surge protection device providing the minimal protection specifications of the General semiconductor, Model #422E device. Transient surge protection is not necessary if the communication trunk, external to the building, is fiber optic in nature.
      iii. The communications circuitry and input/output circuitry, of the SDC's and AHDC's shall provide protection against a 1000 volt, 3 amp transient signal, directly applied to the communication or input/output terminations. The manufacturer's catalog data sheet

shall provide evidence of conformance with this requirement. Systems not complying with this requirement shall provide equivalent protection external to the FMCS controller. Protection shall be provided for the individual communications and input/output terminations for each FMCS controller. Submittal documentation shall clearly define how this requirement will be met and how the external protection will not affect the performance of the controllers.

c. RS-485 Trunk Distance and Topology

The manufacturer's RS-485 trunk shall provide operation over end to end linear distances of 4000 feet for wire connections and 6,500 feet for fiber optic connections, without repeaters, at communication data rates of up to 64 kbps. The trunk may be extended up to 20,000 feet through the use of wire repeaters or 80,000 feet through the use of fiber optic repeaters.

At data rates of up to 19.2 kbps, the trunk distance shall be extendible to distances of up to 20,000 feet using RS-485 communication wire or fiber optic repeaters. A repeater shall be used each 4,000 feet of linear distance for wire or every 6,500 feet for fiber optics. Repeating devices shall contain separate LED indication for each communication interface trunk to indicate proper operation of the repeater as well as the communications trunks.

Contractors shall provide devices which are of FMCS control system manufacturer's design.

d. It shall be possible for the trunk to be "T" eed or "starred", at any location using a repeater, to facilitate the installation. Systems which do not provide this capability shall provide a trunk riser diagram showing end to end distances and locations of system topology necessary to meet the trunk diagram shown on the plans.

e. Fiber Optic Communication Trunk

The temperature control contractor shall provide a dual channel fiber optic data link, as required, to minimize the effects of transient surges caused by lightning or external EMI generating equipment. The data link shall be comprised of a single duplex cable containing two fibers (transmit and receive), of 62.5 micron construction, to accommodate data rates of up to 64 kbps.

The fiber optic trunk shall be connected to SDC devices using manufacturer's standard RS-485 to fiber optic data link modem. Repeating devices shall contain separate LED indication for each communication interface and the fiber modem, to indicate proper operation of all aspects of the device. Fiber modem devices shall be tested and conform with transient surge withstand tests for electrical devices, ANSI C62.41 IEEE-587 Categories A and B. Manufacturer's data sheet shall provide evidence of compliance with this requirement. Manufacturer's products which do not meet this minimum performance requirement shall not be acceptable.

Systems which require a special gateway controller to accommodate the fiber optic trunks, shall provide such a controller per point where the fiber optic cable enters and leaves the building. Gateway controllers shall not inhibit transfer of point data values between SDC controllers throughout the LAN. Such inhibitive systems shall not be acceptable.

In lieu of the above two options, the contractor may provide a fiber optic link to each SDC controller within the LAN. All controllers shall have

access to the fiber optic link for LAN.
Fiber optic cable shall be fully tested and terminated by the temperature control contractor.

E. Standalone Digital Controllers (SDC)

1. General

Standalone Digital Controllers (SDC) shall be 16 bit microcomputer based, utilizing a multi-tasking, multi-user operating system.

The SDC controllers shall permit the simultaneous operation of all control, communication facilities management and operator interface software, as programmed by the Contractor or User. Modification of the on-board SDC controller database shall be performed on-line using the built-in or HHOT interface. Systems which require the SDC to be removed from service while DDC control sequences are modified shall not be acceptable.

SDC controllers shall utilize true floating point arithmetic capabilities. To accommodate totalization of large totalized values, SDC's with reporting capability shall support the calculation, accumulation and display of values within the range of +/-10 to the 10th power.

2. Database and Memory Back-up

All programming defining the functions to be performed by the SDC, including but not limited to application programs and point database within each SDC, shall be protected from loss due to power failure for a minimum of six months. Systems providing non-volatile memory for these functions are preferred. Systems not providing non-volatile memory shall provide a system rechargeable battery backup system sufficient to provide protection for the specified 6 month period. Systems not in compliance shall provide for uninterrupted power to each SDC.

3. Service Ports

SDC controllers shall be equipped with a minimum of one operator service port for the connection of a HHOT. The service port shall be either a built-in RS-232 data terminal port or an RJ-11 type jack which connects to the manufacturer's standard HHOT.

Connection of a service device, to a service port, shall not cause the SDC controller to lose communications with its peers or other networked device controllers.

The service port shall allow utilization of the same HHOT from any location. The same HHOT shall be utilized for any SDC, AHDC, or UDC Systems which utilize more than one variety of HHOT shall not be acceptable.

4. Display and Readout Capability

The SDC controller shall provide manufacturer’s standard display and readout capability.

5. Manual/Auto Control and Notification

The SDC controller shall provide commanded override capability from the HHOT or the built-in operator interface. Such overrides shall be annunciated to the CHS's. Such overrides shall be valid as long as power is applied to the controller.

Manual service overrides, such as Hand/Off/Auto switches, shall be provided as indicated on the drawings. Such overrides shall be located at the controlled device location and conform with OSHA Manual lockout regulations, as appropriate, for safety reasons. SDC indication of such manual override actions shall be provided as feedback status indication points shown on the drawings, in conjunction with the application programs within the SDC. Systems which provide built-in H/O/A switching devices with integral feedback shall provide external manual service overrides, as indicated, to comply with OSHA manual lockout regulations. H/O/A switches remotely located at the SDC controller are not acceptable.

6. Adjustments

Every control panel shall provide adjustments for the functions specified. In general, adjustments shall be provided for all set points used by controllers within each control panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified. Adjustments shall be integral to each individual SDC. The built-in operator interfaces shall allow the easy execution of the adjustment through named identifiers within the SDC. From a single SDC user interface, any other SDC shall be accessible and full adjustment capabilities shall be provided.

7. Sensing and Control Outputs Requirements

a. Sensing
   i. All sensing inputs shall be provided via industry standard signals. Temperatures, humidities, differential pressure signals, and other signal inputs shall be one of the following types:
      1) 0-20 mA
      1) 4-20 mA
      1) 0-5 VDC
      1) 0-12 VDC
   ii. 1000 ohm platinum (at O°C, 2.62 ohms/°C)
   iii. 1000 ohm Balco (2.2 ohms/°F)
   iv. 10 k ohm Thermistor (at 25°C/77°F)

   Custom, definable input signals (accept sensor inputs from RTD devices, other than those of the manufacturer).

   All signal inputs shall be compatible with the controllers used, and with the requirements for readout of variables in true scaled engineering units as specified.

b. Control Outputs
   i. On/Off Outputs

   Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of troubleshooting the 120 VAC or 240 VAC circuit to the contactor. All such relays or digital output modules shall provide a pilot light or LED display of the same status. On/Off output

modules shall be of the modular construction that can be easily and quickly replaced, on an individual basis, if the module were to be damaged.

ii. Modulating Outputs

Modulating outputs shall be industry standard 0-5 VDC, or 0-12 VDC with definable output spans, to adapt to industry available control products. Milliamp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.

All modulating outputs shall provide within the control panel, a meter gauge, or display indication via on board display or HHOT, the commanded position signal for the actuating device. This meter, gauge, or display must provide either a 0-100 percent position indication, or read out directly in the engineering unit of the signal being used. Drive open/Drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement. In the case of Drive open/closed technology, position feedback shall be provided to insure positive indication that the control device is at the commanded position.

F. Air Handler Digital Controller (AHDC)

1. General

a. Controls shall be microprocessor based, Air Handler Digital Controllers (AHDC's). AHDC's shall be provided for single zone VAV unit, and other applications as required. AHDC's shall be based on a minimum 16 bit microprocessor working from software program memory which is physically located in the AHDC. The application control program shall be resident within the same enclosure as the input/output circuitry which translates the sensor signals. All input/output signal conversion shall be performed through a minimum of a 10 bit A to D converter. All input points shall be universal in nature allowing their individual function definition to be assigned through the application software. All unused input points must be available as universally definable at the discretion of the owner. If the input points are not fully universal in nature, unused points must be equal in quantity between Analog Inputs and Digital Inputs. Contractor shall provide a minimum of one AHDC controller per air handling system as shown on the drawings.

The BAS contractor shall provide and field install all AHDC's specified under this section. Mechanical equipment manufacturers desiring to provide AHDC type controls as factory mounted equipment, shall provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the BAS/Temperature control contractor.

b. All input/output signals shall be directly hardwired to the AHDC. Troubleshooting of input/output signals shall be easily executed with a volt-ohm meter (VOM). As a result of this intent, it is specified that power line carrier systems, or other systems which command multiple outputs over a single pair of wires, shall not be utilized.

c. AHDC's shall be in continuous direct communication with the network which forms the facility wide Building Automation System. The AHDC's shall communicate with the SDC at a baud rate of not less than 19,200

baud.

2. Non-Volatile Memory

a. All control sequences programmed into the AHDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained. Power failures shall not cause the AHDC memory to be lost, nor shall there be any need for batteries to be recharged or replaced to maintain the integrity of the controller database. The AHDC shall allow for the creation of unique application control sequences. Systems that only allow selection of sequences from a library or table, are not acceptable.

b. All control sequences shall be fully programmable at the AHDC, allowing for the creation and editing of an application control sequence, while at the unit.

c. The AHDC shall be provided with an interface port for the HHOT. The interface port shall allow the HHOT to have full functionality as described. From the interface port, the HHOT shall be able to directly access any AHDC or UDC in the network.

d. The AHDC shall provide an input/output point trending utility that is capable of accumulating 48 analog point samples and 10 digital point samples, per Input/Output point. Each sample shall be taken on a user defined interval, ranging from 1 second to 255 hours per sample. The digital readings shall be on a change of state occurrence for the digital points. All samples shall be recorded with the engineering units for the value, along with a time and date identifier for each sample taken. The samples shall be protected against loss due to power interruptions through a battery or capacitor backup method for a minimum of 30 days.
Systems unable to provide the above capability shall provide for the individual Input/Output point trending at the SDC. Specifics as to how each AHDC point will be trended, at the SDC, shall be provided in the submittal documents. Included in the explanation shall be the sample intervals, the memory allocation in the SDC and the number of AHDC's per SDC that can be expected.

e. The AHDC shall provide LED indication of transmit/receive communications performance, as well as for the proper/improper operation of the controller itself.

f. The AHDC shall be provided with a battery backed time clock that is capable of maintaining the time of day and calendar for up to thirty days, upon loss of power to the AHDC, without loss of setting. The battery for the time clock shall be replaceable by the customer. The AHDC shall be provided with integral time schedules; as a minimum, two seven day schedules with eight on/off periods per day shall be provided. Holiday override of weekly schedules shall be provided for pre-scheduling of holidays, for the year in advance.

3. Controller Location

a. To simplify controls and mechanical service troubleshooting, the AHDC shall be mounted directly in or on the controls compartment of the air handling system. The AHDC shall be provided in a NEMA 1 enclosure to accommodate direct mounting on the equipment to be controlled. The

AHDC shall be constructed in a modular orientation such that service of the failed components can be done quickly and easily. The modular construction should limit the quantities of printed circuit boards to a maximum of two. All logic, control system, power supply and input/output circuitry shall be contained on a single plug-in circuit board. When required to replace a printed circuit board, it shall not be necessary to disconnect any field wiring. This shall allow all controls maintenance and troubleshooting to be made while at the air handling unit. The AHDC shall be directly wired to sensory devices, staging relays or modulating valves for heating and cooling.

b. For compatibility to the environment of the air handling unit, AHDC's shall have wide ambient ratings. AHDC's shall be rated for service from -40 Deg F (Degrees Fahrenheit) to 140 Deg F.

c. Contractor shall submit description of location of AHDC's on all mechanical and air handling equipment.

G. Unitary Digital Controller (UDC)

1. General

a. Controls shall be microprocessor based Unitary Digital Controllers (UDC's). UDC's shall be provided for equipment as necessary. UDC's shall be based on a minimum 16 bit microprocessor working from software program memory which is physically located in the UDC. The application control program shall be resident within the same enclosure as the input/output circuitry which translates the sensor signals. All input/output signal conversion shall be performed through a minimum of a 10 bit A to D converter.

Contractor shall provide a minimum of one UDC controller per unitary system as required.

The BAS contractor shall provide and install all UDC's specified under this section. Mechanical equipment manufacturers desiring to provide UDC type controls as factory mounted equipment, shall provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the BAS/Temperature control contractor.

b. All input/output signals shall be directly hardwired to the UDC. Troubleshooting of input/output signals shall be easily executed with a volt-ohm-milli-amp meter (VOMA). As a result of this intent, it is specified that power line carrier systems, or other systems which command multiple outputs over a single pair of wires, shall not be utilized.

c. UDC's shall be in continuous, direct communication with the network which forms the facility wide building automation system. The UDC's shall communicate with the SDC at a baud rate of not less than 9,600 baud.

2. Non-Volatile Memory

a. All control sequences programmed into the UDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained. Power failures shall not cause the UDC memory to be lost, nor shall there be any need for batteries to be recharge or replaced to

maintain the integrity of the controller database. The UDC shall allow for the creation of unique application control sequences. Systems that allow only selection of sequences from a library or table are not acceptable.

b. All control sequences shall be fully configurable at the AHDC, allowing for the creation and change of a sequence while at the unit.

c. The UDC shall be provided with the ability to interface with the HHOT. The interface port shall be provided at the wall sensor or within the unitary equipment, as specified on the plans. The interface port shall allow the HHOT to have full functionality as described hereinbefore of this specification. From the interface port, the HHOT shall be able to directly access any AHDC or UDC in the network.

d. The UDC shall provide an input/output point trending utility that is capable of accumulating 48 analog point samples and 10 digital point samples per Input/Output point. Each sample shall be taken on a user defined interval, ranging from 1 second to 255 hours per sample. The digital readings shall be on a change of state occurrence for the digital points. All samples shall be recorded with the engineering units for the value, along with a time and date identifier for each sample taken.
Systems unable to provide the above capability shall provide for the individual input/output point trending at the SDC. Specifics as to how each UDC point will be trended, at the SDC, shall be provided in the submittal documents. Included in the explanation shall be the sample intervals, the memory allocation in the SDC and the number of UDC's per SDC that can be expected.

e. The UDC shall provide LED indication of transmit/receive communication performance, as well as for the proper/improper operation of the controller itself.

3. Controller Location

a. To simplify controls and mechanical service troubleshooting, the UDC shall be mounted directly in the controls compartment of the unitary system. The UDC shall be provided with a sheet metal or polymeric enclosure that is constructed of material allowing for the direct mounting within the primary air stream, as defined by UL-465. The direct mounting shall allow all controls maintenance and troubleshooting to be made while at the unitary equipment. The UDC shall be directly wired to sensory devices, staging relays or modulating valves for heating and cooling.

b. For compatibility to the environment of the unitary equipment, UDC's shall have wide ambient ratings. UDC's shall be rated for service from 32 Deg F (Degrees Fahrenheit) to 140 Deg F.

c. Contractor shall submit description of location of UDC's on all mechanical and unitary equipment.

H. Gateway Digital Controller (GDC)

1. General

a. Controls shall be microprocessor based, Gateway Digital Controllers (GDC's). GDC's shall be provided for the purpose of integrating microprocessor based, communicating, direct digital control systems from

vendors other than the primary, selected controls manufacturer. GDC's shall be based on a minimum 16 bit microprocessor working from software program memory which is physically located in the GDC. All communications interface control programs shall be resident within the GDC.

The BAS contractor shall provide and field install all GDC's specified under this section. Any interface requirement beyond a two wire communications wire link, shall be provided by the equipment manufacturer supplying the non-primary or third party microprocessor based, communicating, direct digital controllers.

b. All GDC's shall exist at the LAN level with the SDC's. The GDC's shall possess all capabilities described under the SDC section while additionally providing the interface to the third party systems described above. The GDC's shall communicate with the third party controllers at the highest possible baud rate offered by the third party system. As a minimum, 9,600 baud communications shall be utilized.

c. All control sequences programmed into the GDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained. Power failures shall not cause the GDC memory to be lost, nor shall there be any need for batteries to be recharged or replaced to maintain the integrity of the controller database. The GDC shall allow the standard database information from the third party system to be integrated in standard FMCS data formats, allowing for the creation of unique application control sequences. Systems that only allow selection of data and sequences from a library or table, are not acceptable.

d. Each GDC shall be provided with manufacturer's standard built-in operator interface.

The GDC shall provide Alarming, point trending and Energy report generation capabilities. Alarming points shall be uniquely definable, with multiple alarms assignable to a single point. Such alarm shall be provided with a unique 80 character message. Systems utilizing an alarm message library, shall describe the size of the library and verify how all alarming within the GDC will be guaranteed unique 80 character messages.

The quantities of trended point values shall be limited only by total controller memory space. If necessary, a GDC may be dedicated fully to a trending task, allowing all controller memory to be available for the trend storage. Each unique trend report shall contain a minimum of 4 different points and a minimum of 128 samples per point. Trending frequency for each report shall be operator definable from a sample once a second to a sample once every 24 hours. Trend reports shall be internally formatted by the GDC and shall be reportable directly to a serial printer, a VT-100 display terminal, a CCS, CHS or any other device capable of receiving a formatted ASCII data file.

e. The energy reports shall not be limited in quantities only by available memory within the GDC. Each Energy Report shall be fully formatted and reportable to a serial printer, a VT-100 display terminal, a CCS, a CHS or any other device capable of receiving a formatted ASCII data file. As a minimum, each Energy Report shall provide a daily report and a monthly report with summary information such as outside air temperature, outside air humidity, total energy consumed and degree day calculations.

f. The GDC shall be provided with a battery backed clock that is capable of

maintaining the time of day and calendar for up to thirty days, upon loss of power to the GDC, without loss of setting. The battery for the time clock shall be field replaceable by the customer.

2.10. SYSTEM SOFTWARE DESCRIPTION

A. General

1. Contractor shall provide all software for a complete and operational system as described herein. Software shall include manufacturer's standard multi-tasking, multi-user operating system for operator consoles and controllers, network communication software for dial-up and hard trunk applications, operator man-machine interface software, control application software and all other software necessary to provide the functions specified herein.

2. System software shall be as manufactured by Johnson Controls, Johnson Controls Facility Explorer, Honeywell, Siemens, Alerton, Reliable Controls, Schneider Electric, Advanced Power, Trane, or approved equal.

2.11. EXCEPTION REPORTING SEQUENCES

A. Alarm/COS Reports

1. For those digital points indicated on the drawings, the Contractor shall provide a unique change-of-state alarm message of up to 70 characters. The message shall report to all devices assigned to the alarm class.

2. For those points indicated on the drawings which are designated as interrupt priority, the Contractor shall provide an interrupting process display at the CHS location which displays the current conditions for the operator.

   In addition, the CHS computer shall automatically send a picture of the process graphic display to the remote locations via e-mail.

3. For those points designated in paragraph 3 above, the FMCS shall also send a history log to the system report printer of the immediate prior history of the points causing the interrupt priority. This log shall contain 1 minute samples of the previous 15 minutes of operation.

4. For those points on the drawings designed as Hard Facts points, the Contractor shall provide an alarm message to a remote facsimile location designated by the Owner. The FMCS system shall provide at the remote location, a facsimile print-out showing location, time/date of alarm and alarm message of the point. For interrupt priority fax alarms, the remote facsimile machine shall receive a hard copy of the interrupt process screen showing on-line dynamic data values of the current conditions.

B. Off Hours Exception Reporting

1. The Owner shall specify up to five sites to which off hours exceptions shall be auto-dialed and reported. This shall allow the owner to assign off hours exception

responses to various facility personnel as necessary. Selection of the site to be dialed can be programmed by the Owner, and set to change automatically per time of day and day of week.

2.12. MONITORING SYSTEM, SENSORS AND WIRING

A. Sensors and other Devices for Input/Output Summary Schedule:

1. Provide all necessary sensors, relays, panels, conduits and wire for the points indicated in the input/output summary as shown on the contract drawings.

2. Analog sensing elements for remote indication shall be independent of local sensors used for local control loops.

3. Temperature sensors shall be Resistance Temperature Detector (RTD) type of 1000 ohm balco. Space (60-90 degrees F); Duct/Well (-30-250 degrees F); Averaging Duct (-30-225 degrees F) or as required under Division 26.

   a. Space temperature sensors shall be provided with blank commercial type locking satin chrome covers.
   b. Duct temperature sensors shall be rigid stem or averaging type as specified in the sequence of operation. Water sensors shall be provided with a separable copper, monel or stainless steel well. Outside air wall mounted sensors shall be provided with a sun shield.

4. Relative humidity sensors shall be capacitance type with 10 percent to 90 percent range. Duct mounted relative humidity sensors shall be provided with a sampling chamber. Wall mounted sensors shall be provided with covers identical to temperature sensors. Space 10 percent -90 percent RH; Duct 10 percent - 90 percent RH.

5. All wall mounted temperature sensors, relative humidity sensors, and CO2 sensors shall be installed with stainless steel wire guard. Set point adjustment shall be achievable without removing the wire guard.

6. Differential and Static Pressure Sensors and Switches

   a. Fan proof-of-flow switches shall be U.L. listed adjustable set point and differential pressure type. Switches shall be piped to fan discharge except where fans operate at less than one inch WG, they shall be piped across the fan. For fractional horsepower and non-ducted fans, relays or auxiliary contacts may be used. Maximum pressure rating shall be at least 10 inches WG. with .05-12 inch W.C. range.
   b. Air flow and static pressure analog sensors shall be high accuracy suitable for the low velocity pressures to be encountered, be selected for approximately 50 percent overrange, and have a 4 to 20 ma output. These differential pressure sensors shall be connected to the air flow measuring station with valved lines for testing and calibration, and shall have adjustments for zero and span. 5 inch W.C. range.

7. Overall system accuracy, including electronic analog sensing elements, shall be as

follows:

a. Air: Plus or minus 1.0 degrees F temperature, plus or minus 2.5 percent r.h., plus or minus 2.0 percent static pressure.
b. Proof of fan operating status, or alarm conditions shall be through positive feedback from differential pressure switches across fan. Auxiliary dry contacts may be used for proof of fans if the motors are fractional H.P., and other non-ducted fans.

8. Digital inputs from devices with isolated, dry type contacts (no grounds, no voltage) of either normally open (N.O.) or normally closed (N.C.) configuration shall be provided. Live contact inputs, those that have voltage present, shall be provided with isolating devices to meet dry contact requirements.

9. Start-stop relay module shall contain relays for start-stop function at the remote point, with relays mounted and factory wired to numbered terminal strips.

10. Outage Devices:

a. Control Relays: Control relay contacts shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dustproof enclosure. Relays shall have silver-cadmium contacts with a minimum life-span rating of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression limiting transients to nondamaging levels.
b. Time Delay Relays: Time delay relay contacts shall be rated for the application with a minimum of two sets of Form C contacts enclosed in a dustproof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Relays shall be equipped with coil transient suppression devices to limit transients to nondamaging levels. Delays contact opening or closing shall be adjustable from one to 60 seconds with a minimum accuracy of plus or minus 2 percent of setting.
c. Latching Relays: Latching relay contacts shall be rated for the application with a minimum of two sets of Form C contacts enclosed in a dustproof enclosure. Relays shall have silver-cadmium contacts with a minimum life-span rating of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to nondamaging levels.
d. Reed Relays: Reed relays shall be encapsulated in a glass-type container housed in a plastic or epoxy case. Contacts shall be rated for the application. Operating and release times shall be one millisecond or less. Reed relays shall have a minimum life span rating of 10 million operations.
e. Contactors: Contactors shall be of the single-coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be double-break silver-to-silver type protected by arcing contacts. Number of contacts and ratings shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be

equipped with coil transient suppression devices to limit transients to nondamaging levels.

f. Solid-State Relays: Input-output isolation shall be greater than 1000 megohms with a breakdown voltage of 1500 V rms or greater at 60 Hz. The contact life shall be 10 million operations or greater. The ambient temperature range shall be minus 20 degrees to plus 140 degrees F. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release times shall be one millisecond or less. Transient suppression shall be provided as an integral part of the relay to limit transients to nondamaging levels.

11. Audible Alarm:

a. All alarms shall annunciate on the ATC system front end computer and via pagers.

2.13. DUCT MOUNTED CARBON MONOXIDE SENSORS

A. Furnish and install duct mounted carbon monoxide (CO) sensors in the discharge ducts of all indirect fired gas heating equipment and where shown on the contract drawings.

B. Duct mounted carbon monoxide sensors shall be Model KCOC as manufactured by Kele or approved equal. Accuracy shall be +2.5% of scale, with a range of 0-200 ppm.

C. Furnish units with control transformer, calibration kit, low voltage power supply, audible alarm, LCD display and SPST relay as required.

D. Analog output shall be 4-20MA or 0-10V as required.

E. Monitor on the automatic temperature control system and display on the BMS computer graphic.

2.14. FIELD INSTALLED CONDENSATE OVERFLOW SWITCHES

A. Condensate overflow switches must be tested to comply with U.L. 508.

B. Interlock condensate overflow switches to shut-down cooling equipment and alarm on ATC system where overflow condition exists.

2.15. CO2 SENSORS/TRANSMITTER

A. Furnish and install wall mount CO2 sensor/transmitters at locations indicated on floor plans. CO2 sensor/transmitter shall be model CD-W00 as manufactured by Johnson Controls or approved equal.

B. Measuring Range: 0 to 2,000 ppm CO2.

C. Response Time: 1 minute

D. Output Signal: As required by ATC system

E. Max power consumption: Less than 2 watts.

F. Listing: U.L. Listed

G. Accessories: Mounting Kit, Transformer required.

H. Install heavy duty stainless steel guards.

PART 3. EXECUTION

3.1. GENERAL

A. The Automatic Temperature Control System and Central Control and Management System, shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner.

3.2. BMS SPECIFIC REQUIREMENTS

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each new system including the existing smoke evacuation system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

B. Custom Reports:

1. Provide custom reports as required for this project:

3.3. WORKSTATION INSTALLATION

A. Desktop Workstations Installation:

1. Install workstation(s) at location(s) directed by Owner.

2. Install multiple-receptacle power strip with cord for use in connecting multiple workstation components to a single duplex electrical power receptacle.

3. Install software on workstation(s) and verify software functions properly.

4. Develop Project-specific graphics, trends, reports, logs and historical database.

5. Power each workstation through a dedicated UPS unit. Locate UPS adjacent to workstation.

B. Portable Workstations Installation:

1. Turn over portable workstations to Owner at Substantial Completion.

2. Install software on workstation(s) and verify software functions properly.

C. Color Graphics Application:

1. Use system schematics indicated as starting point to create graphics.

2. Develop Project-specific library of symbols for representing system equipment and products.

3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.

4. Submit sketch of graphic layout with description of all text for each graphic for Owner's review before creating graphic using graphics software.

5. Seek Owner input in graphics development once using graphics software.

6. Final editing shall be done on-site with Owner's review and feedback.

7. Refine graphics as necessary for Owner acceptance.

8. On receiving Owner acceptance, print a hard copy for inclusion in operation and maintenance manual. Prepare a scanned copy PDF file of each graphic and include with softcopy of DDC system operation and maintenance manual.

3.4. INSTALLATION & SUPERVISION

A. All wiring and tubing shall be properly supported and run in a neat and workmanlike manner. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All piping and wiring within enclosures shall be neatly bundled and anchored to prevent restriction to devices and terminals.

B. The control contractor shall be responsible for all electrical installation required for a fully functional control and automation system and not shown on the electrical plans or required by the electrical specifications. All wiring shall be in accordance to all local and national codes.

1. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications.

2. All electric and electronic wiring shall be minimum #20 AWG minimum THHN and shielded if required.

3. All wiring in the central control room shall be concealed in an approved manner.

C. Verify locations of temperature sensors, relative humidity sensors, CO2 sensors, and other exposed control sensors with plans and Owner prior to installation.

D. The installation and supervision of this project shall be carried out by factory trained personnel who are employed by the Contractor and licensed for this type of work.

E. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

F. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

G. Install in accordance with manufacturer's instructions.

H. Check and verify location of space temperature sensors, relative humidity sensors, CO2 sensors, and other exposed control sensors with plans and room details before installation. Align with lighting switches and relative humidity sensors, and dewpoint temperature sensors.

I. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

J. Provide separable sockets for liquids and flanges for air bulb elements.

K. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

L. Install equipment plumb and level.

M. Install all equipment to be accessible for service and maintenance.

3.5. ACCEPTANCE TESTING

A. Point Verification

To verify end-to-end operation of the system the Contractor shall provide a hard copy of an All Points Summary Listing to the Owner of each part or system to be placed in warranty by the Owner. For CHS systems, the Contractor shall additionally provide a print screen of the process display showing real time dynamic point information for all points on the subsystem(s) to be accepted.

B. Sequence Verification

1. The Contractor shall notify the Owner's representative of systems which perform all specified sequences.

2. The warranty acceptance test shall be of 5 days duration and the system shall perform as follows:

   a. During the five days, the FMCS system shall not report any system diagnostics from the subsystem under test.
   b. The subsystem shall be performance verified as operational using temporary trends of each control loop located in the SDC or MSDC.
   c. During the occupied periods, BAS control loops, under test, shall maintain control of the process variable within the following scales:
      i. Duct Static Pressure +/-0.3 inch WC
      ii. Duct Temperature Loops +/-2 degrees F
      iii. Room Temperature Loops +/-1degrees F

iv. Duct Relative Humidity +/-2x rated error of Humidity Transmitter

d. The contractor shall provide a hard copy printout of the process variable, process variable set point and control loop output percent for the period of 2 hours prior to occupancy to 2 hours after occupancy with samples taken every 15 minutes.

3.6. COORDINATE WITH TAB AGENCY

A. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air reset, and duct smoke detectors.

B. Verify that all controlling instruments are calibrated and set for design operating conditions prior to commencement of TAB work.

C. Calibrate sensors after installation, and before the sensor control verification tests are performed. Prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditional space for each separately controlled zone.

D. Allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

E. All control sequences, software, equipment, and components shall be started-up by a qualified technician. Start-up report shall be submitted to Engineer prior to the commencement of testing and balancing work. Testing and balancing shall not commence until start-up reports are completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

3.7. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and tubing is installed prior to installation proceeding.

3.8. INTERLOCK REQUIREMENTS

A. The fan and equipment interlock requirements are as scheduled on the contract drawings.

B. Furnish and install all necessary relays, transformer, contactors, wiring, conduit, and accessories to perform fan, equipment, and damper interlocks.

C. Unless otherwise noted, fan interlocks shall be arranged such that dampers associated with fan shall be open when fan starts and close when fan stops.

D. In projects with heat pumps, the evaporator fans shall be hard wired interlocked with the heat pumps so that if evaporator fan fails, the heat pump shall de-energize.

3.9. SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

3.10. CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Install piping adjacent to machine to allow service and maintenance.

B. Ground equipment.

1. 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.

C. Connect hand-off-auto selection switches to override automatic interlock controls when switch is in hand position.

3.11. FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

2. Test and adjust controls and safeties.

3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.

4. Test each point through its full operating range to verify that safety and operating

control set points are as required.

5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.

6. Test each system for compliance with sequence of operation.

7. Test software and hardware interlocks.

8. Test all end switches and verify status is reported on the ATC system.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.

2. Check instruments for proper location and accessibility.

3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.

4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.

5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.

6. Check temperature instruments and material and length of sensing elements.

7. Check DDC system as follows:

a. Verify that DDC controller power supply is from emergency power supply, if applicable.
b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
c. Verify that spare I/O capacity has been provided.
d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

E. All temperature control and interlock wiring shall be installed in conduit unless otherwise noted on the plans. Power or interlock wiring shall be run in separate conduit from sensor and communications wiring.

3.12. ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.

2. Make three-point calibration test for both linearity and accuracy for each analog instrument.

3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

4. Control System Inputs and Outputs:

   a. Check analog inputs at 0, 50, and 100 percent of span.
   b. Check analog outputs using volt-ohm-milli-amp meter (VOMA) at 0, 50, and 100 percent output.
   c. Check digital inputs using jumper wire.
   d. Check digital outputs using ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

   a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 0, 50, 90, and 100 percent of span.

6. Pressure:

   a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
   b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

   a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
   b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust dampers.

9. Provide diagnostic and test instruments for calibration and adjustment of system.

10. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial CO_2 CO, temperature, static pressure, differential pressure, and relative humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.13. ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

3.14. SCHEDULING

A. Submit spreadsheet to Owner indicating occupied/unoccupied times for each item controlled by ATC system. Incorporate all scheduling requirements into sequence of operation.

3.15. STAGING

A. Coordinate staging requirements with equipment being controlled. Where multistage units are scheduled or specified, provide all devices, controllers, wiring to control and sequence all stages.

END OF SECTION

DIVISION 23 SECTION 230923
AIRFLOW MONITORING STATIONS
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SECTION 230923 – AIRFLOW MONITORING STATIONS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. Section Includes:

1. Airflow measurement stations and sensors.

2. Airflow switches.

3. Airflow transmitters.

B. Related Requirements:

1. Section 230900 "Instrumentation and Controls of HVAC and Plumbing Systems" for control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

1.3. DEFINITIONS

A. Ethernet: Local area network based on IEEE 802.3 standards.

B. FEP: Fluorinated ethylene propylene.

C. HART: Highway addressable remote transducer protocol is the global standard for sending and receiving digital information across analog wires between smart devices and control or monitoring systems through bi-directional communication that provides data access between intelligent field instruments and host systems. A host can be any software application from technician's hand-held device or laptop to a plant's process control, asset management, safety, or other system using any control platform.

D. PEEK: Polyetheretherketone.

E. PTFE: Polytetrafluoroethylene.

F. PPS: Polyphenylene sulfide.

G. RS-485: A TIA standard for multipoint communications using two twisted pairs.

H. RTD: Resistance temperature detector.

I. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

1.4. ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Operating characteristics; electrical characteristics; and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.

3. Product description with complete technical data, performance curves, and product specification sheets.

4. Installation instructions, including factors affecting performance.

5. Product certificates.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.

2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

4. Include diagrams for air and process signal tubing.

5. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Delegated-Design Submittal:

1. Schedule and design calculations for flow instruments, including the following.

a. Flow at Project design and minimum flow conditions.
b. Pressure drop at Project design and minimum flow conditions.

1.5. INFORMATIONAL SUBMITTALS

A. Product Certificates: For each product requiring a certificate.

B. Product Test Reports: For each product, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Documentation of NIST traceability.

1.6. CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For instruments to include in operation and maintenance manuals.

1.7. MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials and parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Provide parts, as indicated by manufacturer's recommended parts list, for product operation during two-year period following warranty period.

PART 2. PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Delegated Design: Select and size products to achieve specified performance requirements.

B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2. GENERAL REQUIREMENTS FOR FLOW INSTRUMENTS

A. Air sensors and transmitters shall have an extended range of 10 percent above Project design flow and 10 percent below minimum Project flow to signal abnormal flow conditions and to provide flexibility for changes in operation.

B. Source Limitations: For flow instruments, obtain products from single source from single manufacturer.

2.3. AIRFLOW MEASUREMENT

A. General Requirements:

1. Adjustable for changes in system operational parameters.

2. Airflow Sensor and Transmitter Range: Extended range of 10 percent above Project design flow and 10 percent below minimum Project flow to signal abnormal flow conditions.

3. Manufacturer shall certify that each flow instrument indicated complies with specified performance requirements and characteristics.

    a. Product certificates are required.

4. System Accuracy: The total system accuracy, including array averaging error, transducer error, etc… when installed in accordance with the manufacturer’s recommendations and without field adjustment shall be as follows throughout the entire operating range.

    a. Ducts and plenums: +/- 3% of reading

b. Outside air intakes +/- 5% of reading
c. Fan inlets +/- 10% of reading

5. Recalibration:

a. If the technology provided requires recalibration, the contractor shall be responsible for recalibrating the system on a semi-annual basis during the construction phase through the end of the project warranty period.

6. Product Applications

a. Select from instrument types to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.
   i. The contractor will be required as part of the submittal process to provide a working demo that demonstrates that the unit will operate at the lowest air flows possible on the project. If the manufacture is unable to provide a working demo than their submittal will not be reviewed by the design team.
b. Duct-Mounted Airflow Sensors:
   i. Measured Velocities 500 fpm and Less:
      1) Thermal dispersion airflow station.
   ii. Measured Velocities Greater than 500 fpm:
      1) Thermal dispersion airflow station

B. Duct Mounted Thermal Dispersion Airflow Measuring Station:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ebtron: Gold Series. (Basis of Design)
b. Air Monitor Corporation: Electra-Flo

2. Source Limitations: Obtain airflow and temperature measuring sensors and transmitters from single manufacturer.

3. Description: Airflow station shall consist of one or more sensor probes and a remotely mounted microprocessor-based transmitter.

4. Performance:

a. Capable of independently processing up to 16 independently wired sensor assemblies.
b. Airflow rate of each sensor assembly shall be equally weighted and averaged by transmitter prior to output.
c. Temperature of each sensor assembly shall be velocity weighted and averaged by transmitter prior to output.
d. Listed and labeled by an NRTL as successfully tested as an assembly according to UL 873, "Temperature-Indicating and Regulating Equipment."
e. Components shall be interconnected by exposed NRTL-listed plenum-

rated cable or non-listed cable placed in conduit.

f. Each flow station shall be factory calibrated at a minimum of 16 airflow rates and three temperatures to standards that are traceable to NIST.

g. Airflow Accuracy: Within 2 percent of reading over the entire operating airflow range, with 0.25 percent repeatability.

i. Devices whose accuracy is combined accuracy of transmitter and sensor probes must demonstrate that total accuracy meets the performance requirements throughout the measurement range.

h. Temperature Accuracy: Within 0.15 deg F over entire operating range of minus 20 to plus 160 deg F.

i. Sensor Ambient Operating Temperature Range: Minus 20 to plus 160 deg F.

j. Transmitter Ambient Operating Temperature Range: Minus 20 to plus 120 deg F.

k. Sensor and Transmitter Ambient Operating Humidity Range: Zero to 99 percent, non-condensing.

l. Instrument shall compensate for changes in air temperature and density throughout calibrated velocity range for seasonal extremes at Project location.

m. Pressure Drop: 0.05-inch wg at 2000 fpm across a 24-by-24-inch area.

n. Instruments mounted in throat or face of fan inlet cone shall not negatively influence fan performance by reducing flow more than 1 percent of Project design flow or negatively impact fan-generated sound. Losses in performance shall be documented with submittal data, and adjustments to compensate for performance impact shall be made to fan in order to deliver Project design airflow indicated.

5. Sensor Assemblies:

a. Each sensor probe shall contain two individually wired, hermetically sealed bead-in-glass thermistors.

b. Mount thermistors in sensor using a marine-grade, waterproof epoxy.

c. Thermistor leads shall be protected and not exposed to the environment.

d. Each sensor assembly shall independently determine airflow rate and temperature at each measurement point.

e. Each sensor probe shall have an integral cable for connection to remotely mounted transmitter.

f. Sensor Probe Material: Gold anodized, extruded 6063 aluminum tube or Type 316 polished stainless steel.

g. Probe Assembly Mounting Brackets Material: Type 304 stainless steel.

6. Transmitter:

a. Integral digital display capable of simultaneously displaying total airflow and average temperature, individual airflow, and temperature readings of each independent sensor assembly.

b. Capable of field configuration and diagnostics using an onboard push-button interface and digital display.

i. Include an integral power switch to operate on 24-V ac (isolation not required) and include the following:

1) Integral protection from transients and power surges.

2) Circuitry to ensure reset after power disruption, transients, and brownouts.

3) Integral transformer to convert field power source to operating voltage required by instrument.

2.4. AIRFLOW TRANSMITTERS

A. Airflow Transmitter with 0.10 Percent Accuracy and Auto-Zero Feature:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ebtron
b. Air Monitor Corporation: Veltron Mass-tron II

2. Transmitter shall receive total- and static-pressure signals from a primary element, amplify signals, extract the square root, and scale the signals to produce 4- to 20-mA dc output signals linear to airflow.

3. Transmitter shall have built in capability for both process temperature and pressure compensation.

4. NEMA 250, Type 1 enclosure.

5. Construct assembly so that shock, vibration, and pressures surges of up to 1 psig will neither harm transmitter, nor affect its accuracy.

6. Transmitter shall include automatic zeroing circuit capable of automatically readjusting transmitter zero at predetermined time intervals. The automatic zeroing circuit shall re-zero transmitter to within 0.1 percent of true zero.

7. Performance:

a. Range: As required by application and at least 10 percent below minimum airflow and 10 percent greater than design airflow.
b. Calibrated Span: Field adjustable, minus 40 percent of the range.
c. Accuracy: Within 0.10 percent of natural span.
d. Repeatability: Within 0.15 percent of calibrated span.
e. Linearity: Within 0.2 percent of calibrated span.
f. Hysteresis and Deadband (Combined): Less than 0.2 percent of calibrated span.

8. Integral multi-line digital LED or digital display for continuous indication of airflow.

PART 3. EXECUTION

3.1. EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Provide the services of an independent inspection agency to confirm that proposed mounting locations comply with requirements indicated and approved submittals.

1. Indicate dimensioned locations with mounting height for all surface-mounted products to walls and ceilings on shop drawings.

2. Do not begin installation without submittal approval of mounting location.

E. Complete installation rough-in only after confirmation by independent inspection is complete and approval of location is documented for review by Owner and Engineer on request.

F. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to force.

D. Install ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

E. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.3. ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Refer to Division 26.

C. Furnish and install power wiring. Refer to Division 26.

D. Furnish and install raceways. Refer to Division 26.

3.4. INSTRUMENTS, GENERAL INSTALLATION REQUIREMENTS

A. Mounting Location:

1. Rough-in: Outline instrument-mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.

2. Install switches and transmitters for air and liquid flow associated with individual air-handling units and connected ductwork and piping near air-handlings units co-located in air-handling unit system control panel, to provide service personnel a single and convenient location for inspection and service.

3. Install airflow switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.

4. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Mounting Height:

1. Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.

2. Unless indicated otherwise, mount switches and transmitters, located in mechanical equipment rooms and other similar space not subject to code, state, and federal accessibility requirements, within a range of 42 to 72 inches (1050 to1800 mm) above the adjacent floor, grade, or service catwalk or platform.

   a. Make every effort to mount at 60 inches (1500 mm).

3. Where indicated for rooftop equipment, mount display within rooftop equipment.

C. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

3.5. FLOW INSTRUMENTS INSTALLATION

A. Airflow Sensors:

1. Install sensors in straight sections of duct with manufacturer-recommended straight duct upstream and downstream of sensor.

2. Installed sensors shall be accessible for visual inspection and service. Install access door(s) in duct or equipment located upstream of sensor, to allow service personnel to hand clean sensors.

B. Transmitters:

1. Install airflow transmitters serving an air system in a single location adjacent to or within system control panel.

3.6. IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Division 26.

B. Install engraved phenolic nameplate with instrument identification and on face of ceiling directly below instruments concealed above ceilings.

3.7. CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.8. CHECKOUT PROCEDURES

A. Description:

1. Check out installed products before continuity tests, leak tests, and calibration.

2. Check instruments for proper location and accessibility.

3. Check instruments for proper installation with respect to direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

4. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

B. Flow Instrument Checkout:

1. Verify that sensors are installed correctly with respect to flow direction.

2. Verify that sensor attachment is properly secured and sealed.

3. Verify that processing tubing attachment is secure and isolation valves have been provided.

4. Inspect instrument tag against approved submittal.

5. Verify that recommended upstream and downstream distances have been maintained.

3.9. ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:

1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.

4. Equipment and procedures used for calibration shall meet instrument manufacturer's recommendations.

5. Provide diagnostic and test equipment for calibration and adjustment.

6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

8. If after-calibration-indicated performance cannot be achieved, replace out-of-tolerance instruments.

9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.

2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.

3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

C. Digital Signals:

1. Check digital signals using a jumper wire.

2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.

2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.10. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

B. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.

C. Record videos on DVD disks.

D. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION

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HVAC AIR DISTRIBUTION
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SECTION 233000 - HVAC AIR DISTRIBUTION

PART 1. GENERAL

1.1. SUMMARY

A. For General Mechanical Requirements, see Division 23 Section, “Common Work Results for HVAC” and Division 01, “General Requirements”.

B. The fabrication and installation of all ductwork, together with related equipment, shall comply with the standards of the National Fire Protection Association, as set forth in NFPA Standard No. 90A, as well as with the requirements of the Sheet Metal and Air Conditioning Contractors' National Association, Inc., and the latest edition of the ASHRAE Guide.

C. All duct sizes shown are net inside clear dimensions. Where internal duct lining is used, increase duct sizes accordingly to provide the indicated net free area. Unless otherwise indicated size runouts, drops, and connections to air handling equipment, grilles, registers, diffusers, fans, coils, louvers, filters, and other equipment to the full size of the equipment connection.

D. Minor changes may be made in duct sizes where required to fit the available space, provided the indicated net free area and approximate aspect ratio are maintained. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE/SMACNA Table of equivalent rectangular and round ducts.

E. Smoothly transition all ductwork to prevent excessive or unnecessary turbulence or pressure loss.

F. All exposed ductwork in finished areas shall be painted in color as indicated by Engineer. All ductwork requiring paint shall be constructed of paint grade galvanized sheet steel with a paintable finish.

1.2. REFERENCES

A. ASTM A 36 - Structural Steel

B. ASTM A 90 - Weight of coating on Zinc-Coated (Galvanized) Iron or Steel Articles

C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

D. ASTM C 916 Type II – Standard Specification for Adhesives for Duct Thermal Insulation

E. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality

F. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

G. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the

Hot-Dip Process

H. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality

I. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled

J. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality

K. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

L. AWS D9.1 - Welding of Sheet Metal

M. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

N. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems

O. SMACNA - HVAC Air Duct Leakage Test Manual

P. UL 181 - Factory-Made Air Ducts and Connectors.

Q. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

R. NFPA 70 - National Electrical Code

S. SMACNA - HVAC Duct Construction Standards - Metal and Flexible

T. UL 33 - Heat Responsive Links for Fire-Protection Service.

U. UL 555 - Fire Dampers and Ceiling Dampers

1.3. QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the projects specified in this section with minimum five (5) years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum five (5) years' experience.

1.4. REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA- 90A and NFPA-90B Standards.

1.5. ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturer.

B. Maintain temperatures during and after installation of duct sealants.

1.6. ALTERNATES

A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

PART 2. PRODUCTS

2.1. DUCTWORK

A. Unless otherwise indicated or specified, fabricate ductwork of galvanized sheet steel, stainless steel, or aluminum conforming to Commercial Designation 3003 Temper H14 and Duct Sheet. Duct gages, jointing and reinforcement shall conform to Tables 4, 5, 6 and 7, as applicable, Chapter I of the latest ASHRAE Guide and Data Book. Construction details shall conform to Section I and Section II, as applicable, of Duct Manual and Sheet Metal Construction for Ventilation and Air Conditioning Systems as published by Sheet Metal and Air Conditioning Contractors' Association, Inc.

B. Erect sheet metal ductwork in a first-class, workmanlike manner secured in place rigidly and permanently. Provide suitable hangers, securely attached to building construction with bolts, clips or inserts. Hangers shall be structural shapes, unistrut, kindorf or channel; strap hangers or the use of wire will not be permitted. All thread hangers shall not pass through or be inside duct. Hangers shall not penetrate the duct insulation vapor barrier. Support vertical ducts passing through floors by angles riveted to duct and resting either on floor or on brackets secured to building construction. All space around ducts where they pass through any walls, floors, ceilings, or roofs shall be sealed tight with incombustible inert material. Do not arrange ducts so as to impair the effectiveness of fireproofing around structural members. Provide sheet metal flanged collars around exposed ducts passing through walls, floors, or ceilings to provide finished appearance. Seal all duct joints and seams including supply, return, outside air, combustion air, relief air, ventilation air and exhaust ductwork with Hardcast Sealing System as manufactured by Hardcast, Inc., Foster, Childers, or approved equal.

C. Flexible connections of neoprene, excelon, or other NFPA approved non-inflammable fabric shall be provided in the duct system at all fan inlet and outlet connections. Flexible duct connectors shall be Durodyne or approved equal.

D. Provide cut turning vanes in all duct turns where centerline radius is located. Turning vanes shall be air-foil type with extended trailing edges. Fabricate to comply with SMACNA Sheet Metal Construction for Ventilation and Air Conditioning Systems Manual.

E. Provide duct collars and angle iron framework for mounting of automatic dampers.

F. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

G. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

I. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4-inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

J. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

K. Fasteners: Rivets, bolts, or sheet metal screws.

L. Hanger Rods: ASTM A36 - Galvanized steel; threaded both ends, threaded one end, or continuously threaded.

2.2. DUCT SYSTEMS

A. All supply, return, exhaust, fresh air intake, relief, ventilation, outside air and combustion air ductwork shall be constructed for low pressure service (2 inch W.G.). All exposed round ductwork in finished areas shall be paintable grade, dual wall, constructed for medium pressure service (6 inch W.G.).

2.3. DUCT CONSTRUCTION

A. Rectangular and/or Round Ductwork (Low Pressure):

1. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G-90 Zinc coating in conformance with ASTM A90.

2. Make allowance for internal duct lining where required. Sizes shown on the drawings are inside clear dimensions.

3. Determine duct gauges for the longest duct side and use for all four sides. Joints and reinforcing requirements apply to the longest duct side.

4. Reinforce all ducts to prevent buckling, vibration, or noise as recommended in the referenced construction standards, and as required to suit the installed conditions.

5. Do not cross break duct which will receive rigid insulation covering.

6. Where tap sizes of divided-flow fittings are not indicated, make branch and main/connection sizes proportional to their respective air flows and maintain uniform transverse velocities in the fitting.

7. Make radius elbows and radius tee connection with throat radius equal to or greater than the width of the duct. Use vaned elbows where shown and where radius elbows will not fit the space, and in all square bends.

8. Turning vanes shall be the air-foil type with extended trailing edges, 36-inch

maximum vane length. Where longer vanes are required, use two or more sets of vanes with intermediate runners securely fastened together.

9. Bolt, screw, rivet, or spot weld reinforcing members securely to the duct on not less than 6-inch centers.

10. Where ducts are open-ended without grilles, registers, or other means of stiffening, reinforce and stiffen the open end with standing seams or an angle frame. Provide rolled edges to prevent any exposed sharp edges.

11. Paint all cut ends on galvanized angles, rods, and other uncoated surfaces with aluminum paint.

12. Where ductwork is not painted or otherwise finished, remove all exposed traces of joint sealers, manufacturer's identification and other markings.

13. Aluminum sheet shall be 3003 H14 alloy or duct sheet, 16,000 psi minimum tensile strength, and capable of being formed to a Pittsburgh lock seam.

14. Reinforcing members for aluminum ductwork shall be galvanized steel or aluminum unless otherwise indicated. Where aluminum reinforcing is used, size the member in accordance with ASHRAE recommendations to have rigidity equivalent to listed mild steel angle sizes.

15. Where aluminum ductwork is used, make allowance for increased thermal expansion. Particularly avoid direct contact between aluminum and concrete or masonry walls subject to dampness.

16. Determine duct gauges per SMACNA based on duct size and pressure indicated.

17. All exterior ductwork shall be single wall type with exterior field applied jacketing insulation. Inner wall shall be galvanized steel metal; outer wall shall be aluminum exterior duct insulation system as specified in Division 23 Section, “HVAC Insulation”.

B. Round Ductwork (Dual Wall - Medium Pressure)

1. Medium pressure flat oval and round ductwork shall be spiral lock-seam Type K-27 with Type P liner as manufactured by United Sheet Metal Company, Inc., Semco Manufacturing, Inc., Lindab, Ductmate, MKT Metal Manufacturing, or approved equal, Uniseal duct and Uniform fittings. Construct ductwork of galvanized sheet steel. Elbows 8 inches in diameter and smaller shall be smooth formed. Larger elbows shall be five section type. Tees and crosses and laterals shall be conical. Make joints with sleeve type couplings, short length sheet metal screws and duct sealant. Seal joints with Hardcast, Foster, Childers, or approved equal, as hereinbefore specified. Conform to duct manufacturer's recommendations for jointing and installation. Ductwork and fittings shall be manufactured by a company regularly engaged in the construction of spiral ductwork and fittings. Contractor-fabricated ductwork will not be acceptable for ductwork and fittings. Manufacturers substituted for the above specified manufacturers shall submit for approval independently published laboratory test

data on all proposed ductwork and fittings showing materials of construction, air flow, pressure drop and acoustical performance characteristics.

2. Round dual wall ductwork shall be installed to the extent shown on the drawings. All duct lining shall be provided with a perforated galvanized liner on the surface exposed to the air stream. All exposed ductwork in finished areas and where indicated on contract drawings shall be painted in color as selected by Owner. All ductwork requiring paint shall be constructed of paint grade sheet steel with paintable finish.

3. Round dual wall ductwork shall contain a 2 inch thick fiberglass insulation sandwiched between inner and outer ducts.

2.4. AIR VOLUME CONTROLS

A. Furnish and install air volume control devices where indicated and where required to adjust and balance air flow in the systems, whether indicated or not. Volume dampers shall be provided in all branch ducts serving air outlets and inlets. For existing air devices install a new volume damper and where required for access, a new access door to allow access and adjustment.

B. Manual volume dampers in ductwork shall be factory-assembled units with rigid frame, opposed-blade action, and locking quadrant operator. Mark the extended damper shaft and align the operating handle to indicate the blade position. Dampers shall be as manufactured by Ruskin, American Warming and Ventilating, Inc., Arrow, Vent Products Company, or approved equal. Rectangular dampers shall be Type MD35, with steel channel frame, 16 gauge steel blades, 9 inch maximum blade spacing, low pressure, nylon bearings, galvanized finish with aluminum paint touch up. Round manual balancing dampers shall be Type MDRS25 manufactured by Ruskin, Arrow, American Warming and Ventilating, Inc., or as approved equal. When external insulation is to be applied, provide sheet metal standoffs on all manual volume dampers. Provide blade stops to minimize air gaps around damper blades when closed.

C. Motor-operated dampers shall be as hereinafter specified under Division 23 Section, “Instrumentation and Controls of HVAC & Plumbing System”.

D. Duct turning vanes shall be Tuttle & Bailey Ducturns, or approved equal.

E. Furnish and install duct collars and angle iron frames for the installation of ATC dampers.

F. Where volume dampers are installed in exposed finished spaces locate damper handle on top of duct.

G. Where volume dampers are installed above ceilings attach a colored piece of tape so that Test and Balance Engineer can easily locate for air flow adjustment.

H. Where existing air devices do not contain manual volume dampers in the run-out ductwork, install manual volume damper at each existing air device duct runout.

2.5. INSTRUMENT TEST PORTS

A. Furnish and install instrument test ports in the ductwork to allow use of pitot tube length. Equip holes with Ventlok #699 instrument ports. Fittings shall extend beyond duct covering and insulation.

2.6. DUCT THERMOMETERS

A. Duct thermometers shall be Dresser Industries, Trerice, Weiss, Weksler, Miljoco, or approved equal direct-mounting filled system dial thermometers. Duct thermometers shall be vapor-actuated, universal-angle dial type, cast aluminum case with 4 ½ inch diameter, glass lens. Duct thermometers shall include adjustable joint with finish to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal place, with locking device. Thermal bulbs shall be copper with phosphor-bronze bourden pressure tube. Movement shall be brass, precision geared. Duct thermometer scales shall be Progressive, satin-faced non-reflective aluminum with permanently etched markings. Each stem shall be copper-plated aluminum or brass for separable socket of length to suit installation.

B. Where ductwork is installed at a height that would require duct thermometers to be installed 10 feet above finished floor or greater then remote-ready filled - system dial thermometers shall be installed. Connecting tubing shall be bronze, double-braided, armor-over-copper capillary; of length to suite installation.

C. Duct thermometers shall be furnished and installed at single zone VAV units as follows:

LOCATION	RANGE
Outdoor Air Duct	-40 degrees Fahrenheit to 120 degrees Fahrenheit
Return Air Duct	40 degrees Fahrenheit to 180 degrees Fahrenheit
Mixed Air Plenum	30 degrees Fahrenheit to 180 degrees Fahrenheit
Supply Air Duct	30 degrees Fahrenheit to 180 degrees Fahrenheit
Exhaust Air Duct	30 degrees Fahrenheit to 180 degrees Fahrenheit

D. Description: Flanged fitting bracket for mounting in hole of duct, with threaded end for attaching thermometer.

1. Extension Neck Length: Nominal thickness of 2 inches, but not less than thickness of exterior insulation.

2. Insertion Neck Length: Nominal thickness of 2 inches, but not less than thickness of insulation lining.

2.7. DUCT ACCESS DOORS

A. Furnish and install adequately sized duct access doors at fire dampers, smoke dampers,

air measuring devices, motor-operated dampers, duct smoke detectors, duct coils and other locations where indicated and required for duct access. Doors shall be the continuous piano-hinged type with approved latches and neoprene compression-type gaskets with 1 inch thick fiberglass double skin and shall be Ruskin Model ADH22, Air Balance, Inc., FSA-100 or as approved equal. Stiffen ductwork at door openings. Where doors are installed in insulated ductwork, provide equivalent insulation in the door assembly. Where access doors are installed in the fire-rated partitions, provide Fire Seal access doors as manufactured by Air Balance, Inc., or approved equal, UL approved, meeting the rating of the enclosure in which the access door is installed.

B. Where duct access doors are installed in medium pressure ductwork, they shall be as manufactured by Ruskin, Type ADHP-3, or approved equal, with six latches continuous gasket and insulated core.

2.8. DUCT LINING (LOW PRESSURE DUCTWORK)

A. All low pressure supply and return ductwork within 10 feet of single zone VAV units, and as additionally shown on Contract Drawings, shall be lined on the interior for sound attenuation and thermal insulation.

B. All low pressure ductwork within 10 feet of return [or exhaust] air fans and as additionally shown on Contract Drawings shall be lined on the interior for sound attenuation and thermal insulation. (Does not apply to Kitchen Hood Exhaust Fans)]

C. All internal duct lining for low pressure duct systems shall be provided with an interior galvanized perforated liner.

D. Provide additional exterior insulation where required and as indicated in Division 23 Section, “HVAC Insulation”.

E. The lining insulation shall be 1 inch thick, 3.0 pcf density, Aeroflex plus Duct Liner Type 300, Owens Corning Quiet R Rotary Duct Liner, Manville, Knauf, or approved equal. The material shall be specifically designed for this application, shall have a black, fire-resistant coating, shall meet NFPA Standards 90A and 90B and shall have a UL Fire Hazard Classification of Flame Spread 25 or less and smoke developed of 10 or less. The black-coated surface shall face the air stream.

F. All exposed edges and the leading edge of all cross joints of the liner shall be coated with the same adhesive used to secure the duct liner to metal surface. All air stream surfaces shall be treated with EPA registered fungicide Foster 40-20. Coating shall meet ASTM D 5590 with 0 growth rating.

G. The duct liner shall be adhered to the metal with 100 percent coverage of adhesive. Adhesive shall conform to Adhesive and Sealant Council Standards for adhesives for duct liner; ASTM C916, Type II (ASC-A-7001-A-1971). Adhesive shall be Foster 85-60, Childers CP-127 or approved equal.

H. The duct liner shall be additionally secured with mechanical fasteners, which shall compress the duct liner sufficiently to hold it firmly in place. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association.

I. All duct lining shall be installed in complete accordance with the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Duct Liner Application Standard, First Edition and Green Guard Indoor Air Quality certification program requirements.

J. Dimensions on drawings indicate inside clear opening of rectangular ductwork. Increase duct dimensions 2 inches each way for accommodating insulation on all shop or field-fabricated rectangular ductwork where lining is specified.

2.9. DUCT LINING (MEDIUM PRESSURE DUCTWORK)

A. All medium pressure supply and return ductwork within 10 feet of single zone VAV units and as additional shown on contract drawings shall be lined on the interior for sound attenuation and thermal insulation.

B. All medium pressure ductwork within 10 feet of return or exhaust air fans and as shown on Contract Drawings shall be lined on the interior for sound attenuation and thermal insulation.

C. Provide additional exterior insulation where required and as indicated in Division 23 Section, “HVAC Insulation”.

D. All internal duct lining for medium pressure duct systems shall be provided with interior galvanized perforated liner.

E. The insulation shall be 1 inch thick, 3.0 pcf density, Aeroflex plus Duct Liner Type 300, Owens Corning Quiet R Rotary Duct Lines, Manville, Knauf, or approved equal. The material shall be specifically designed for this application, shall have a black, fire-resistant coating, shall meet NFPA Standards 90A and 90B and shall have a UL Fire Hazard Classification of Flame Spread 25 or less and smoke developed of 10 or less. The black-coated surface shall face the air stream.

F. All exposed edges and the leading edge of all cross joints of the liner shall be coated with the same adhesive used to secure the duct liner to metal surface. All air stream surfaces shall be treated with EPA registered fungicide Foster 40-20. Coating shall meet ASTM D5590 with 0 growth rating.

G. The duct liner shall be adhered to the metal with 100 percent coverage of adhesive. Adhesive shall conform to Adhesive and Sealant Council Standards for adhesives for duct liner; ASTM C 916 (ASC-A-7001-A-1971). Adhesive shall be Foster 85-60, Childers CP-127 or approved equal.

H. The duct liner shall be additionally secured with mechanical fasteners which shall compress the duct lines sufficiently to hold it firmly in place. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association.

I. All duct lining shall be installed in complete accordance with the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Duct Liner Application Standard, First Edition and Green Guard Indoor Air Quality certification program requirements.

J. Dimensions on drawings indicate inside clear opening of rectangular ductwork. Increase duct dimensions 2 inches each way for accommodating insulation on all shop or field-fabricated rectangular ductwork where lining is specified.

2.10. AIR DEVICE REQUIREMENTS

A. Furnish and install air supply, return, exhaust devices of sizes and capacities as scheduled on the drawings. Catalog numbers shown are Titus, Inc., products for equipment which have been found suitable for the application. Other manufacturers listed below or approved equal will be considered only if performance characteristics including throw, drop, pressure loss, sound pressure level, etc., are equal to or better than the performance characteristics of the specified products. All air devices shall be ADC certified. Ductwork behind registers, grilles, open ended ducts, and diffusers shall be given two coats of flat black paint. Perimeter of all ceiling diffusers shall be caulked to provide a neat, aesthetic appearance.

B. Where air terminal devices are installed in duct collars or branches, furnish and install air extractors. Furnish and install control grids, volume dampers, and/or other accessories necessary to ensure uniform air flow across the terminal devices. Accessories shall be of the same material as the terminal device. Install fixed blade terminals so that blades block the normal line of vision. Furnish three (3) of each type of removable key operators.

A. Contractor shall determine frame and mounting type as per type of ceiling as shown on Architectural drawings.

C. Air devices and accessories that are installed in a finished, non-white ceiling shall be of a color as selected by the Owner.

D. Noise Criteria: All air devices shall be sized and selected to limit maximum NC (Noise Criteria) levels to 30.

2.11. RETURN/EXHAUST/TRANSFER GRILLES

A. RG1 Intake Grille, Square/Rectangular

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Titus Model 350FS
    b. Metal-Aire
    c. Price
    d. Tuttle & Bailey
    e. Anemostat
    f. Carnes
    g. Nailor
    h. Krueger

2. Construction:

a.	Material:	Heavy Duty, 16 gauge Steel frame/border and 14 gauge blades.
b.	Finish:	White Baked Enamel
c.	Ceiling Type:	Sidewall
d.	Blades:	Fixed, 35° Angle, 3/4” Spacing

3. Accessories:

a.	Face:	Grille

4. The register shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

B. RG2 Return Grille, Square/Rectangular with Filter, Steel

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Titus Model 350RSF
b. Metal-Aire
a. Price
b. Tuttle & Bailey
c. Anemostat
d. Carnes
e. Nailor
f. Krueger

2. Construction:

a.	Material:	Steel, 16 gauge
b.	Finish:	White Baked Enamel
c.	Ceiling Type:	Sidewall
d.	Blades:	Fixed, 35° Angle, 3/4” Spacing

3. Accessories:

a.	Face:	Grille
b.	Damper:	Integral, Opposed Blade type
c.	Core:	Hinged

4. Provide return air filter racks and 1” thick filters.

5. The register shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

6. Furnish spare filters with each air device.

E. Noise Criteria: All air devices shall be sized and selected to limit maximum NC (noise criteria) levels to 30.

2.12. LOUVERS (FIXED BLADE)

A. Furnish and install wall louvers of the size and capacity shown on the contract drawings. Louvers shall be Greenheck Model EHV-901 (high velocity wind driven rain) heavy gauge extruded aluminum stationary type louvers, Vent Projects Company, or approved equal. Louvers shall be stationary, dual module type consisting of a "front" louver with J-style blades and a "rear" louver with vertical rain resistant style blades. Louver frame shall be a total depth of 9 inches.

B. Front louvers shall be drainable type fabricated from heavy gauge 6063-T5 aluminum extrusions of .081 inch nominal wall thickness. Blades shall be positioned at 37 degree and 45 degree angles, approximately 4.25 inches on centers. Rear louver shall b vertical rain resistant style, heavy gauge extruded 6063-T5 aluminum, 0.060 nominal thickness, positioned on approximately 1.5 inch blade spacing. Each louver shall be equipped with a frame and removable rear-mounted screen of flattened aluminum. Each factory assembled louver section shall be designed to withstand wind loadings of 25 psf. Louvers too large for complete factory assembly shall be built up by the installing contractor from factory assembled louver sections.

C. Louvers shall be tested in accordance with AMCA 550-L, AMCA-540, and AMCA 550 (Certified High Velocity, Rain Resistant, and Impact Resistant Louver).

D. Louvers shall be supplied with a factory Kynar finish applied after a thorough cleaning and preparation of the metal surface. A total dry film thickness of approximately 1.2 mils shall be provided. Custom color shall be as selected by Owner.

E. Louvers shall be provided with ¼ inch x ¼ inch aluminum bird screens, factory-furnished and installed. Louver performance data shall be A.M.C.A. certified. All louvers shall be caulked weathertight around entire perimeter.

2.13. LOUVERS (COMBINATION DAMPER/LOUVER)

A. Furnish and install wall louvers at the size and capacity shown on the contract drawings. Louvers shall be model EAC-601 as manufactured by Greenheck.

B. Louver frame shall be 6 inch deep channel style with 0.125 inch extruded aluminum wall thickness. Stationary front blades shall be drainable style located on approximately 6.5 inch centers and 45 degree angles with 0.081 inch extruded aluminum wall thickness.

C. Operable rear blades shall be center pivot style with 0.081 inch extruded aluminum wall thickness. Jamb seals shall be compressible style stainless steel. Blade seals shall be dual-durometer extruded vinyl style. Blade linkage shall be out of airstream and concealed within frame. Blade axles shall be 0.5 inch diagonal zinc plated steel. Axle bearings shall be synthetic sleeve type.

D. Finish shall be a factory 70% Kynar finish applied after a thorough cleaning and preparation of the metal surfaces. Custom color shall be as selected by Owner.

E. Louver performance shall be certified in accordance with the AMCA 511 Certified Ratings Program when tested in accordance with AMCA 500-L Air Performance and Water Penetration. Beginning point of water penetration shall not be less than 1020 feet

per minute free area intake velocity.

F. Louvers shall be designed and manufactured to withstand a minimum 25 pound per square foot wind load.

2.14. OPEN END DUCTS (OED)

A. Whether indicated on plans or not, all open-ended ducts shall be provided with a protective screen.

B. All open-ended ducts shall be furnished with a 12 gauge ½ inch x ½ inch aluminum mesh screen. Screens shall be permanently installed in a removable frame, and the frame shall be attached to the open-ended duct in a neat, workmanship-like manner without any exposed edges or sharp surfaces.

C. Screen shall be attached to a ¾ inch x 1/8 inch continuous galvanized perimeter frame. Install duct stiffeners greater than 16 inches in any direction at open-ended ducts.

D. Behind all open end ducts, paint ductwork and dampers with two (2) coats of flat black paint.

2.15. DUCT SEALANTS AND ADHESIVES

A. All ductwork shall be sealed, including low pressure exhaust systems. Transverse joints and longitudinal seams in duct systems shall be sealed with a duct sealant of the type specified hereinafter in Section 1, 2, or 3, or with a tape sealing system as specified in Section 4. Spiral lockseams are not longitudinal seams and do not require duct sealant. All seams and joints shall require duct sealant suitable for the pressure rating and installation application. All sealants shall exceed 500 hours without becoming brittle under ASTM-D572 test conditions (oxygen bomb), unless specified otherwise. No surface preparation or solvent cleaning shall be necessary to remove light coatings of oil and dust before applying sealant unless specified otherwise. Flanged joints shall be sealed according to Section 5. Construction joints that are not fully welded shall be sealed according to Section 6. Adhesive to secure insulation to metal surfaces shall be that specified in Section 7.

1. Assembly joints to be installed indoors or outdoors shall be sealed with Foster 32-19, Childers CP-146, United Duct Sealer WB, or equivalent, which is a water-based sealant formulated to withstand service temperatures from 20 degrees F to +200 degrees F. Sealant shall have a UL Classification marking with a flame spread of 15 and smoke developed of 0 when applied to inorganic reinforced cement board, both at a coverage of 31 square feet per gallon. Store and apply between 40°F (4°C) and 100°F (38°C); protect from freezing.

2. Assembly joints to be installed indoors shall be sealed with Foster 32-19, childers CP-146, UNI-GRIP™ duct sealer or equivalent, which is a water-based (vinyl-acrylic polymer) sealant formulated to withstand temperatures from –20 degrees to +200 degrees Fahrenheit. Surfaces to be sealed should be clean, dry, and free from oil, grease, and dirt. Sealant shall be nonflammable (wet) and fire retardant. Sealant shall have a UL Classification marking with a flame spread of 5 and smoke developed of 5 when applied to 18-gauge galvanized steel and a flame

spread of 0 and smoke developed of 0 when applied to inorganic reinforced cement board, both at a coverage of 40 square feet per gallon.

3. Assembly joints shall be sealed with UNI-CAST® tape sealing system or equivalent, which is a combination of an adhesive activator and woven-fiber tape impregnated with a gypsum mineral compound. Modified acrylic/silicone activator (MTA-20 for indoor use) reacts exothermically with the tape to form a hard, airtight seal. Sealant shall be formulated to withstand temperatures from –40 degrees F to +200 degrees Fahrenheit. Combination of tape and MTA-20 adhesive shall have a flame spread and smoke developed of 0. Do not use for outdoors.

4. Flanged joints to be installed indoors shall be sealed with UNI-GASKET™ flange sealer or equivalent, which has a synthetic elastomer base and is formulated to withstand temperatures from –20 degrees F to +150 degrees F. Sealant shall have a UL Classification marking with a flame spread of 5 and smoke developed of 5 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 5 when applied to inorganic reinforced cement board, both at a coverage of 80 square feet per gallon.

5. Where duct fittings are constructed with standing seam or spot-welded techniques, all construction joints shall be sealed with UNI-WELD™ metal cement or equivalent, which is composed of neoprene rubber, resins, and inert reinforcing material dispersed in a petroleum distillate. Sealant shall be formulated to withstand temperatures from –20 degrees F to +225 degrees F. Sealant shall have a UL Classification marking with a flame spread of 0 and smoke developed of 0 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 0 when applied to inorganic reinforced cement board, tested as applied in two 1/8 inch beads 8 inches on center.

6. Where insulation is to be secured to metal surfaces, the adhesive used shall be Foster 85-60, Childers CP-127, UNI-TACK™ duct liner adhesive or equivalent, which are water-based, vinyl-acrylic copolymer adhesives formulated to withstand temperatures from –20 degrees Fahrenheit to +200 degrees Fahrenheit. Adhesive shall have a UL Classification marking with a flame spread of 0 and smoke developed of 0 when applied to 18-gauge galvanized steel and a flame spread of 0 and smoke developed of 0 when applied to inorganic reinforced cement board, both at a coverage of 267 square feet per gallon. Adhesive shall conform to ASTM C916, Type II.

B. Manufacturers: Duct Mate, United McGill, MKT Metal Manufacturers, Semco, Elgen, Childers, Foster, or as approved equal.

2.16. FILTER MEDIA DURING CONSTRUCTION

A. Filter media installed during construction: Minimum MERV 8.

PART 3. EXECUTION

3.1. DUCT INSTALLATION REQUIREMENTS

A. Coordinate ductwork with other work and install ducts at proper elevations and locations to maintain indicated ceiling heights and clearances. Provide all elbows, transitions, offsets, connections, and other fittings necessary to fit the work into place or to connect to equipment or diffusers. Method of duct support connection to structure and slabs shall be approved and Shop Drawings shall be submitted.

B. Substantially support ductwork with structural shapes, flat bars, or formed strap hangers securely attached to the building structure by means of bolts, clamps, or inserts. Support vertical ducts by angles attached to the duct and resting on the floor or supported by brackets or hangers attached to the building structure. Strap hangers shall be 16-gauge minimum galvanized steel formed under the bottom edge of duct. Use square ¼ inch thick washers tight against the bend on upper strap attachments to horizontal surfaces. Place all supports external to the ductwork and out of the air stream. Provide additional supports at coils and other concentrated loads. Arrange supports so that duct weight is not transmitted to ceilings, fans or other equipment.

C. Prevent direct contact between ductwork and building surfaces or other equipment. Where ducts pass through walls, partitions, floors, ceilings, or roofs, pack and seal the space around the duct with an approved fire-safe inert material. Provide flanged duct escutcheons at all exposed ducts that pass through walls, partitions, floors, and ceilings.

D. Use galvanized (compatible) corrosion-resistant hangers, supports, brackets, and hardware.

E. Furnish and install NFPA-approved duct connections where shown and at all connections to fans, air handling units, and similar rotating equipment. Use glass-reinforced neoprene fabric, roll-formed to sheet metal strips or flanges. Support adjacent ductwork to provide sufficient slack in the connection.

F. See NFPA 90A, and latest publication of SMACNA. Prevent direct contact between ductwork and building surfaces or other equipment. The opening in the construction around the duct shall not exceed one-inch average clearance on all sides. Where ducts pass through walls, partitions, floors, ceilings, or roofs, pack and seal the space around the duct with an approved fire-safe inert material capable of preventing the passage of flame and hot gases sufficiently to ignite cotton waste when subjected to the same NFPA 251 Time-Temperature Conditions required for fire barrier penetration. All exposed duct penetrations shall be finished with a sheet metal field erected flange escutcheon to form a neat appearance.

G. Coordinate duct installation with the requirements of Division 23 Section, “Vibration Controls for HVAC, Plumbing & Fire Protection Equipment”.

H. Install in accordance with manufacturer’s instructions.

I. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

J. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

K. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

L. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

M. Use crimp joints, with or without bead, for joining round duct sizes eight (8) inches and smaller with crimp in direction of air flow.

N. Use double nuts and lock washers on threaded rod supports.

O. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork systems. Also provide temporary closures of metal or taped polyethylene at all air handling equipment openings to prevent dust from entering equipment openings.

P. Paint behind all air devices, louvers, and open end ducts with 2 coats of flat black paint.

3.2. ACCESSORY INSTALLATION REQUIREMENTS

A. Install accessories in accordance with manufacturer's instruction, NFPA 90A, and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Also provide temporary closures of metal or taped polyethylene at all air handling equipment openings to prevent dust from entering equipment openings.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, duct detectors, air flow monitoring stations, duct-mounted equipment, and elsewhere as indicated. Provide minimum 10 x 10 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

C. Provide duct test holes where required for testing and balancing purposes. Review locations with Test and Balance Engineer prior to installation.

D. For all motor operated dampers, mark the shaft so operators know the position of the damper.

E. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment and supported by vibration isolators. Refer to Division 23 Section, "Vibration Control for HVAC and Plumbing Systems".

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum duct widths from duct take-off.

G. Use splitter dampers only where indicated.

H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless

of whether dampers are specified as part of the diffuser, grille, or register assembly.

I. Install diffusers, registers, and grilles to ductwork with airtight construction.

J. Check location of all air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangements.

K. Install duct thermometer support flanges in wall of duct. Attach to duct with screws. Locate duct mounted thermometers, minimum 10 feet downstream of mixing dampers, coils or other devices causing air turbulence.

L. Install remote - reading duct dial thermometers in control panels with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length. Mount control panel 60 inches above finished floor and label each dial thermometer.

M. Install duct accessories according to applicable details shown in SMACNA's HVAC Duct Construction Standards Metal and Flexible for metal ducts.

N. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

O. Provide test holes at fan inlet and outlet and elsewhere as indicated.

P. Install fire, smoke, and combination fire and smoke dampers according to manufacturer's UL approved written instructions.

1. Install fusible links in fire dampers. Label access doors according to equipment served.

Q. Adjust duct accessories for proper settings.

R. Adjust fire and smoke dampers for proper action.

3.3. DUCT LINING INSTALLATION REQUIREMENTS

A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black pigmented or mat faced surface of the duct liner shall face the airstream.

B. Duct liner shall be adhered to the sheet metal. with 90 percent coverage of adhesive complying with requirements of ASTM C916. All exposed leading edges and transverse joints shall be factory coated or coated with adhesive during fabrication. Install perforated galvanized inner liner where indicated

C. Duct liner shall be additionally secured with mechanical fasteners, either weld-secured or impact-driven, which shall compress the duct liner sufficiently to hold it firmly in place. Adhesive bonded pins are not permitted due to long term adhesive aging characteristics. Spacing of mechanical fasteners with respect to duct liner interior width shall be in accordance with SMACNA HVAC DGS. Maximum spacing for mechanical fasteners shall be as follows:

Velocity = 0 to 2,500 feet per minute (0 to 12.8m/s):	
From transverse end of liner	3: (75mm)
Across width of duct	12 inches (300 mm) O.C.
From corners of duct	4 inches (100mm)
Along length of duct	18 inches (450mm) O.C.

Velocity = 2,501 to 5,000 feet per minute (12.8 to 25.4 m/s):	
From transverse end of liner	3 inches (75m)
Across width of duct	6 inches (150mm) O.C.
From corners of duct	4 inches (100mm)
Along length of duct	16 inches (400mm) O.C.

D. When air velocities exceed 4,000 fpm (20.3m/s), galvanized sheet metal nosing shall be applied to all leading edges of duct liner.

E. Acoustical Duct Liner shall be cut to assure overlapping and compressed longitudinal corner joints.

F. Upon completion of installation of duct liner and before operation is to commence, visually inspect the system and verify that the duct liner insulation has been correctly installed.

G. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.

H. Check the duct system to ensure that there are no air leaks through joints.

3.4. CLEANING

A. Clean duct system and force air at high velocity through ducts to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

C. Ductwork shall be cleaned in accordance with “Duct Cleanliness for New Construction (SMACNA 2000)”, and shall achieve a “Basic” cleanliness level.

3.5. LEAKAGE TESTS

A. All low pressure sheet metal ductwork shall undergo leakage tests at 2 inch W.G. Tests shall be accomplished under this section and witnessed as specified under Division 23 Section, “Testing, Adjusting, and Balancing for HVAC and Plumbing”.

B. All medium pressure sheet metal ductwork shall undergo leakage tests at 5 inch W.G. Tests shall be accomplished under this section and witnessed as specified under Division 23 Section, “Testing, Adjusting, and Balancing for HVAC and Plumbing”.

C. Leakage from each duct system shall not exceed 5 percent for low pressure systems and 1 percent for medium pressure systems of the normal air handling capacity of the system. If the system ductwork is tested in sections, the leakage shall not exceed ½ of 1 percent of the CFM to be handled by that section, and the total leakage of the system shall not exceed 1 percent of the total system CFM. Test pressure shall not exceed the pressure limits of the duct construction as defined in SMACNA High Pressure Duct Construction Standards. Repair all leaks which are audible, regardless of the leakage rate of the duct system as a whole, by remaking the entire defective joint or seam. Spot sealing of ducts in place will not be acceptable.

D. All duct accessories, including but not limited to volume dampers, ATC sensors, motor operated dampers, duct access doors, duct detectors, and duct coils shall be installed prior to duct leakage testing.

E. Submit a complete report of the ductwork leakage tests to the Engineer and include final approved copies in test and balance reports.

3.6. DUCTWORK IDENTIFICATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. All ductwork shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color Code and System Identification shall comply with ANSI Standards.

C. Marking shall be plain block letters, stenciled on ductwork (above and below ceilings) and shall be located near each branch connection and at least every ten feet on straight runs of ductwork. Where ductwork is aligned adjacent to each other, markings shall be neatly lined up. All markings shall be located in such a manner as to be easily legible from the floor.

D. Identify ductwork with plastic nameplates or stenciled painting. Identify with air handling unit/fan identification and area served.

E. Length of fan color field for ductwork shall be 32 inches. Lettering shall be minimum 3-1/2 inches high.

END OF SECTION

DIVISION 23 SECTION 233005
NON-METALLIC DUCTWORK
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SECTION 233005 – NON-METALLIC DUCTWORK

PART 1. GENERAL

1.1. DESCRIPTION OF WORK

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

B. Types of non-metal ductwork required for this project include the following:

C. Textile Air Dispersion Products

1.2. QUALITY ASSURANCE

A. Building Codes and Standards:

1. Product shall be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread/smoke developed requirements of NFPA 90-A and also classified in accordance with ICC Evaluation Service AC167 and UL 2518.

2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.

B. Design & Quality Control

1. Manufacturer shall have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

1.3. SUBMITTALS

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.

B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A, ICC AC167, and UL 2518.

C. Provide detailed drawings confirming configuration of Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).

D. Provide detailed installation instructions for components to be installed.

E. Provide warranty and maintenance documentation.

1.4. WARRANTY

A. Manufacturer shall provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5. DELIVERY, STORAGE AND HANDLING

A. Protect textile air dispersion system and suspension components from damage during shipping, storage, and handling.

B. Store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2. PRODUCTS

2.1. MANUFACTURER

A. Subject to compliance with requirements, choose one of the following:

B. DuctSox® Corporation
Phone: (866) DUCTSOX or (563) 588-5300
FAX: (866) 398-1646 or (563) 588-5330
www.DuctSox.com

2.2. TEXTILE AIR DISPERSION SYSTEM

A. 1 Row Suspension: Air diffusers shall be constructed with one row suspension system.

1. Tension Cable

a. One Row Cable

i. Systems shall be installed 1-1/2” above top-dead-center. Textile system attachment to cable shall be made using Gliders spaced every 24 inches. Available for systems less than 32” diameter. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.

1) Cable suspension

- Stainless steel.

2) Support lengths available in 10’.

2. U-Track

a. One Row U-Track

i. Systems shall be installed 1-1/2” above top-dead-center. Textile system attachment to cable shall be made using Gliders spaced every 24 inches. Available for systems less than 32” diameter. U-Track suspension hardware to include 8’ sections of aluminum track, aluminum splice connectors, track endcaps and vertical cable support kits – consisting of a length of cable with cable connectors. Radius aluminum track must be included for all horizontal/flat radius sections.

1) U-Track suspension options

- Stainless steel.

2) Support lengths available in 10’.

B. Hoops (IHS) System: Air diffusers shall be constructed with internal retention system.

1. System shall consist of an internal 360 degree hoop system, spaced 5’ on center.
2. System shall be installed with a one row suspension system located 1.5” above top-dead-center of the textile system.
3. System attachment to cable or U-Track shall be made using Gliders spaced 12 inches.
4. Available for diameters from 8” – 48”.
5. One row suspension options(must specify if multiple on same project)

    a. Cable suspension hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.

        i. Cable suspension options

            - Impregnated steel cable(required for natatorium applications)

        ii. Support length shall be 5’(standard).

C. Textile

1. Sedona – XM

    a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.
    b. Air Permeability: 2 (+2/-1) CFM/ft2 per ASTM D737, Frazier
    c. Weight: 6.8 oz. /yd2 per ASTM D3776
    d. Warranty: 10 years

2. Textile Color

    a. Custom color and Multiple Silkscreened Logo as selected by Owner.
    b. Assume six logos in bid.

D. Textile System Fabrication Requirements

1. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps, and mid-sections) and top access zippers for vertical cable safety attachment

2. Integrated air dispersion shall be specified and approved by manufacturer. (select only those that apply)

    a. Linear Vents
        i. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5” SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
        ii. Size of vent openings and location of linear vents to be specified

and approved by manufacturer.

3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.

4. Inlet connection includes zipper for easy removal / maintenance.

5. Lengths to include required intermediate zippers as specified by manufacturer

6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.

7. End cap includes zipper for easy maintenance.

8. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

E. Design Parameters

1. Textile air diffusers shall be designed for pressures of 0.25” water gage minimum to 3.1” maximum, with 0.5” as the standard.

2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).

3. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.

4. Do not use textile diffusers in concealed locations.

5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

PART 3. INSTALLATION

3.1. INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

B. Erect scaffolding as required to allow installation of the nonmetallic ductwork over the existing pool surface. Coordinate allowable times for work to occur with the Owner.

3.2. CLEANING AND PROTECTION

A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

DIVISION 26 SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL
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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.

2. Sleeves for raceways and cables.

3. Grout.

4. Common electrical installation requirements.

B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all electrical work.

C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Architect and the Engineer.

D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered.

E. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Article “Submittals” specified below. The right is reserved to make reasonable changes in location of equipment, boxes, conduit/wiring, and devices, up to the time of rough-in or fabrication.

F. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.

G. Coordinate the work under Division 26 with the work of all other construction trades.

H. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the Contract Documents.

1.3. CONTRACTOR QUALIFICATION

A. Any Contractor or Subcontractor performing work under Division 26 shall be fully qualified and acceptable to the Architect/Engineer and Owner. Submit the following

evidence when requested:

1. A list of not less than five comparable projects which the Contractor completed.

2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.

3. Local and/or State License, where required.

4. Membership in trade or professional organizations where required.

5. Copy of Master Electrician's License.

B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.

C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

D. Supervisory Qualifications: The electrical work on the project shall be under the direct supervision of a licensed Master Electrician.

E. Qualifications of Installers:

1. For the actual fabrication, installation, and testing of the work, shall use only thoroughly trained and experienced personnel who are completely familiar with the requirements of this work and with the installation recommendations of the manufacturers of the specified items.

2. Utilize a full-time project foreman in charge of all electrical work. This person shall be fully qualified and experience in such work and shall be available, on site, at all times during Construction. All problems, questions, coordination, etc. related to electrical work shall take place through this person to the Architect.

1.4. PERMITS, FEES, AND INSPECTIONS

A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.

B. Permits and fees shall comply with Division 01 Section, General Requirements.

C. Notify Inspection Authorities to schedule inspections of work.

D. Notify Engineer in advance of scheduled inspections.

E. An electrical foreman, superintendent or other supervisor shall be in attendance for all scheduled inspections.

F. State Mandated Electrical Inspections: The Contractor shall obtain electrical installation inspection from a non-governmental electrical inspector approved by the State Fire

Marshal. The Contractor shall coordinate inspections, coordinate inspection schedule with the Owner, and obtain the electrical inspection certificate within 15 days after completion of electrical installation. The Contractor shall obtain electrical inspections of portions of the Work as they are completed and as required by the electrical inspector, and sufficiently ahead of close-in work so that corrections and re-inspections may be made, and in all cases while the area is accessible and visible for inspection.

1.5. EXAMINATION OF SITE

A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for Contractor's failure to do so.

B. Examine and verify specific conditions described in individual Specifications sections.

C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

1.6. INTERPRETATION OF DOCUMENTS

A. Any discrepancies between Drawings, Specifications, Drawings and Specifications, or within Drawings and Specifications shall be promptly brought to the attention of the Owner during the bidding period. No allowance shall subsequently be made by reason of failure to have brought said discrepancies to the attention of the Owner during the bidding period or of any error on the Bidder's part.

B. The locations of products shown on Drawings are approximate. Place the devices to eliminate all interference with overhead ducts, piping, etc. Where any doubt exists, the exact location shall be determined by the Owner.

C. No electrical equipment, e.g. transformers, panelboards, disconnect switches, motor controllers, etc. shall be installed beneath ductwork, piping, etc.

D. All general trades and existing conditions shall be checked before installing any outlets, power wiring, etc.

E. Equipment sizes shown on the Drawings are estimated. Before installing any wire or conduit, obtain the exact equipment requirements and install wire, conduit, or other item of the correct size for the equipment actually installed. However, wire and conduit sizes shown on the Drawings shall be taken as a minimum and shall not be reduced without written approval from the Architect and Owner.

F. Where variances occur between the Drawings and Specifications or within either document itself, the item or arrangement of better quality, greater quality, or higher cost shall be included in the Contract Price. The Engineer will decide on the item and manner in which the work shall be installed.

G. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions, and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access.

Where departures are proposed because of field conditions or other causes, prepare and submit detailed Shop Drawings for approval in accordance with Article "Submittals" as herein after specified. The right is reserved to make reasonable changes in location of equipment, conduit/wiring, and devices, up to the time of rough-in or fabrication.

H. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Engineer and Owner.

I. Perform the work in a first-class, substantial and workmanlike manner. Any materials installed which do not present an orderly and neat workmanlike appearance shall be removed and replaced when so directed by the Engineer, at the Contractor's expense.

J. The complete set of Mechanical, and Electrical Drawings and Specifications apply to this work. The successful Bidder shall familiarize himself with all other related documents.

1.7. MATERIALS AND EQUIPMENT

A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality.

B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.

C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.

D. Substitution will not be permitted for specified items of material or equipment where noted.

E. All items of equipment furnished shall have a service record of at least five (5) years.

1.8. ELECTRICAL WORK UNDER OTHER DIVISIONS

A. HVAC Equipment and Systems

1. In general, any electrically operated or controlled equipment furnished under HVAC divisions shall be supplied with control wiring, transformers, contacts, etc.

2. Division 26 shall provide power circuits to such equipment and a disconnecting means for each piece of equipment, as well as all electrical control equipment and wiring related thereto.

3. Certain mechanical units are furnished from the factory with motor starters,

contactors, transformers, fuses, wiring, etc., required for fans, pumps, etc. When this equipment is supplied from the factory, Division 26 shall coordinate with Division 23 such that only one set of starters, fuses, switches, etc. is provided.

4. Some HVAC equipment must be protected by fuses, which shall be marked on the equipment nameplate. In these instances, if the equipment has an integral non-fused disconnecting means, the fusible safety switch indicated on the electrical drawings must remain per NEC Article 440.

5. In general, control and interlock equipment (including, but not limited to wiring, conduit, transformers, relays, contacts, etc.) for HVAC equipment and systems is furnished under Division 23. Division 26 shall install and connect all equipment as necessary.

6. HVAC equipment refers to, but is not limited to the following:

    a. Single Zone VAV Units
    b. ATC Panels
    c. Ductwork
        i. Do not install any electrical equipment, including but not limited to switchboards, transformers, panelboards, safety switches, motor controllers, etc. beneath ductwork. Where this cannot be accomplished due to field conditions, notify the Engineer in writing.
    d. Piping
        i. Do not install any electrical equipment, including but not limited to switchboards, transformers, panelboards, safety switches, motor controllers, etc. beneath piping. Where this cannot be accomplished due to field conditions, notify the Architect/Engineer in writing.

7. To ensure proper electrical coordination between the electrical components supplied under Division 26 and the equipment supplied under Division 23, a schedule shall be submitted, prior to start of work, for review by the Engineer with the following column headings:

    a. Equipment or Item
    b. HP or KVA
    c. Voltage and Phase
    d. Power Factor
    e. Capacitor
    f. Motor Starter
    g. Disconnect
    h. Controls
    i. Remarks

1.9. FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.10. REFERENCED STANDARDS, CODES AND SPECIFICATIONS

A. Specifications, Codes and Standards listed below are included as part of this Specification, latest edition:

1.	ADA	-	Americans with Disabilities Act
2.	ANSI	-	American National Standards Institute
3.	ASTM	-	American Society for Testing and Materials
4.	CSA	-	Canadian Standards Association
5.	EPA	-	Environmental Protection Agency
6.	FM	-	Factory Mutual
7.	IBC	-	International Building Code
8.	IEEE	-	Institute of Electrical and Electronics Engineers
9.	MDE	-	Maryland Department of the Environment
10.	MOSH	-	Maryland Occupational Safety and Health
11.	NEC	-	National Electrical Code
12.	NECA	-	National Electrical Contractors Association
13.	NEMA	-	National Electrical Manufacturers Association
14.	NFPA	-	National Fire Protection Association
15.	OSHA	-	Occupational Safety and Health Act
16.	UL	-	Underwriters' Laboratories

B. Electrical construction materials shall, where a listing is normal for the particular class of material, be listed in Electrical Construction Materials List of the Underwriters' Laboratories, Inc. (U.L.) and shall bear the listing label. Electrical equipment shall, where a listing is normal for the particular class of equipment, be listed in the Electrical Appliance and Utilization Equipment List of the Underwriters' Laboratories, Inc. (U.L.) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by other nationally recognized testing laboratory, inspection agency or approved organization (such as E.T.L. or Factory Mutual) shall be acceptable.

1.11. SUBMITTALS

A. Product Data: Include complete descriptive product data for items specified in Part 2 of this Section.

1.12. SUBMITTAL PROCEDURES

A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in the best interest of the Owner.

B. After acceptance of Material and Equipment List, submit three (3) copies or more as required under the General Conditions, of complete descriptive data for all items as outlined below.

C. Electronic submittals shall be prepared as a Portable Document Format (PDF) file and shall include as page 1 the Contractor's stamp, followed by the submittal contents. Submittal form shall identify the Project, Contractor, Subcontractor or Supplier, and pertinent Contract Document references.

D. Submittals shall consist of specifications, product data sheets, manufacturer's catalog cuts, dimensional shop drawings, wiring diagrams, installation instructions, samples, and any other information necessary to indicate complete compliance with Contract Documents.

E. Submittals shall include, but not be limited to, the following information: size, type, functional characteristics, compliance with standards in Division 26, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.

F. Identify submittals, indicating intended application, location and service of submitted items. Refer to Specification sections or paragraphs and Drawings where applicable.

G. Clearly indicate exact type, model number, style, size, operating characteristics, ratings, options and special features of proposed item specifically for application to this project. Submittals of a general nature will not be acceptable.

H. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Call attention, in writing, to deviation from contract requirements.

I. Thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission. Coordinate installation requirements and all electrical requirements for equipment submitted. The Contractor shall be responsible for correctness of all submittals.

J. Submittals will be reviewed for general compliance with design concept in accordance with Contract Documents, but dimensions, quantities, or other details will not be verified.

K. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold Contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

L. For substituted items, clearly list on the first page of the submittal all differences between the specified item and the proposed item. The Contractor shall be responsible for corrective

action and maintaining the Specification requirements if differences have not been clearly indicated in the submittal.

M. Where proposals to use an item of equipment or application other than that specified or detailed on the Contract Drawings, which requires any redesign of the structure, partitions, foundation, HVAC, piping, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign and all new drawings and detailing required thereafter shall be prepared by the Contractor at his own expense for review by the Owner's representative before any such work is implemented.

N. All Contractor-proposed changes and revisions shall be at the Contractor's risk and expense. The Contractor shall fully coordinate all revisions, substitutions and changes with other trades for a complete, code compliant, and fully functional installation.

O. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted. Use only final or corrected submittals and data prior to fabrication and/or installation.

P. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct submittal. Identify all submittals by the name of the item/system and the applicable Specification Section and/or Drawing number. Grouping of items/systems that are not related shall be unacceptable.

Q. Items and Systems

1. Access Doors
2. Arc Flash Hazard Analysis and Labels
3. Circuit Breakers
4. Conductors and Cables - 600V or Less
5. Conduit and Raceway
6. Connectors and Splices
7. Electrical Connection Coordination Schedule
8. Equipment Nameplates/Labels
9. Firestopping Materials
10. Ground Conductors
11. Grout
12. Hangers and Supports
13. Identification Products
14. Installer Certificates

15. Junction and Pull Boxes, Standard Sizes

16. Operation and Maintenance Manual

17. Outlet and Device Boxes

18. Panelboard Circuit Directories

19. Power System Studies

20. Qualification Data

21. Receptacles

22. Record Drawings

23. Sleeves

24. Surface Metal Raceway

25. Surface Non-Metallic Raceway

26. Testing Agency Qualifications

27. Test Reports

28. Weatherproof Boxes and Covers

29. Wiring Diagrams

R. Submit for approval any other submittals as required by the Engineer or Owner. No item listed above shall be delivered to the site, or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.

S. Prepare and submit a detailed schedule of values indicating the Contract costs for the major work items. Provide additional detail and information as requested by the Engineer.

T. For resubmissions, the Contractor must address in writing all of the Engineer's comments on the original submission to verify compliance.

1.13. DEFINITIONS

A. Approve: To permit use of material, equipment or methods conditional upon compliance with contract documents requirements.

B. Building Line: Exterior wall of building.

C. Child Care Facility: A building or structure, or portion thereof for educational, supervisory, or personal services for more than four children seven years old or younger.

D. Concealed: Hidden from sight in chases, formed spaces, shafts, hung ceilings.

E. Conduits: Include conduit, all fittings, identification, and other accessories relative to such conduit.

F. Contractor: The Electrical Contractor and any of his subcontractors, vendors, suppliers, or fabricators.

G. EPDM: Ethylene-propylene-diene terpolymer rubber

H. Exposed: Not installed underground or concealed as defined above.

I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.

J. Furnish and install or Provide: To supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.

K. Location, Damp: Locations protected from water and not subject to saturation with water or other liquids, but subject to moderate degrees of moisture. Examples of such locations include interior locations such as basements, crawlspaces, attics, cold-storage rooms, etc…

L. Location, Dry: A location not normally subject to dampness or wetness. A dry location may temporarily be subject to dampness or wetness during building construction.

M. Location, Wet: Locations subject to saturation with water or other liquids, locations exposed to weather, and installations underground or in concrete slabs or masonry in direct contact with the Earth. Examples of such locations include all exterior locations (including those under canopies, roofed open porches, etc…) commercial kitchens, and vehicle washing areas.

N. NBR: Acrylonitrile-butadiene rubber.

O. Review: Limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

1.14. WARRANTY

A. Contractor's attention is directed to warranty obligations contained in the General Conditions.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer’s warranties shall be included in the operations and maintenance manuals.

C. The Contractor guarantees for a two (2) year period from the time of final acceptance by the Owner:

1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to

which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That the Contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The Contractor shall also make good all damages caused to their work or materials in the process of complying with this section.

4. That the entire work shall be water-tight and leak-proof.

1.15. OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare three (3) hard copies and electronic copies of the Operation and Maintenance Manual and shall deliver these copies of the manual to the Owner. Provide one (1) electronic copy for each hard copy set of the O&M manual.

B. The manual shall be as specified herein. The manual must be approved and will not be accepted as final until so stamped.

C. Hard copies of the manual shall be bound in three-ring loose-leaf binders similar to National No. 3881 with the following title lettered on the front and spine of the binder: *Operation and Maintenance Manual – Worcester County Recreation Center – HVAC System Replacements – Electrical*.

1. Provide divider tabs and table of contents for organizing and separating information. Tab titling shall be clearly printed under reinforced plastic tabs.

2. If more than one (1) binder is required, volume numbers shall be included on front and spine of each volume.

3. No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out.

D. Electronic copies of the manual shall be saved on USB flash drives, and shall be in searchable PDF format with interactive index tabs. Approved electronic copies shall be stored in flash drive zipper cases in front of volume 1 (if applicable) of hard copies of the manual.

E. Provide the following data in the manual:

1. As first entry, an approved letter indicating the starting/ending time of Contractor's warranty period.

2. Directory listing names, addresses, e-mail addresses, and telephone numbers for Engineer, Contractor, Sub-contractor(s), equipment suppliers, sales and authorized service representatives.

3. Maintenance operation and lubrication instructions on each piece of equipment furnished.

4. Complete catalog data on each piece of electrical equipment furnished including

approved Shop Drawing/Submittal with Engineer's Comments (if any).

5. Manufacturer's extended limited warranties on equipment.

6. Catalog data of all equipment, starters, etc. shall include wiring diagrams, parts list and assembly drawing(s).

7. Access panel charts with index illustrating the location and purpose of access panels.

8. Approved Electrical Certificates, including certificate of approval from electrical inspector.

9. List of extra materials turned over to Owner, with transmittal/receipt signed by Owner.

10. Sign-in sheets from demonstration and training sessions.

11. Start-up and test reports for equipment.

F. Additional items identified within other Sections of these Specifications.

G. Submit Operation and Maintenance Manual prior to the anticipated date of Substantial Completion for Engineer review and approval. Substantial Completion requires that Operation and Maintenance Manuals be reviewed and approved.

1.16. RECORD DRAWINGS

A. Upon completion of the electrical installations, the Contractor shall deliver to the Engineer one complete set of prints of the electrical Contract Drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.

B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering the same to the Architect.

C. Contractor shall note respective addendum, supplemental instruction, request for information, change order, etc. number adjacent to all red-line changes on Record Drawings.

1.17. INSTRUCTION

A. Upon completion of all work, thoroughly instruct the Owner's representatives in the proper operation and maintenance of all electrical equipment and systems.

B. Instructions shall be done only after completed systems have been put into operation and tested for proper operation and performance.

C. Instructions shall be given only by experts in the equipment or system and shall include descriptions and demonstrations of procedures of operation, data record keeping, etc.

D. The Operation and Maintenance Manual shall be available at the time of the instructions,

for use by Instructors and Owner personnel.

E. Deliver all instruction materials to the Owner prior to the formal instruction period.

F. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer.

1.18. INSTALLATION AND COORDINATION DRAWINGS

A. Prepare, submit and use composite installation and coordination drawings to assure proper coordination and installation of the work. Drawings shall include, but not be limited to the following:

1. Mechanical Rooms indicating transformers, panelboards, enclosures, boxes, conduits, mechanical equipment, ductwork, and piping, etc…

2. Electrical Rooms indicating switchboards, panelboards, enclosures, boxes, transformers, conduits, wireways, etc…

B. Draw plans to a scale not less than ¼ inch equals one foot. Include plans, sections and elevations of the proposed work, showing all equipment (mechanical, plumbing and electrical), conduit and wiring in the areas involved. Fully dimension all work, horizontally and vertically. Show coordination with other work including piping, ductwork and other mechanical work, walls, doors, ceilings, columns, beams, joists and other architectural and structural work.

C. Identify all equipment and devices on wiring diagrams. Where field connections are shown to factory-wired terminals, furnish manufacturer's literature showing internal wiring of equipment.

D. Prepare, submit, and use scaled layout drawings indicating dimensions, clearances, and actual equipment dimensions. Layout Drawings shall include, but not be limited to the following:

1. Building penetrations.

E. Prepare scaled coordination drawings in accordance with the Specifications. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of power, lighting, and all special system raceways, equipment, and materials. Include the following:

a. Working space and dedicated space clearances per the NEC.
b. Clearances for equipment disassembly required for periodic maintenance.
c. Exterior wall penetrations.
d. Fire-rated wall penetrations.
e. Equipment connections and support details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment

into the building during construction, including, but not limited to, the following: Major conduits and feeders.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. The successful Bidder shall be responsible for indicating all raceways described in notes or indicated by home run symbols.

5. The complete set of Mechanical, and Electrical Drawings and Specifications apply to this work. The successful bidder shall familiarize himself with all other related documents to avoid possible demolition and installation conflicts.

PART 2. PRODUCTS

2.1. SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Non-Metallic Pipe Sleeves: Schedule 80 PVC.

D. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2. GROUT

A. Nonmetallic, Non-Shrink Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3. EXECUTION

3.1. DEMOLITION

A. Unless otherwise noted all existing equipment, conduit, wire, etc., shall remain.

B. Where existing equipment is indicated to be removed, all associated conduit, power, controls, insulation, hangers, supports and housekeeping pads, etc…, shall also be removed. Patch, paint and repair walls/roof/floor to match existing and/or new finishes.

C. The Contractor shall be responsible for visiting the site and determining the existing conditions in which the work is to be performed.

D. Where any abandoned conduits in existing floors, walls, ceilings, etc., conflict with new work, remove abandoned conduits as necessary to accommodate new work.

E. The location of all existing equipment, conduits etc., indicated is approximate only and shall be checked and verified. Provide all new electrical work required to connect to or clear existing work as applicable.

F. Maintain egress at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and the Authority(ies) Having Jurisdiction (AHJ).

G. Make provisions and include in bid all costs associated with confined entry/space requirements in crawl spaces and all other applicable OSHA and MOSH regulations.

H. Where required to maintain the existing systems in operation, temporarily back-feed existing systems from new equipment. Contractor shall temporarily extend existing conduit systems to new conduit systems.

I. At completion of project all temporary conduit, wires, etc., shall be removed in their entirety.

J. Existing conduit, equipment, wiring, etc., not required for re-use or re-installation in this project, shall be removed from the project site.

K. Deliver to the Owner, on the premises where directed, existing equipment and materials which are removed and which are desired by the Owner or are indicated to remain the property of the Owner.

L. All other materials and equipment which are removed shall become property of the Contractor and shall be promptly removed, from the premises, and disposed of by the Contractor, in an approved manner.

M. Where conduit and wiring are removed, remove all conduit hangers which were supporting the removed conduit. Patch the remaining penetration voids with like materials and paint to match existing construction.

N. Where required, provide and coordinate removal and re-installation of existing equipment. Take care to protect materials and equipment indicated for reuse. Contractor shall repair or replace items which are damaged. Contractor shall have Owner’s representative present to confirm condition of equipment prior to demolition.

O. Before demolition begins, and in the presence of the Owners representative, test and note all deficiencies in all existing systems affected by demolition but not completely removed by demolition. Provide a copy of the list of system deficiencies to the Owner and the Engineer.

P. The Owner shall have the first right of refusal for all fixtures, devices and equipment removed by the Contractor.

Q. All devices and equipment designated by the Owner to remain the property of the Owner shall be moved and stored by the Contractor at a location on site as designated by the Owner. It shall be the Contractor's responsibility to store all devices and equipment in a safe manner to prevent damage while stored.

R. All existing equipment refused by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor in a timely manner and disposed of in a legal manner.

S. Work Abandoned in Place: Cut and remove conduit a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

T. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

U. Terminate services and utilities in accordance with local laws, ordinances, rules and regulations.

3.2. CUTTING AND PATCHING

A. Accomplish all cutting and patching necessary for the installation of work under Division 26. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and workmanlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.

3.3. OUTAGES

A. While work is in progress, except for designated short intervals during which connections are made, continuity of service shall be maintained to all existing systems. Interruptions shall be coordinated with the Owner as to time and duration. The Contractor shall be responsible for any interruptions to service and shall repair any damages to existing systems caused by his operations.

B. Provide a minimum of seven (7) days' notice to schedule outages. The Contractor shall include in their bid outages and/or work in occupied areas to occur on weekends, holidays, or at night. Coordinate and get approval of all outages with the Owner.

C. Submit Outage Request Form, attached at the end of this Section, to Owner for approval.

3.4. COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Install equipment with working space and dedicated space in strict accordance with NEC Article 110.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

F. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

G. Verify exact electrical requirements for each piece of equipment receiving one or more electrical connections, including but not limited to voltage, phase, and maximum fuse/overcurrent protection device rating. Provide electrical circuit of proper characteristics to serve provided equipment.

H. Include any and all items required by the National Electrical Code and/or field conditions for the proper connection and installation of each piece of equipment.

I. Make all connections to equipment in accordance with manufacturer's instructions.

J. Right of Way: Give to piping systems installed at a required slope.

K. Coordinate electrical work under other Divisions in accordance with Part 1 of this Section, Article "Electrical Work Under Other Divisions".

3.5. PHASING

A. Refer to Contract Drawings for any required phasing.

B. Maintain building egress and traffic ways at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and Authorities Having Jurisdiction (AHJ).

C. Provide dust barriers/partitions, penetration closures, etc. to ensure safety of building occupants and protection of existing surroundings.

3.6. COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

5. To provide working space and dedicated space clearances per NEC Article 110.26.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in this Section.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 26 Section 260528, "Firestopping for Electrical Systems".

3.7. EXCAVATION AND BACKFILLING

A. General:

1. Perform all necessary excavation, or installation of work under Division 26, in whatever materials or conditions encountered, using suitable methods and equipment.

2. Accurately establish required lines and grades and properly locate the work.

3. Determine the locations of all existing utilities before commencing the work.

B. Excavation:

1. Excavate only the required elevations. If excavation is carried below the foundation lines or other required limits, backfill the excess with concrete.

2. Keep banks of trenches as nearly vertical as possible, and provide sheeting and/or shoring as required for protection of work and safety of personnel. Follow local, State, OSHA, MOSH, and other applicable Guidelines.

3. Keep excavations dry. Protect excavations from freezing.

C. Backfilling:

1. Backfill excavations to the required elevations and restore surfaces to their original or required conditions.

2. Backfill shall be similar material, free from objectionable matter such as rubbish, roots, stumps, brush, rocks and other sharp objects. Unless otherwise indicated, suitable material from the excavation may be used for backfill.

3. Carefully place and mechanically tamp backfill in layers not exceeding 12 inches loose thickness. Compact to 95 percent minimum.

4. Do not backfill against frozen material. Do not use frozen material for backfill.

3.8. WALL AND FLOOR PENETRATIONS

A. All penetrations of partitions, ceilings, roofs and floors under Division 26 shall be sleeved, sealed, and caulked as specified herein.

B. All penetrations of fire rated assemblies shall be sleeved, sealed, caulked and protected to

maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized. See Division 26 Section 260528, "Firestopping for Electrical Systems".

C. Provide conduit escutcheons for all exposed conduit penetrations in finished interior spaces and all exposed exterior penetrations. Escutcheons shall match those provided under Division 23.

D. Conduit sleeves:

1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.

2. Twenty-two (22) gauge galvanized steel elsewhere.

3.9. PENETRATION OF WATERPROOF CONSTRUCTION

A. The building shall remain watertight at all times.

B. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, flashings, fittings, sleeves, and caulking to make penetrations absolutely watertight.

3.10. SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Sleeves installed in floors shall extend 2 inches (50 mm) above finished floor level unless otherwise indicated on the Contract Drawings.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

I. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of

joint.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements of Division 26 Section 260258, “Firestopping for Electrical Systems”.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and joint sealant/grout.

3.11. FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 26 Section 260528, "Firestopping for Electrical Systems".

3.12. HANGERS AND SUPPORTS

A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.

B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

C. Refer to Division 26 Section 260529, “Hangers and Supports for Electrical Systems”, for additional requirements.

3.13. CONNECTIONS AND ALTERATIONS TO EXISTING WORK

A. Unless otherwise noted on the Drawings, where existing electrical work is removed, including hangers, to a point below finished floors or behind finished walls and capped, such point shall be far enough behind finished surfaces to allow for installation of normal thickness of required finish material.

B. Where work specified in Division 26 connects to existing equipment, conduits, etc., Contractor shall perform all necessary alterations, cuttings, fittings, etc., of existing work as may be necessary to make satisfactory connections between new and existing work, and to leave completed work in a finished and workmanlike condition.

C. Where the work specified under Division 26, or under other Divisions, requires relocation of existing equipment, conduit etc., Contractor shall perform all work and make necessary changes to existing work as may be required to leave completed work in a finished and workmanlike condition.

D. Where the relocation of existing equipment is required for access or the installation of new equipment, the Contractor shall temporarily remove and/or relocate and re-install as

required to leave the existing and new work in a finished and workman like condition.

3.14. EQUIPMENT BY OTHERS

A. This Contractor shall make all system connections required to equipment furnished and installed under other divisions or furnished by the Owner. Connections shall be complete in all respects to render this equipment functional to its fullest intent.

B. It shall be the responsibility of the supplier of the equipment to furnish complete instructions for connections. Failure to do so will not relieve the Contractor of any responsibility for improper equipment operation.

3.15. PROVISIONS FOR ACCESS

A. The Contractor shall provide access panels and doors for all concealed equipment, and other devices requiring maintenance, service, adjustment or manual operation.

B. Where access doors are necessary, furnish and install manufactured painted steel door assemblies consisting of hinged door, key locks, and frame designed for the particular wall or ceiling construction. Properly locate each door. Door sizes shall be a 12 inches x 12 inches for hand access, 18 inches x 18 inches for shoulder access and 24 inches x 24 inches for full body access where required. Review locations and sizes with Architect prior to fabrication. Provide U.L. approved and labeled access doors where installed in fire rated walls or ceilings. Doors shall be Milcor Metal Access Doors as manufactured by Inland-Ryerson, Mifab, or approved equal.

1. Acoustical or Cement Plaster: Style B

2. Hard Finish Plaster: Style K or L

3. Masonry or Dry Wall: Style M

C. Where access is by means of lift-out ceiling tiles or panels, mark each ceiling grid using small color-coded and numbered tabs. Provide a chart or index for identification. Place markers within ceiling grid not on ceiling tiles.

D. Access panels, doors, etc. described herein shall be furnished under the section of Specifications providing the particular service and to be turned over to the pertinent trade for installation. Coordinate installation with installing Contractor. All access doors shall be painted in baked enamel finish to match ceiling or wall finish.

E. Submit shop drawings indicating the proposed location of all access panels/doors. Access doors in finished spaces shall be coordinated with air devices, lighting and sprinklers to provide a neat and symmetrical appearance.

F. Provide sufficient access and working space for repair and maintenance about all lighting and electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with OSHA 29 CFR 1910 Subpart D and 1910.303(g).

3.16. PAINTING AND FINISHES

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 26 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed, as defined herein.

F. Remove all construction marking and writing from exposed equipment, conduit, boxes, and building surfaces. Do not paint manufacturer's labels or tags.

G. All exterior equipment and conduits shall be painted to match adjacent surface in color as selected by Owner.

H. All exposed conduit, boxes, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Owner and conform to ANSI Standards.

I. Do not paint panelboard fronts, grounding busbars, equipment nameplates, warning labels, etc.

3.17. COLOR SELECTION

A. Color of finishes shall be as selected by the Owner.

3.18. PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.

B. Cover temporary openings in conduits and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver conduits with factory applied end caps.

C. Cover or otherwise protect all finishes.

D. Replace damaged materials, devices, finishes and equipment.

E. Protect stored conduits from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

3.19. OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions.

Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.

B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.

C. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the commencement of testing.

D. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items.

3.20. TESTING AND ADJUSTMENT

A. Perform all tests which are specified or required to demonstrate that the work is installed and operating properly. Where formal tests are required, give proper notices and perform all necessary preliminary tests to assure that the work is complete and ready for final test.

B. Adjust all systems, equipment and controls to operate in a safe, efficient and stable manner.

C. On all circuits, 600 volts or less, provide circuits that are free from ground faults, short circuits and open circuits.

D. Other tests of a specific nature for special equipment shall be as specified under the respective equipment.

E. Submit all test results to the Engineer for approval.

END OF SECTION

OUTAGE REQUEST FORM

DATE APPLIED: _____ BY: _____

DATE FOR OUTAGE: _____ FIRM: _____

START OUTAGE-TIME: _____ DATE:_____

END OUTAGE - TIME: _____ DATE:_____

AREAS AND ROOMS: _____

FLOOR(S): _____

AREA(S): _____

ROOM(S): _____

WORK TO BE PERFORMED: _____

SYSTEM(S): _____

REQUEST APPROVED BY: _____

(FOREMAN OR OTHER PERSON IN CHARGE)

FOR OWNER'S USE ONLY:

APPROVED: _____

YES ____ NO ___ BY: _____DATE: _____

DATE/TIME-AS REQUESTED: _____ OTHER : _____

OWNER'S PRESENCE REQUIRED: _____

YES: ____ NO: ____ NAME: _____

POINT OF CONTACT: _____ PHONE: _____

DIVISION 26 SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
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SECTION 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3. DEFINITIONS

A. AWG: American Wire Gauge.

B. MC: Metal-clad.

C. RoHS: Restriction of Hazardous Substances.

1.4. ACTION SUBMITTALS

A. Product Data: Provide for each type of product including but not limited to conductors, cables, and connectors.

1.5. INFORMATIONAL SUBMITTALS

A. Qualification Data: For performing field quality-control tests.

1.6. CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.7. QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms Listed and Labeled: As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory as defined in OSHA Regulation 1910.7.

B. Comply with NEMA/Insulated Cable Engineers Association (ICEA) Standards.

C. Comply with NECA Standard of Installation.

D. Comply with NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

E. American Society for Testing and Materials (ASTM): Comply with requirements of the following:

1. B3: Standard Specification for Soft or Annealed Copper Wire

2. B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

3. D753: Standard Specification for General Purpose Polychloroprene Jacket for Wire and Cable

F. Electrical Testing Laboratories (ETL): Provide wiring, cabling and connector products which are ETL listed and labeled.

G. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems:

1. 82: Test procedure for Impulse Voltage Tests on Insulated Conductors

2. 241: Recommended Practice for Electric Power Systems in Commercial Buildings

H. NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.

I. National Electrical Manufacturer's Association (NEMA): Comply with requirements of the following:

1. WC70: Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.

J. UL: Provide material conforming to the following standards:

1. UL 83 - Thermoplastic-Insulated Wires and Cables.

2. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors

K. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26, Binational Wire and Cable Packaging Standard.

B. Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

1.9. COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Engineer.

C. Determine required separation between cables and other work.

D. Determine cable routing to avoid interference with other work.

1.10. PROJECT CONDITIONS

A. Verify that field measurements are as shown on the Drawings.

B. Conductors are based on the following materials, sizes as indicated on the Contract Drawings:

APPLICATION	CONDUCTOR MATERIAL	REMARKS
Branch Circuits	Copper	Note 1, 2

Notes:

1. Provide copper conductors where required by equipment manufacturer, e.g. chillers.
2. Refer to "Wire and Insulation Applications" in Part 3 of this Section for branch circuit conductor sizing based on home run length and circuit length.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2. PRODUCTS

2.1. MANUFACTURERS

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. Wires and Cables:

   a. American Insulated Wire Corp.
   b. BICC Brand Rex Company.

c. CME Wire and Cable.
d. Colonial Wire Company.
e. Encore Wire Corporation.
f. General Cable.
g. Senator Wire & Cable Company.
h. Southwire Company.

2. Connectors and Accessories for Wires and Cables:

a. 3M Company; Electrical Products Division.
b. AMP Incorporated.
c. Buchanan.
d. General Signal; O Z/Gedney Unit.
e. Greaves Corporation.
f. Ideal Industries.
g. Monogram Company; AFC.
h. NSI Industries, Inc.
i. Square D Company; Anderson.

3. Metal Clad (MC) Cable

a. Alcan Cable.
b. Atkore AFC Cable Systems.
c. Encore Wire Corporation.
d. General Cable.
e. Nexans.
f. Prysmian Cables and Systems.
g. Service Wire Company.
h. Southwire Company.
i. United Copper Industries.

4. Metal Clad (MC) Connectors

a. Arlington Industries, Inc.
b. Bridgeport.
c. Crouse-Hinds.
d. Thomas & Betts.

2.2. GENERAL CONDUCTOR REQUIREMENTS

A. UL-listed building wires and cables with conductor material, insulation type, cable construction and rating as specified herein.

B. Conductors shall meet or exceed requirements of all applicable ASTM specifications, UL Standard 83, UL Standard 1581, NEMA WC 70, Federal Specification A-A-59544 and shall be RoHS/REACH Compliant.

C. Conductor Insulation:

1. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.

2. Type THHN and Type THWN-2: Comply with UL 83.

3. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.

4. Type XHHW-2: Comply with UL 44.

D. Conductors shall be minimum of 12 AWG, unless otherwise required by equipment manufacturer.

E. Conductors shall be solid for 10 AWG and smaller, and stranded for 8 AWG and larger, unless otherwise indicated herein or on the Contract Drawings.

F. Conductors shall be stranded for connections to the following equipment:

1. Motors (including fans, pumps, etc.)

G. Building wire and cables shall be color-coded using colors factory impregnated throughout the insulation and jacket. The following color code convention(s) shall be used except where existing systems have established another color code convention:

1. 120/208-Volt, 3-Phase, 4-Wire System:

a.	Phase A:	Black
b.	Phase B:	Red
c.	Phase C:	Blue
d.	Neutral:	White
e.	Ground:	Green

2. 277/480-Volt, 3-Phase, 4-Wire System:

a.	Phase A:	Brown
b.	Phase B:	Orange
c.	Phase C:	Yellow
d.	Neutral:	Gray
e.	Ground:	Green

2.3. COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. RoHS compliant.

3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors. Annealed (soft) copper, 600 volt, Type THHN/THWN (dual-rated) single conductors rated 90°C dry / 75°C wet, with a minimum conductivity of 98 percent at 20°C (68°F), or a maximum resistivity of 1.7 micro-ohms per centimeter.

2.4. CONNECTORS AND SPLICES

A. UL listed, factory fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 Article, “Wire and Insulation Applications”.

B. Split Bolt Connectors: Not acceptable.

C. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

D. Spring Wire Connectors: Not acceptable.

E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic high conductivity copper tubing, internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.

G. Heat shrinkable tubing shall meet the requirements of ANSI C119.1-1986 for buried connections to 90 degrees C and shall be material flame-retarded per IEEE 383 Vertical Tray Flame Test.

H. Motor connection kits shall consist of heat-shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends against ingress of moisture and contamination. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations. Connection kits shall be independent of cable manufacturer's tolerances.

I. Wire Nut Connectors:

1. Description: Twist-on wire connectors for branch circuit conductors 10 AWG and smaller with a color-coded housing.

2. Construction: Flame-retardant polypropylene housing, rated for 105 degrees Celsius. Zinc-plated steel insert. Square-wire spring to maintain secure positive grip that will not relax over time, no pre-twisting required.

3. Dimensions: Connectors shall be appropriately sized according to manufacturer’s recommendation for the suitable wire sizes and voltage rating (600 volts minimum).

4. Quality Assurance:

a. UL Listed to 486C and 94V-2 Flame Rating.

b. CSA Certified to C22.2 No. 188
c. RoHS Compliant

5. Special Features:

a. Wire connectors for making grounding connections shall have green-colored housing and shall have opening at end of connector for grounding conductor to pass through for connection to metallic outlet boxes.
b. Wire connectors for all exterior applications, underground applications, and damp/wet interior locations shall be pre-filled with silicone-based sealant to protect against moisture and corrosion, and shall be UL Listed to 486D for use in damp/wet locations, including direct burial applications.

6. Basis of Design: Provide products by Ideal Industries, Inc. or approved equal.

J. Insulated Connectors (for Conductors 8 AWG and Larger in Dry Locations)

1. Description: Multi-conductor connectors for low voltage (600V or less) circuits, insulated with high-dielectric strength plastisol, molded for precise fit and supplied with removable access plugs over the hex screws.

2. Construction: Range-taking mechanical connector made of aluminum accepts both aluminum and copper conductors. Molded cover of UV stable, impact resistant polypropylene provides rugged protection. Mounting holes at each end of the connector for direct isolated mounting to wiring trough, panelboard, or wireway.

3. Dimensions: Splices and connectors shall be appropriately sized according to manufacturer's recommendation for the suitable wire sizes, quantities, and voltage rating.

4. Quality Assurance: UL listed. UV resistant.

5. Special Features: Connectors shall be rated for temperatures from -45 degrees Celsius to 90 degrees Celsius.

6. Basis of Design: IPLM/IPLMD Series as manufactured by Polaris, or approved equal.

2.5. METAL CLAD (MC) CABLE

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. Comply with UL 1569.

3. RoHS compliant.

4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Cable Types:

1. Single circuit with color-coded conductors. Multi-circuit cables are not permitted.

2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424. Steel armor color-coded red.

D. Conductors:

1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

2. Only cables with conductor sizes 12 AWG and 10 AWG shall be permitted.

3. Conductors shall have color-coded insulation and jacketing per Paragraph "General Conductor Requirements" in this Section.

4. Conductors shall be protected by an anti-short bushing at each termination.

E. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.

F. Armor: Aluminum, interlocked.

2.6. METAL CLAD (MC) CABLE CONNECTORS

A. Snap-In Connectors

1. Snap-in connectors for metal clad cable shall be constructed of die-cast zinc, shall be compatible with steel and aluminum cables, and shall have the following features:

a. Insulated throat
b. Removable ring to secure connector to box
c. Angled, two-prong clip to secure cable
d. Removable screw to secure cable clip

2. Snap-in connectors shall be available in a variety of sizes and configurations to accommodate different cable sizes/diameters, wire counts, cable counts, etc.

3. Single connectors shall be compatible with 1/2-inch knockouts. Duplex connectors shall be compatible with 3/4-inch knockouts.

4. Provide SNAP^{2}IT connectors as manufactured by Arlington Industries, Inc., or approved equal by listed manufacturer.

B. Lock-Nut Connectors

1. Straight connectors shall be one-piece spring-steel, set screw design with nylon insulator and locknut. Provide ACB series, as manufactured by Crouse-Hinds, or

approved equal.

2. 45 and 90 degree connectors shall be die cast zinc, clamp type with insulated throat and locknut. Provide ACBXX45 or ACBXX90 series as manufactured by Crouse-Hinds, or approved equal.

2.7. INSULATING TAPE, PUTTY, RESIN AND SUPPORTS

A. Tape: Provide plastic electrical insulating tape which is flame-retardant, cold and weather-resistant. Tape for use in areas subject to temperatures 30 degrees C to 105 degrees C, or where the tape will be subjected to an oil splash, tape shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant acrylic adhesive.

B. Materials: Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.

C. Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

PART 3. EXECUTION

3.1. EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. By beginning work, the Contractor has accepted conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2. PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3. WIRE AND INSULATION APPLICATIONS

A. All conductors shall be of the size indicated on the Contract Drawings unless otherwise required by the National Electrical Code or the equipment manufacturer. Any discrepancies shall be brought to the attention of the Engineer.

B. No branch circuit wires smaller than 12 AWG shall be used unless otherwise indicated or required by the equipment manufacturer.

C. Conductors 8 AWG and larger shall be stranded. Conductors 10 AWG and smaller shall be solid except as otherwise indicated in Part 2 of this Section.

D. Control wiring shall not be less than 14 AWG and shall be color coded using colors impregnated into the insulation. All control wiring shall be color coded with wires of colors different from those used to designate phase wires.

E. Wiring for general 15 and 20 amp branch circuit work shall be as follows unless otherwise indicated:

HOME RUN LENGTH AND WIRE SIZE				CIRCUIT LENGTH AND WIRE SIZE			
120 Volt		277 Volt		120 Volt		277 Volt	
0 – 60 '	12AWG	0 – 175 '	12AWG	0-100 '	12AWG	0 – 200 '	12AWG
60 – 100 '	10AWG	175 - 350'	10AWG	100’ & Up	10AWG	200 ' & Up	10AWG
100' & Up	8AWG	350> & Up	8AWG				

F. Circuit length as given above shall be the wire length between the first and last outlet on the circuit. Home run length as given above shall be the wire length between the first outlet and the panelboard. In accordance with the above, where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, ensure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.

G. Conductors shall be continuous from outlet to outlet and from terminal board to point of final connection, and no splice shall be made except within outlet or junction boxes.

H. All wiring, contacts, and terminal blocks shall be suitably tagged for ease in identification and tracing of circuits. Identification tags shall be engraved fiber or plastic type, subject to acceptance. Wires shall be numbered and coded, using Brady Quicklabels, or equal.

I. Wiring shall be tagged at terminations, in pull boxes, junction boxes, outlet boxes, panelboards, etc.

J. Joints of 10 AWG and smaller shall be made with properly insulated solderless type pressure connectors. Where stranded conductors or multiple solid conductors are connected to terminals, solderless lugs manufactured by Thomas and Betts Company or equivalent shall be used.

K. Joints of 8 AWG and larger shall be of the type indented into the conductor by means of a hand or hydraulic pressure tool. Connectors shall be Burndy Hy dent, T&B Sta Kon, or equivalent. Connectors for control wiring shall be Burndy Hy Lug, or equivalent.

3.4. MC CABLE APPLICATIONS

A. MC cable shall be permitted only where concealed above accessible ceilings and/or within drywall partitions and in accordance with the requirements of Division 26 Section 260533, “Raceways and Boxes for Electrical Systems”.

B. MC Cable shall be allowed for connections within a room from a junction box to lighting fixtures.

C. Conduit home runs shall be in electrical metallic tubing (EMT).

D. MC cable shall be allowed from a junction box within a room to outlet boxes in the same room.

E. Provide anti-short bushings for all MC cable terminations.

F. Cables shall be supported with appropriate hangers; tie wire is not acceptable.

G. MC cable shall not be used to support other cables/wires.

3.5. INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's Standard of Installation.

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Pull Conductors: Use a UL-listed and 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.

D. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceway. Completely and thoroughly swab conduit system before installing conductors.

E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Division 26 Section 260500, “Common Work Results for Electrical” and Division 26 Section 265029, “Hangers and Supports for Electrical Systems”.

G. Seal around cables penetrating fire rated elements according to Division 26 Section 260528, “Firestopping for Electrical Systems”.

H. Identify wires and cables according to Division 26 Section 260553, “Identification for Electrical Systems”.

I. Conductors installed in parallel shall be of equal lengths.

J. Wiring at Outlets: Install with at least 6 inches (150 mm) of slack conductor at each outlet in accordance with Article 300.14 of the National Electrical Code.

K. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

L. The Contractor shall provide suitable installation equipment to prevent cutting and abrasion of conductor insulation. The Contractor shall use suitable cable guides, pulleys, and protective sleeving to prevent damage to cable during installation. Ropes used for pulling

of wire and cable shall be made of polyethylene or other suitable non-metallic material. Pulling lines shall be attached to cable by means of either woven basket grips or pulling types attached directly to the conductors. Wire pulling lubricants, if used, shall conform to UL requirements applicable to the various insulations and raceway materials. The lubricants shall be certified by the manufacturer to be non-injurious to such insulation and materials.

M. Each cable shall be labeled at terminals and at all accessible points in equipment and in pull boxes. Each wire shall be labeled at both ends. Labels shall be self-sticking wire markers.

N. Riser cables shall have cable supports as required by Code.

O. For rubber and plastic-covered wire and cable, pulling compound Ideal Yellow 77 may be used.

P. Terminal lugs for wires 8 AWG and larger shall be T&B 54,000 Series or Burndy HY-Dent, compression type, unless noted otherwise. One-hole lugs for wires 4/0 AWG and smaller. Two-hole lugs for all wires 250 kcmil AWG and larger.

Q. Install wires and cables using braided rope larger than the cable being pulled to keep twists to a minimum.

R. Provide an insulated green equipment grounding conductor (EGC), sized per NEC, for all feeder and branch circuits, shown or not shown.

S. Multi-wire branch circuits shall not be permitted. Provide a separate insulated neutral (grounded) conductor for all feeder and branch circuits requiring a neutral connection.

T. Install electrical cables, wires, and connectors as indicated in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.

U. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.

V. Conductors installed in runs within 6 inches of heating pipes or equipment shall be of types required by the NEC and shall be listed for the application.

W. No conductors shall be drawn into conduit until all work, which may cause cable damage, is completed.

X. During installation, do not deform cable by improper bending, stretching, twisting, kinking, or pinching, nor do any other abusive handling. Any failure to observe these instructions will be detected and corrected during the demonstrations following completion of the installation.

Y. All cable runs shall contain S loops or other means to accommodate expansion or contraction as required.

Z. Cable bends will have a radius not less than the value recommended by the cable

manufacturer.

AA. All labels shall be of durable material and securely fastened to the cable.

BB. Wiring of different system voltages shall not be mixed at pull boxes enclosures, surface metal raceway, wire troughs, etc., unless a barrier (separator) is provided between the differing systems.

3.6. CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and tap connectors compatible with conductor material.

D. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

E. 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.

F. Wire splices and taps shall be adequate to carry full current rating of wire.

G. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes. Junction boxes may be utilized where required. Wire connectors of insulating material or solderless pressure connections, properly taped, shall be utilized for all splices in wiring.

H. Splices in branch circuits shall be made where indicated or as required for the installation. All splices shall be accessible and made in enclosure approved for that purpose.

I. For splices in branch circuits provide connectors as follows;

1. Wire Sizes 10 AWG and smaller: Provide wire nut connectors as specified in Part 2 of this Section.

2. Wire Sizes 8 AWG and Larger: Provide insulated connectors as specified in Part 2 of this Section.

J. Thoroughly clean wiring prior to installing lugs or connectors.

3.7. IDENTIFICATION

A. All building wire and cable shall be color-coded to identify the electrical system(s) as specified. Where color-coding is field-applied, the same shall be accomplished with colored electrical tape wrapped concentrically around each conductor in half-lapped turns, for at least the last six (6) inches of the conductor. One turn around the conductor is not acceptable.

B. Identify wire and cable using Thomas and Betts Type WM vinyl markers.

C. Identify each phase and neutral conductor with its circuit number or other designation indicated on the Drawings in all junction, pull, terminal boxes, and cabinets.

D. Provide identification tags on each conductor entering each panelboard, switch, junction box, and pull box to identify conductor.

E. Comply with the requirements of Division 26 Section 260553, "Identification for Electrical Systems".

3.8. FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection:

1. Inspect for defects and physical damage, labeling, and compliance with requirements of drawings and schedules.

2. Clean conductors using Manufacturer's approved methods and materials.

3. Verify that conductors are correct size and are terminated with appropriately sized lugs.

4. Verify that conductors are correct color for phase identification.

5. Verify that conductors are labeled to identify circuit designation.

6. Verify that neutral conductors are only terminated at neutral lugs/bus, and that grounding conductors are only terminated at grounding lugs/bus.

B. Electrical Tests: Upon installation of conductors and before electrical circuitry has been energized, provide the following minimum inspections and tests according to manufacturer's written instructions to ensure conductors are operational within industry and manufacturer's tolerances, are installed according to the Contract Documents, and are suitable for energizing.

1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration.

2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.

3. Verify continuity of each conductor.

4. Infrared Scanning: Perform an infrared scan of each splice and termination in conductors 3 AWG and larger, as follows:

a. Remove equipment covers so terminations are accessible to scanner.
b. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values.
c. Provide calibration record for device.

d. Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest.
e. Prepare reports identifying equipment checked and describing results of tests. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

5. Test Labeling: On satisfactory completion of tests and related effort, apply a label to tested components indicating test results, date, and responsible organization and person.

END OF SECTION

DIVISION 26 SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
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SECTION 260526– GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 26 Section 260519, “Low-Voltage Electrical Power Conductors and Cables”, for conductor and cable requirements.

1.2. SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.3. DEFINITIONS

A. EGC: Equipment grounding conductor.

1.4. SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product Data for grounding conductors and connectors.

C. Field tests and observation reports indicating and interpreting the test reports for compliance with performance requirements.

1.5. QUALITY ASSURANCE

A. Comply with NFPA 70 - National Electrical Code.

B. Comply with UL 467 - UL Standard for Safety Grounding and Bonding Equipment.

C. Comply with ANSI/IEEE C2 - National Electrical Safety Code.

D. Comply with ANSI/IEEE 32 - Requirements, terms and test procedures for neutral grounding devices.

E. Comply with IEEE Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

F. Comply with ANSI C33.8.

G. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms Listed and Labeled: As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

PART 2. PRODUCTS

2.1. MANUFACTURERS

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. Erico Inc.; Electrical Products Group.

2. Harger Lightning and Grounding; Harger, Inc.

3. Heary Brothers Lightning Protection Co.

4. Ideal Industries, Inc.

5. ILSCO.

6. O-Z/Gedney Co.

7. Raco, Inc.

8. Thomas & Betts, Electrical.

2.2. GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3. WIRE AND CABLE GROUNDING CONDUCTORS

A. Comply with Division 26 Section 260519, “Low-Voltage Electrical Power Conductors and Cables”. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

B. Equipment Grounding Conductors: Size as indicated on the Drawings, or as required by National Electrical Code (NEC) Table 250-122, whichever is larger. Insulated with green color insulation.

C. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.

2. Assembly of Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

PART 3. EXECUTION

3.1. APPLICATION

A. Equipment Grounding Conductors: Comply with National Electrical Code Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install Equipment Grounding Conductor (EGC) with circuit conductors for the items below in addition to those required by Code:

a. Receptacle branch circuits.
b. Single-phase motor or appliance branch circuits.
c. Three-phase motor or appliance branch circuits.
d. Flexible raceway runs.
e. Metal-clad (MC) cable runs.

3.2. INSTALLATION

A. General: Ground electrical systems and equipment according to National Electrical Code requirements, except where Drawings or Specifications exceed NEC requirements.

B. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Grounding shall satisfy requirements of the applicable publications. All exposed noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in nonmetallic raceways, and grounded conductors of the wiring system shall be grounded.

D. The grounded conductor (neutral) of the wiring system shall be connected to the system grounding conductor at a single place in the system by removable bonding jumpers, sized according to the applicable provisions of the National Electrical Code. The grounded conductor (neutral) connection to the grounding conductor (ground) shall be located in the enclosure for the system's overcurrent protection or where otherwise indicated on the Drawings or Specifications.

E. Equipment grounding conductors shall be extended from the ground bus in the distribution equipment to the receptacle, fixture or device lugs where they are provided. When not provided, they shall be connected to equipment enclosures. The connections shall be arranged such that removal of receptacle, the equipment grounding conductors, or ground jumpers from ground busing, shall not affect the system ground.

F. Ground bus shall be provided as indicated on the Drawings or as necessary to provide termination for equipment grounding conductor. Non-current carrying metal parts of electric equipment shall be effectively grounded by bonding to the bus.

G. Raceways shall not be considered as a grounding conductor. Each power, lighting, or

control raceway shall have a separate equipment grounding conductor installed. Receptacles shall have a separate grounding pole.

3.3. CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Equipment Grounding Conductor (EGC) Terminations: For 8 AWG and larger, use compression-type grounding lugs. 10 AWG and smaller grounding conductors may be terminated with wire nut connectors as specified in Division 26 Section, “Low-Voltage Electrical Power Conductors and Cables”.

C. Non-Contact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION

DIVISION 26 SECTION 260528
FIRESTOPPING FOR ELECTRICAL SYSTEMS
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SECTION 260528 – FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 26 Section 260533, “Raceways and Boxes for Electrical Systems”, for raceway seals and manufactured electrical devices.

1.2. SUMMARY

A. Section includes:

1. Through-penetration firestopping in fire rated construction.

1.3. REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory

a. Through-penetration firestop devices (XHCR)
b. Fire resistance rating (BXUV)
c. Through-penetration firestop systems (XHEZ)
d. Fill, void, or cavity material (XHHW)

B. American Society for Testing and Materials Standards: ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4. DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time-rated fire walls, time rated ceiling/floor assemblies, and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

F. Sleeve: Metal fabrication or pipe section extended through thickness of barrier and used to permanently guard penetration. Refer to Division 26 Section 260500, “Common Work

Results for Electrical", for sleeve requirements.

1.5. SYSTEM DESCRIPTION

A. Design Requirements

1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption.

1.6. SUBMITTALS

A. Submit in accordance with Division 01, unless otherwise indicated.

B. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.

2. Manufacturer's installation instructions.

1.7. QUALITY ASSURANCE

A. Installer's qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, State or local authority where applicable.

2. At least 2 years' experience with systems.

3. Successfully completed at least 5 comparable scale projects using this system.

B. Local and State regulatory requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System numbers, or UL classified devices.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

D. Manufacturer shall be a member of the International Firestop Council (IFC).

1.8. DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.

2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9. PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.

2. Furnish forced air ventilation during installation if required by manufacturer.

3. Keep flammable materials away from sparks or flame.

4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

1.10. GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fall in joint adhesion, extrusion resistance, migration resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be two years from date of substantial completion unless otherwise noted.

PART 2. PRODUCTS

2.1. MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Hilti

2. 3M

3. Nelson

2.2. THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems of devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrate type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.

2. Acceptable manufacturers and products.

   a. Those listed in the UL Fire Resistance directory for the UL System involved and as further defined in the "System and Applications Schedule" in Part 3 of this Section.
   b. All firestopping products must be from a single manufacturer.

2.3. ACCESSORIES

A. Fill, void or cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.

B. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.

C. Sleeves: Minimum 24 MSG galvanized steel, 12-inch diameter or smaller steel pipe. Sleeve shall project ½-inch from each surface of the floor/wall. Size as recommended by firestop manufacturer.

D. Box Inserts: Intumescent inserts designed for installation inside of outlet and switch boxes to help protect fire-rated assemblies.

E. Putty Pads: Moldable firestop putty designed for installation on outside of outlet and switch boxes.

PART 3. EXECUTION

3.1. EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3. INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective barrier.

C. Protect materials from damage on surfaces subject to traffic.

D. When large openings are created in walls or floors to permit installation of conduits, cable tray, or other items, close unused portions of opening with firestopping materials tested for the application.

E. Provide sleeves the full thickness of the assembly being penetrated and cut sleeves to a length of 1-inch more than the overall thickness of the penetration, or as recommended by the firestop manufacturer.

F. Provide firestop box inserts and/or putty pads for outlet boxes in fire-rated partitions.

3.4. FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.5. ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.6. SYSTEMS AND APPLICATION SCHEDULES*

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
Metal Pipe	CAJ1001 CP25S/L, CP25N/S CAJ1006 CS-195+, FS-195+ CAJ1007 FS-195+, 1-inch& 2-inch Wide CAJ1009 2000, 2000+, 2003 CAJ1010 2000, 2000+, 2003 CAJ1012 2000, 2000+, 2003 CAJ1013 2000, 2000+, 2003 CAJ1014 2000, 2000+, 2003 CAJ1015 2000, 2000+, 2003 CAJ1017 FD 150 CAJ1021 FD 150 CAJ1027 MPS-2+ CAJ1044 CP 25WB+ CAJ1052 CP 25S/L, CP 25N/S CAJ1058 2000, 2000+, 2003 CAJ1060 2000, 2000+, 2003 CAJ1063 2000, 2000+, 2003	WL1001 CP 25 WL1002 FS-195+ WL1003 CP 25WB+,CP 25N/S WL1008 2000+ WL1009 2000+ WL1010 2000+ WL1016 CP 25WB+ WL1017 CP 25WB+,CP 25N/S WL1032 CP 25WB+,CP 25N/S WL1036 FD 150 WL1037 CS-195+,FS-195+ WL1067 CP 25N/S WL1073 CP 25WB+ WL1080 MPS-2+ WL1082 2000+	FC1002 CP 25 FC1003 2000,2000+,20003 FC1006 CP 25WB+

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
	CAJ1066 CP 25N/S,CP 25S/L, CP 25WB+ CAJ1091 CP 25N/S,CP 25S/L, CP 25WB+ CAJ1092 CP 25WB+ CAJ1112 FS-195+ CAJ1160 CP 25S/L, CP 25N/S CAJ1175 CP 25WB+ CAJ1176 CP 25WB+ CAJ1188 2000+ CBJ1020 CS-195+, FS-195+ CBJ1021 CS-195+, MPS-2+ CBJ1031 2001 CBJ1032 2001 FA1002 CP 25WB+ WJ1010 CP 25WB+ WJ1023 2001		
Non-Metallic	CAJ2001 FS-195+, 1-inch& 2-inch WIDE, PPD'S CAJ2002 FS-195+ CAJ2003 CS-195+, FS-195+ CAJ2005 FS-195+ CAJ2006 FS-195+ CAJ2013 FS-195+ CAJ2019 2000, 2000+, 2003 CAJ2027 FS-195+, CP 25N/S, CP 25S/L, CP 25WB+ CAJ2028 FS-195, MPS-2+ CAJ2029 FS-195+, PPD'S CAJ2030 CS-195+, FS-195+ CAJ2040 FS-195+, CP 25WB+ CAJ2044 FS-195+, CP 25N/S, CP 25S/L CP 25 WB+ CAJ2090 FS-195+ CAJ2177 FS-195+, PPD'S FA2001 FS-195+, PPD'S FS2002 CS-195+, FS-195+, MPS-2+, PPD'S FA2011 FS-195+ WJ2012 FS-195+ 1-inch WIDE	WL2002 FS-195+, PPD'S WL2003 FS-195+ WL2004 FS-195+ WL2005 FS-195+ 4' WIDE WL2006 FS-195+ WL2013 FS-195+ WL2031 CS-195+, FS-195+ WL2032 CS-195+, FS-195+ WL2033 FS-195+ WL2073 FS-195+ 1-inch WIDE	FC2002 FS-195+, PPD'S FC2007 FS-195+, PPD'S FC2008 FS-195+ FC2009 FS-195+, PPD'S FC2024 FS-195+ FC2026 FS-195+ FC2028 FS-195+, 1' & 2-inch WIDE, PPD'S
Insulated Cable	CAJ3001 CP 25N/S, CP 25S/L CAJ3005 CS 195+, FS-195+ CAJ3007 2001 CAJ3009 2000, 2000+, 2003 CAJ3010 2000, 2000+, 2003 CAJ3011 2001 CAJ3014 FD 150 CAJ3015 FD 150 CAJ3021 MPS-2+ CAJ3029 2000, 2000+, 2003 CAJ3030 CP 25WB+ CAJ3031 CP 25N/S, CP 25S/L CAJ3041 2000, 2000+, 2003 CAJ3044 CS-195+, FS-195+ CAJ3058 FS-195+, MPS-2+ CAJ3071 CP 25N/S, CP 25S/L CAJ3074 CP 25N/S, CP 25S/L CAJ3075 2001 CAJ3080 CP 25WB+	WL3001 CP 25, MPS-2+ WL3008 2000+ WL3009 2000+ WL3015 CP 25WB+, CP 25N/S WL3022 2000+ WL3030 FS-195+ WL3031 MPS-2+ WL3032 CP 25WB+ WL3041 2000+ WL3051 CP 25N/S WL3056 CP25N/S WL3062 CP 25WB+	FC3001 CP 25S/L, CP 25N/S FC3002 2000+ FC3003 2000, 2000+, 20003 FC3007 CP 25WB+, MPS-2+ FC3008 FS-195+

PENETRATING ITEM	CONCRETE	GYPSUM	WOOD FLOOR/CEILING
	CBJ3016 CS-195+, FS-195+ CBJ3017 CS-195+, MPS-2+ FA3001 CP 25WB+ FB3004 CS-195+, MP WJ3015 2001 WJ3016 2001		
Mixed Penetrating Items Combos	CAJ8001 CS-195+ FS-195+ CAJ8003 2000, 2000+, 20003 CAJ8004 2000, 2000+, 20003 CAJ8006 2001 CAJ8013 FS-195+, CP 25 CBJ8004 CS-195, FS-195+ CBJ8005 CS-195+, MPS-2+ CBJ8008 2001 FA8001 FS-195+, CP 25WB+	WL8002 CS-195+, FS-195+	

*Underwriter's Laboratories, Inc., Fire Resistance Directory.

END OF SECTION

DIVISION 26 SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
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SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 26 Section 260500, “Common Work Results for Electrical”, for general installation requirements.

1.2. SUMMARY

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

B. Provide equipment supports consisting of structural members, hangers, rods, racks, and incidental materials.

C. Provide all labor, supervision, and fabrication. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to properly distribute the load and impact over building areas. Provide all engineering and fabrication as required for installation of support system.

D. Provide hangers, clamps, anchors, inserts, supports, supplementary steel framing, and hardware of the proper size and load capacity to support electrical equipment and raceways, whether indicated on the drawings or not.

1.3. SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 01 Specification Sections.

B. Product data for each type of product specified.

1.4. QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 National Electrical Code.

B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party Certification follow-up services.

C. Installation Standard: Installation shall meet or exceed the National Electrical Contractors Association (NECA) Standard of Installation.

D. Manufacturer's Qualifications:

1. The Manufacturer shall not have had less than ten years' experience in manufacturing Strut Support Systems.

2. The Manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.

E. All Strut Support System components must be supplied by a single manufacturer.

F. Standards:

1. Work shall meet the requirements of the following standards:

a. Federal, State and Local Codes.
b. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members.
c. American Society for Testing and Materials (ASTM).
d. Underwriters Laboratories (UL).
e. National Electrical Code (NEC).

1.5. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.6. GUARANTEE

A. Separate guarantees shall be issued from the erector and manufacturer, valid for a period of one year against any defects that may arise from the installation or manufacture of the Strut Support System components.

PART 2. PRODUCTS

2.1. MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Slotted Metal Angle and U-Channel Systems:

a. American Electric, Kindorf
b. Alstrut
c. Unistrut Diversified Products
d. Power-Strut
e. Thomas & Betts

2.2. COATINGS

A. Dry, Interior Locations: Supports, support hardware, and fasteners shall be protected with

zinc coating or with treatment of equivalent corrosion-resistance using approved alternative treatment, finish, or inherent material characteristic. All products installed in dry interior locations shall be hot-dip galvanized, unless otherwise noted.

B. Damp or Wet Locations: Supports, support hardware, and fasteners installed in damp or wet locations, including exterior locations, shall be Type 316 stainless steel.

2.3. MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features, as follows:

1. Expansion Anchors - Carbon steel wedge or sleeve type.

2. Toggle Bolts - All steel springhead type.

3. Power-Driven Threaded Studs - Heat-treated steel, designed specifically for the intended application.

C. U-Channel Systems:

1. Sixteen-gauge channels with 9/16-inch-diameter slotted holes at a minimum of two inches on center in top surface.

2. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

3. Provide plastic end caps for ends of u-channel at free-standing equipment supports (including outdoor locations), as well as u-channel supports lower than 8’-0” AFF.

2.4. ANCHOR METHODS

A. Hollow Masonry: Toggle bolts or plastic conical type expansion anchors.

B. Solid Masonry: Lead expansion anchors or preset inserts.

C. Metal Surfaces: Machine screws, bolts, or welded studs.

D. Wood Surfaces: Wood screws.

E. Concrete Surfaces: Self-drilling anchors or power-driven studs**.**

PART 3. EXECUTION

3.1. EXAMINATION

A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

3.2. INSTALLATION

A. Set Strut System components into final position true to line, level and plumb, in accordance with approved Shop Drawings.

B. Anchor material firmly in place. Tighten all connections to their recommended torques.

C. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

D. Coordinate with the building structural system and with other electrical installation.

E. Raceway Supports: Comply with the NEC and the following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.

2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.

3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

4. Support parallel runs of horizontal raceways together on trapeze-type hangers.

5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

6. Space supports for raceways in accordance with Table I of this Section. Space supports for raceway types not covered by the above in accordance with NEC.

7. Support exposed and concealed raceway within one foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminations are not made with chase nipples or threadless box connectors.

8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminations.

F. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting disconnects, light fixtures, and other devices.

G. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to the raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including, but not limited to conduits, raceways, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4-inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.

I. General Supporting Installations:

1. Provide appropriate concrete anchors for hanger rods. Rods shall be screwed into or extended through frame construction (with washer and nut). Supports shall secure conduit in place, and shall prevent vibration, provide for expansion and contraction and shall make neat appearance. Strap hangers or chains are not permitted.

2. Electrical raceways 1-1/2-inches and smaller shall be secured with 1-hole malleable iron straps or brackets to walls. Trapeze supports shall be used for groups or parallel raceways with raceways secured to trapeze with approved clamps. Individual runs of raceways 2-inches and larger shall be supported by Clevis type hangers.

3. Provide all steel supports including roof curbs for all equipment provided under this Section.

4. Electrical raceway supports to be spaced on the following maximum centers, unless otherwise required by the NEC:

a. 3/4-inch to 1-inch conduit - 8 feet
b. 1-1/4-inch and larger conduit - 10 feet

J. Provide additional hangers or steel members to distribute the load among two or more structural members when required or directed.

K. Locations:

1. Anchor bolts, sleeves, inserts, hangers, and supports required for the electrical work shall be furnished and installed under Division 26.

2. Coordinate with other trades the location of anchors, sleeves, inserts, and supports and ensure that they are properly installed.

3. Openings and sleeves shall be set true to line, level, plumb, and position and shall be set true to line, level, plumb, and position and shall be so maintained during construction. Where sleeves and openings are provided in poured concrete, inspect same during and after concrete is poured to ensure proper position and correct any deviation.

L. Hangers and Supports:

1. Provide hangers, angles, channels, and other supports required by field conditions to install items of electrical equipment. Design of supports and methods of fastening to building structure shall be acceptable to the Owner.

2. Use of power-actuated fasteners and devices is permitted in the vertical surfaces of the building only with the following requirements.

   a. For fastening conduits 1-1/2-inch and smaller and lighting fixtures 50 lbs or less.
   b. Load capacity per manufacturers' recommendations.
   c. Fasteners shall be located in the thickest part of the slab.
   d. Devices shall comply with OSHA requirements.

3. Use of lead shield expansion anchors is not permitted.

4. No electrical items shall rest on, or depend for support on suspended ceiling media (tiles, lath, plaster, splines, etc.).

5. In spaces with suspended ceilings, support conduits directly from structural slabs, decks (or framing members). Do not support conduits on ceiling suspension members.

6. Provide weight-distribution facilities, where required so as not to exceed the load bearing capabilities of floor or walls that bear the weight of, or support, electrical items.

7. For point-of-attachment weight of 100 lbs. or less, fasten items as follows:

   a. On wood, use wood screws.
   b. On concrete and solid masonry that is already in place, use self-drilling concrete anchors or expansion bolt and couplings.
   c. On hollow construction, use toggle bolts.
   d. On structural steel, use beam clamps.

8. For point-of-attachment weights from 100 lbs. to 300 lbs., provide supports as

follows:

a. At cast-in-place concrete slabs, use concrete inserts in bottom of slab, with 8" slip-through steel rods set transverse to the reinforcing steel.
b. At concrete slab already in place, uses 16-inches x 8-inches x ½-inch steel plates at the top of the slab, with through-bolts welded in place. The plates shall be chased in and grouted flush, where no fill is to be applied.

9. Equipment shall not be held in place by its own dead weight. Provide base anchor fasteners in each case.

10. Trapeze type hangers may be used where several conduits are to be installed at the same elevation. The spacing of such trapeze hangers shall be in accordance with the NEC for the smallest conduit in the run.

11. Vertical conduits shall be supported by heavy wrought iron clamps or collars anchored to construction at each floor.

M. Inserts:

1. Inserts for suspended items in poured concrete construction shall be malleable-iron concrete inserts, adjustable type with insert nut. Items manufactured by Barrett, Crawford, Elcen, or Grinnell shall be used where applicable.

2. Inserts for surface-mounted items shall be suitable for the composition of the slab, wall, or structure on which installation is to be made.

N. TABLE I: SPACING FOR RACEWAY SUPPORTS

TABLE I: SPACING FOR RACEWAY SUPPORTS				
Raceway Size (Inches)	No. of Conductors in Run	Location	PVC & RMC (Ft.)	EMT (Ft.)
		HORIZONTAL RUNS		
3/4	1 or 2	Flat ceiling or wall.	5	5
3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7
3/4	3 or more	Any location.	7	7
3/4 - 1	3 or more	Any location.		
1 & larger	1 or 2	Flat ceiling or wall.	6	6
1 & larger	1 or more	Where it is difficult to provide supports except at intervals fixed by the building construction.	10	10
1 & larger	3 or more	Any location.	10	10
Any	---	Concealed.	10	10
		VERTICAL RUNS		
1/2, 3/4	---	Exposed.	7	7
1, 1-1/4	---	Exposed.	8	8
1-1/2 & larger	---	Exposed.	10	10
Any	---	Concealed.	10	10

Abbreviations:	EMT	Electrical Metallic Tubing
	PVC	Rigid Polyvinyl Chloride Conduit
	RMC	Rigid Metal Conduit

3.3. CLEANUP

A. Upon completion of this Section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.4. PROTECTION

A. During installation, protect this work from damage.

B. Upon completion of this scope of work, it shall become the responsibility of the General Contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
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END OF SECTION 18

SECTION 260533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 26 Section 260519, “Low-Voltage Electrical Power Conductors and Cables”, for conductors installed in raceways and boxes and conductor terminations.

2. Division 26 Section 260528, “Firestopping for Electrical Systems”, for requirements for firestopping at penetrations through walls and floors that are fire barriers.

3. Division 26 Section 260529, “Hangers and Supports for Electrical Systems”, for raceways and box supports.

4. Division 26 Section 260533.23, “Surface Raceways for Electrical Systems”, for surface raceways, fittings, and accessories.

5. Division 26 Section 262726, “Wiring Devices”, for devices installed in boxes.

1.2. SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:

a. EMT
b. FMC
c. LFMC
d. PVC
e. RMC
f. RNC
g. Wireways

2. Boxes, enclosures, and cabinets include the following:

a. Device boxes
b. Outlet boxes
c. Pull and junction boxes
d. Cabinets and hinged cover enclosures

3. Miscellaneous Products include the following:

a. Expansion/Deflection fittings

b. Bushings

1.3. DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FMC: Flexible Metal Conduit.

C. LFMC: Liquid-tight Flexible Metal Conduit.

D. PVC: Rigid Polyvinyl Chloride Conduit.

E. RMC: Rigid Metal Conduit.

F. RNC: Rigid Nonmetallic Conduit.

1.4. ACTION SUBMITTALS

A. Product Data: For raceways, fittings, boxes, wireways, hinged cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5. INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. 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:

a. Structural members in paths of conduit groups with common supports.
b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

1.6. QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation" and NECA 101 “Recommended Practice for Installing Steel Conduits”.

C. Comply with NFPA 70.

1.7. COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

B. Verify routing and termination locations of conduits and boxes prior to rough-in.

C. Conduit routing shown on Drawings is only approximate and diagrammatic. Route conduits as required for a complete conduit and wiring system.

D. Coordinate final locations, mounting heights, and orientation of all outlet, junction, and pull boxes.

1.8. PROJECT RECORD DOCUMENTS

A. Accurately record routing of all concealed conduits. Record actual routing of all exposed conduits/larger than 1 inch. Indicate actual locations and mounting heights of outlet boxes, pull and junction boxes, branch circuits, arrangements, etc.

PART 2. PRODUCTS

2.1. MANUFACTURERS

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. Metal Conduit and Tubing:

    a. Allied Tube & Conduit Corporation.
    b. Anamet, Inc.; Anaconda Metal Hose.
    c. AFC/Monogram Company.
    d. Carol Cable Co., Inc.
    e. Cole Flex Corp.
    f. Electri Flex Co.
    g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    h. Grinnell Co.; Allied Tube and Conduit Div.
    i. Monogram Co.; AFC.
    j. Spiraduct, Inc.
    k. Triangle PWC, Inc.
    l. Wheatland Tube Corporation

2. Nonmetallic Conduit and Tubing:

    a. Anamet, Inc.; Anaconda Metal Hose.
    b. Arnco Corp.
    c. Breeze Illinois, Inc.
    d. Cantex Industries; Harsco Corp.
    e. Certainteed Corp.; Pipe & Plastics Group.
    f. Cole Flex Corp.
    g. Condux International; Electrical Products.

h. Electri Flex Co.
i. George Ingraham Corp.
j. Hubbell, Inc.; Raco, Inc.
k. Lamson & Sessions; Carlon Electrical Products.
l. R&G Sloan Manufacturing Co., Inc.
m. Spiraduct, Inc.
n. Thomas & Betts Corporation

3. Conduit Bodies and Fittings:

a. American Electric; Construction Materials Group.
b. Crouse Hinds; Div. of Cooper Industries.
c. Emerson Electric Co.; Appleton Electric Co.
d. Hubbell, Inc.; Killark Electric Manufacturing Co.
e. Lamson & Sessions; Carlon Electrical Products.
f. Z/Gedney; Unit of General Signal.
g. Scott Fetzer Co.; Adalet PLM.
h. Spring City Electrical Manufacturing Co.
i. Thomas & Betts Corporation.

4. Metal Wireways:

a. Hoffman Engineering Co.
b. Keystone/Rees, Inc.
c. Square D Co.

5. Boxes, Enclosures, and Cabinets:

a. American Electric; FL Industries.
b. Butler Manufacturing Co.; Walker Division.
c. Crouse Hinds; Div. of Cooper Industries.
d. Electric Panelboard Co., Inc.
e. Erickson Electrical Equipment Co.
f. Hoffman Engineering Co.; Federal Hoffman, Inc.
g. Hubbell Inc.; Killark Electric Manufacturing Co.
h. Hubbell Inc.; Raco, Inc.
i. Lamson & Sessions; Carlon Electrical Products.
j. Z/Gedney; Unit of General Signal.
k. Parker Electrical Manufacturing Co.
l. Robroy Industries, Inc.; Electrical Division.
m. Scott Fetzer Co.; Adalet PLM.
n. Spring City Electrical Manufacturing Co.
o. Thomas & Betts Corp.
p. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.2. METAL CONDUITS AND FITTINGS

A. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Metal Conduit:

1. Colored EMT: Comply with ANSI C80.3 and UL 797; Hot galvanized steel O.D. with a vibrant color top coat and an organic corrosion-resistant I.D. coating.

    a. Provide True Color® EMT as manufactured by Allied Tube and Conduit, or approved equal by listed manufacturer.

2. EMT: Comply with ANSI C80.3 and UL 797; Hot galvanized steel O.D. with an organic corrosion-resistant I.D. coating.

3. FMC: Comply with UL 1; zinc-coated steel.

4. GRC/RMC: Comply with ANSI C80.1 and UL 6.

5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

6. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040 inch (1 mm), minimum.

C. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.

4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

5. Fittings for EMT:

    a. Material: Steel.
    b. Type: Compression.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

D. Joint Compound for GRC/RMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.3. NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.

2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.4. METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include 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.

C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

D. Wireway Covers: Screw cover type.

E. Finish:

1. Dry Interior Locations: Manufacturer's standard enamel or galvanized finish, NEMA 1.

2. Damp/Wet Locations: ANSI 49 gray polyester over phosphatized steel, NEMA 3R.

2.5. OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized flat-rolled sheet steel.

B. Cast Metal Boxes: NEMA FB 1, Type FD, cast box, deep type, with gasketed cover, and threaded hubs.

C. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including corrosion-resistant screws, mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.

2.6. PULL AND JUNCTION BOXES

A. Boxes for dry interior locations:

1. Small Sheet Metal Boxes: NEMA OS 1, galvanized flat-rolled sheet steel.

B. Boxes for Outdoor and Wet Locations: Flat flanged, surface-mounted, UL listed as raintight, galvanized cast iron box and cover with neoprene gasket and stainless-steel cover screws.

2.7. BOX EXTENSIONS

A. Where more than one box is needed to flush out installation, provide a large (i.e., 6" x 6") box to flush out the existing box and nipple over to a new box.

2.8. BUSHINGS

A. Bushings shall be self-extinguishing thermoplastic type with 105 degrees C (minimum) temperature rating.

B. Bushings with grounding lugs shall be malleable iron body with 105 degrees C (minimum) insulating ring. Insulating material shall be locked in place and non-removable.

2.9. EXPANSION / DEFLECTION FITTINGS

A. Provide an expansion/deflection fitting in each concealed or exposed electrical run crossing a building expansion joint. Fittings shall be complete with bronze end couplings, neoprene sleeves, tinned copper braid integral bonding jumper and stainless-steel bands. Expansion/deflection fittings shall be suitable for the size and type of conduit run they connect. Bonding jumper shall comply with NEC and UL requirements.

B. Expansion/deflection fitting shall accommodate the following movements without collapsing or fracturing the conduit and damaging the wires it contains:

1. Axial expansion or contraction up to 3/4-inch.

2. Angular misalignment of the axes of the conduits up to 30 degrees in all directions.

3. Parallel misalignment of the axes of the conduits up to 3/4-inch in all directions.

C. Expansion/Deflection fitting shall be OZ/Gedney Type "DX" or approved equal by Crouse Hinds (Type XD).

2.10. ENCLOSURES AND CABINETS

A. Hinged Cover Enclosures: NEMA 250, Type 1 in dry locations, and Type 4 in wet or damp locations, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and

removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3. EXECUTION

3.1. EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2. RACEWAY AND BOX REQUIREMENTS

A. Conduit Application Schedule:

APPLICATION	CONDUIT TYPE	REMARKS
Exposed exterior locations.	RMC	Use threaded or rain-tight fittings and stainless steel hardware.
Damp/Wet interior locations.	RMC	Use threaded or rain-tight fittings and stainless steel hardware.
Exposed dry interior locations	EMT, RMC	Schedule 40 PVC is acceptable for concealing grounding electrode conductors, except for plenum spaces. Provide RMC conduit where subject to physical damage.
Exterior underground.	RNC (Sched. 40 PVC) RMC	RMC Elbows/Sweeps unless otherwise noted on the Drawings. Coat RMC with two heavy coats of asphaltum, or provide PVC-coated RMC.
Equipment connections in dry interior locations.	FMC (e.g. Greenfield)	Short lengths only (maximum 6 feet).
Equipment connections in wet interior locations.	LFMC (e.g. Sealtite)	Short lengths only (maximum 6 feet). Use threaded or rain-tight fittings and stainless steel hardware.
Equipment connections in exterior locations.	LFMC (e.g Sealtite)	Short lengths only (maximum 6 feet). Use threaded or rain-tight fittings and stainless steel hardware.
Concealed in dry wall construction.	EMT, MC Cabling	Refer to Division 26 Section 260519, “Conductors and Cables”, for MC Cable Requirements.
Concealed above suspended ceilings.	EMT, MC Cabling	Refer to Division 26 Section 260519, “Conductors and Cables”, for MC Cable Requirements.

B. General Requirements

1. Provide hot-dip Rigid Metal Conduit (RMC) for exposed work in locations subject to physical damage and for work in damp/wet locations .

2. Where rigid non-metallic conduit is exposed, it shall be Schedule 80 PVC, with all

provisions for thermal expansion/contraction as recommended by the Manufacturer.

3. Conduits for exterior underground electric work shall be rigid steel, galvanized and sherardized, leaving the building and to points 5 feet beyond footings. Beyond 5 feet of building, underground conduits shall be non-metallic Schedule 40 PVC, Type II.

4. Elbows for conduits turning up through slabs and/or equipment pads shall be rigid metal conduit (RMC) unless otherwise noted on the Drawings or required by the electric utility.

5. All steel conduits below grade or in contact with earth shall be PVC-coated or painted with two heavy coats of asphaltum.

6. Provide hot-dip Rigid Metal Conduit (RMC) with bonded PVC jacket (Plastic-Bond or Kor-Kap) for work not completely encased in concrete but laid directly in or in contact with ground or on a vapor barrier and additionally, as directed.

7. Aluminum conduit is prohibited.

C. Fittings:

1. All fittings to match conduit material and to be suitable for the purpose intended. Join conduit with fittings designed and approved for the purpose and make joints tight.

2. Fasten EMT conduit with concrete-tight or rain-tight compression fittings made from zinc-plated steel. Fittings using set screw or indentations as a means of attachment or made from cast "white metal" are prohibited. All connectors shall have insulated throats.

3. Fasten rigid metal conduit with threaded galvanized steel fittings, double locknuts, and insulated bushings. Insulated bushings shall be OZ/Gedney type "B", or equal.

4. Fasten Flexible Metallic Conduit (FMC) with Thomas & Betts (T&B) "Tite-Bite" insulated connectors, or equal.

5. Fasten liquid-tightconduit with fittings incorporating a threaded ferrule, nylon sealing ring, and steel or malleable iron compression nut and body. Furnish Crouse Hinds metallic liquid-tight fittings, or equal.

6. Watertight fittings shall use a copper base anti-corrosive conductive compound. Provide watertight fittings for conduits in damp or wet locations and underground locations.

7. Provide UL listed compound filled sealing fittings for NEC-required locations, for conduits passing from interior to exterior, and at the interface of widely different space temperatures such as refrigeration or cold storage rooms where conduits pass from warm locations to cool locations, such as the boundaries of air-conditioned spaces and non-conditioned air spaces. For concealed conduits, install each fitting

in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

8. Provide expansion fittings with bonding jumpers where conduits cross expansion joints or where otherwise required to compensate for thermal expansion and contraction. Provide expansion fittings in each straight uninterrupted run of surface-mounted conduit, both horizontal and vertical, in excess of 200 feet. Distance between fittings shall not exceed 200 linear feet. The Contractor shall refer to the Architectural Drawings for expansion joint locations.

D. Conduit Bodies:

1. Conduit bodies shall be selected such that the conduit body access is parallel with the face of the adjacent box, enclosure, wall, etc.

2. LB conduit bodies shall be provided where the change in direction is to the back (e.g. through a wall).

3. LR conduit bodies shall be provided where the change in direction is to the left.

4. LL conduit bodies shall be provided where the change in direction is to the right.

5. C-Shaped conduit bodies shall be provided for straight runs with no change in direction.

6. T-Shaped and X-Shaped conduit bodies shall be provided where there are multiple changes in direction.

E. Box Locations:

1. Electrical boxes shall accommodate wire pulling, splices, taps, equipment connections and Code compliance.

2. Coordinate access doors as required to provide access to boxes in hard ceilings and similar inaccessible areas.

F. Outlet Boxes:

1. Outlet boxes for dry interior locations and for concealed work shall be zinc-coated or cadmium-plated sheet steel boxes suitable for the service and type outlet.

2. Boxes and conduit fittings for damp or wet locations and exposed locations subject to damage shall be NEMA 4 cast-aluminum, cast steel or cast-iron type with gasketed cover plates and threaded hubs for conduit entrance.

3. Extra-large boxes shall be provided in accordance with the National Electrical Code where necessary to prevent crowding of wire in the box.

4. Plastic boxes and cast "white metal" boxes classified as NEMA 4 will not be acceptable.

5. All boxes, whether outlet, junction, pull, or equipment, shall be furnished with

appropriate covers.

6. No sectionalized boxes shall be used.

7. Back-to-back outlet boxes are not permitted. Separate boxes a minimum of 6" in standard walls and a minimum of 2 feet in acoustical walls.

8. Outlet boxes in fire-rated partitions shall have firestop box inserts and/or firestopping putty pads. Refer to Division 26 Section 260528, “Firestopping for Electrical Systems”, for additional information.

9. Provide factory-made knockout closures for unused openings in outlet boxes.

10. Provide blank coverplates for all unused boxes.

11. Provide recessed outlet boxes in finished areas, supported from interior partition studs. Supports are to be stamped steel stud bridges for hollow stud walls and adjustable steel channel fasteners for flush ceiling outlet boxes.

12. Provide back supports for boxes in metal stud walls.

G. Junction and Pull Boxes:

1. Junction and pull boxes shall be furnished and installed as shown or where required to facilitate pulling of wires or cables. Such boxes shall be installed in accessible locations. All boxes for concealed work shall be constructed of 12-gauge USS galvanized sheet steel minimum, unless otherwise specified or indicated and provided with mounting brackets and flat screw covers secured in position by round head brass or stainless steel 300 grade machine screws. Boxes for exterior work shall be cast aluminum or galvanized cast iron type with threaded hubs unless otherwise directed. Gasketed cover plates shall be furnished for outdoor installation.

2. Provide barrier (separators) where conductors with different system voltages share the same box.

3. Wherever possible, locate pull and junction boxes above accessible ceilings in finished areas.

4. Pull or junction boxes shall be supported independently of conduit.

3.3. INSTALLATION OF RACEWAYS

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Furnish and install a separate and independent raceway system as shown on the Drawings for each of the various wiring systems including, but not limited to, the following:

1. Control Wiring

2. Fire Alarm System

3. Power 120/208 volt

4. Power 277/480 volt

C. All raceway systems shall be completely wired as specified herein, shown on drawings and/or required for satisfactory operation of the various systems.

D. Raceways, generally, shall be concealed conduit as specified herein. Where wiring troughs are required or used to facilitate the wiring installation, they shall be equal to Square D Company's Square-Duct and fittings, with hinged cover arranged for total removal, all finished in baked enamel and all components U/L listed. The gutters shall be of ample size to accommodate conductors therein and as required by the NEC.

E. Raceways or conduits entering buildings or structures from outside shall be sealed, including spare or unused raceways. Sealants shall be identified for use with the cable/conductor insulation.

F. Raceways or conduits installed underground shall be sealed or plugged at both ends, including spare or unused raceways. Sealants shall be identified for use with the cable/conductor insulation.

G. Support all conduit not embedded in concrete or masonry such that strain is not transmitted to outlet boxes and pull/junction boxes, etc. Supports to be sufficiently rigid to prevent distortion of conduits during wire pulling.

H. Minimum Raceway Size:

1. 3/4-inch trade size for interior work

2. 1-inch trade size for exterior underground work.

I. Conceal raceways within finished walls, ceilings, and floors wherever possible, unless otherwise indicated.

J. Electrical Metallic Tubing (EMT) shall be used for the following unless otherwise indicated:

1. Branch circuits for lighting, receptacles, and power concealed in:

a. Dry wall construction.
b. Hard ceilings, e.g. gypsum, etc.
c. Masonry walls.

2. Exposed in equipment room areas as needed to serve fixed equipment.

3. Circuits for communication and signaling concealed in:

a. Dry wall construction.
b. Hard ceilings, e.g. gypsum, etc…

K. Rigid Metal Conduit (RMC) shall be used for the following, unless otherwise indicated:

1. Branch circuits for lighting, receptacle and power, installed exposed in areas subject to physical damage.

2. Circuits for communication and signaling exposed in areas subject to physical damage.

L. Control, Automatic Temperature Control (ATC), and Fire Alarm system wiring shall be installed in raceways within partitions, terminated 8" above accessible ceiling with 90 degree bend with insulating bushing on the end. Free-run cabling above accessible ceilings shall be supported by J-hooks and/or bridle rings at required spacing intervals. Cabling above inaccessible ceilings and in exposed locations shall be installed completely in raceway.

M. Wiring above ceiling shall be plenum rated cable, where required by Code.

N. Wiring installed concealed above hard ceilings and exposed in areas with no ceilings shall be installed in conduit.

O. Conduit shall be run concealed wherever possible, within walls, ceilings, or floors, unless otherwise indicated or specified. Where exposed conduits runs are shown or required, they shall be run parallel to building construction and shall be suitably supported at required intervals.

P. Conduit may be run exposed in Mechanical Equipment rooms, Electrical rooms, and where necessary in Storage rooms and unfinished areas. Where conduit is run exposed, it shall be run as close as possible to walls and ceilings and shall not interfere with equipment, ductwork and piping.

Q. Keep raceways at least 12 inches (300 mm) away from parallel runs of flues, steam or hot water pipes and other hot surfaces above 77 degrees F. Install horizontal raceway runs above water and steam piping.

R. Install raceways level and square and at proper elevations. Provide adequate headroom.

S. Complete raceway installation before starting conductor installation.

T. Support raceways as specified in Division 26 Section 260529, "Hangers and Supports for Electrical Systems". Arrange supports to prevent misalignment during wiring installation.

U. Use capped bushings or "push-penny" plugs to prevent foreign matter from entering the conduit system during construction. Clean and plug or cap all conduits left empty for future use.

V. Make bends and offsets so the inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

W. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

X. Run concealed raceways, with a minimum of bends, in the shortest practical distance

considering the type of building construction and obstructions, unless otherwise indicated.

Y. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

Z. Run parallel or banked raceways together, on common supports where practical.

AA. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

BB. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

2. Use insulating bushings to protect conductors.

CC. Tighten set screws of threadless fittings with suitable tools.

DD. Install pull wires in empty raceways. Use 14 AWG zinc coated steel or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

EE. Lubricants for pulling wires shall be approved for use with the types of wire and conduit installed.

FF. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

GG. Use conduit hubs to fasten conduit to boxes in damp and wet locations.

HH. All metal raceways for circuits over 250-volts to ground shall be bonded per NEC Article 250.97.

II. Install no more than equivalent of three 90° bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inches (50 mm) in size.

JJ. Avoid moisture traps; provide junction box with drain fittings at low points in conduit system.

KK. Die-cast fittings of pot metal will not be accepted.

LL. Conduits shall be free of any burrs, foreign objects, and water prior to conduit installation.

MM. Conduit placed against concrete or masonry above ground shall be fastened to the concrete or masonry with pipe straps or one screw clamp attached to the concrete by means of expansion screw anchors and screws. "Caddy Clip" type hangers or straps will be permitted only in non-exposed areas and restricted to 3/4" conduit.

NN. Rigid conduit or Electrical Metallic Tubing (EMT) shall not be strapped or fastened to

equipment subject to vibration or mounted on shock-absorbing bases.

OO. Conduit shall be installed in such manner as to ensure against the collection of trapped condensation, and runs of conduit shall be without traps wherever possible. Drill 1/8" diameter weep holes where necessary.

PP. Conduits run to and from cabinets shall be run neatly, in accurate manner and shall emerge from the floors and ceilings at right angles thereto.

QQ. Provide wall flanges and gasketing on conduits entering fan housings to minimize air leakage at points of penetration of housing.

RR. Conduit risers shall be rigidly supported on the building structure, using appropriate supports only.

SS. Exposed conduit installed on or adjacent to ventilating ducts shall be installed after the ducts are in place, and shall be run from ceiling or wall junction boxes in such manner as to retain accessibility to junction box covers and to permit future removal or replacement of ducts.

TT. Conduits and other electrical items shall not be fastened to, or supported from ventilating ducts but shall be separately supported. The method of supporting and details of the supporting members shall be reviewed by the Owner's Representative. In no case shall screws penetrate the sheet metal of the ducts.

UU. Exposed conduit run on surface shall be supported according to Code and within three feet of each outlet, junction box, or cabinet, by galvanized malleable conduit clamps and clamp backs. Suspended conduits shall be supported every five feet by conduit hangers and round rods, or where two or more conduits are run parallel, by trapeze hangers suitably braced to prevent swaying.

VV. Screws and other hardware for all work in damp/wet locations shall be stainless steel, unless otherwise noted.

WW. Zinc coated galvanized steel screws may be used for interior dry locations only.

XX. No running threads shall be cut or used.

3.4. INSTALLATION OF BOXES

A. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.

B. Provide junction boxes, pull boxes, cable support boxes, and wireways as required for proper installation of the electrical work. Covers shall be accessible. Small junction boxes shall be similar to outlet boxes. Provide barriers (separators) where different system voltage wires share the same box.

C. Pull boxes, cable support boxes, and large junction boxes for indoor use shall be made of

Code gauge steel or no less than 12 gauge. Covers shall be held in place with zinc-coated galvanized steel screws. Paint interior and exterior surfaces with rust-inhibitive paint. (Pull boxes and covers shall be hot-dipped galvanized.)

D. Boxes located outdoors and in damp or wet locations shall be cast metal or alloy, fitted with screw-fastened covers and gaskets, and with threaded conduit connections. Fasteners shall be stainless steel.

E. Pull boxes shall be installed at all necessary points to facilitate pulling of wires and to prevent injury to the insulation or other damage that might result from pulling resistance or for other reasons necessary for proper installation. Pull box locations shall be approved by the Owner's representative prior to installation.

F. Where boxes are used in connection with exposed conduit, plain covers attached to the box with a suitable number of countersunk flat head machine screws shall be used.

G. Pull boxes with barriers shall have a single cover plate and the barriers shall be of the same gauge as the pull box.

H. Exposed pull boxes will not be permitted in finished spaces.

I. Location of pull boxes shall be coordinated with piping, ductwork, and other equipment so as to permit sufficient clearance for maintenance and access.

J. Pull boxes recessed in walls or partitions shall be provided with flanged type covers.

K. Outlet boxes and covers shall be of proper Code size for the number of wires and/or conduits passing through or terminating therein, as well as the quantity, type, and dimensions of wiring device(s) installed therein. In no case shall any box be less than 4" square. Special attention shall be paid to boxes with deep wiring devices, E.G., GFCI receptacles.

L. Each circuit in each pullbox shall be marked with a tag guide denoting panels to which they connect.

M. Outlet boxes shall be provided with suitable plaster rings and covers or plates.

N. Unused knockout holes shall remain closed and those opened by error shall be closed with approved factory-made knock-out seals.

O. Outlet boxes installed in plenum ceilings shall be in accordance with applicable codes.

P. Outlet boxes shall be installed true and plumb so that the covers or plates will be level and at uniform elevations for the types of outlets contained.

Q. Outlet box locations as indicated shall be considered to be approximate only. Determine exact locations from architectural details or from field instructions and coordinate outlet box locations with the work of other trades.

R. Install junction and pull boxes to be accessible.

S. Locations of junction and pull boxes requiring access panels shall be reviewed by the

Owner's Representative.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner at minimum.

3.5. INSTALLATION OF TERMINATIONS

A. Where raceways are terminated with lock nuts and bushings, align the raceway to enter squarely, and install the lock nuts with dished part against the box. Where terminations cannot be made secure with one lock nut, use two lock nuts, one inside and one outside of the box.

B. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

C. Open ends shall be capped with approved manufactured conduit seals as soon as installed and kept capped until ready to pull in conductors.

D. Where conductors enter a raceway, cabinet, pull box, and junction box, the conductors shall be protected by an insulated bushing providing a smoothly rounded surface.

E. Water tight hubs shall be used at termination of rigid conduit in knock-out openings.

F. Ends of conduits shall be equipped with insulating bushings for 1" and smaller, and insulated metallic bushings for 1-1/4" and larger. Ends of conduit shall be temporarily capped prior to installation and during construction to exclude foreign material.

3.6. FLEXIBLE CONNECTIONS

A. Provide Liquidtight Flexible Metal Conduit (LFMC), e.g. Sealtite, in short lengths (maximum 6 feet) for the final connection of exterior equipment, motors and equipment in damp or wet locations as defined in Division 26 Section 260500, “Common Work Results for Electrical”.

B. Grounding conductors with green colored insulation shall be extended through all flexible connections including fixture "whips", and fastened to terminals within the first junction boxes on either side of the flexible length.

C. Flexible connections shall be sized per the Contract Drawings, or as required in accordance with Code; the more stringent requirement shall apply.

3.7. PAINTING AND FINISHES

A. All new exterior equipment and conduits shall be painted to match adjacent surface in color as selected by Owner.

B. All new exposed conduit, boxes, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Owner and conform to ANSI Standards.

C. Conduit and boxes for fire alarm cabling and devices shall be red, except for finished locations, where they shall be painted to match adjacent surfaces.

D. Paint all steel conduits in contact with earth with two coats of asphaltum for corrosion protection.

3.8. PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

B. Repair damage to galvanized finishes with zinc rich paint recommended by manufacturer.

C. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

D. Steel conduit: Conduit that shows corrosion within the guarantee period shall be replaced.

3.9. CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

B. After conduits and accessories have been installed, and concreting operations completed, conduit runs shall be satisfactorily cleared of obstructions and foreign matter. Defects which might damage cable upon installation shall be corrected. Where new conduits installed are connected to existing conduits the entire run to the nearest box or other termination point shall be cleaned.

END OF SECTION

DIVISION 26 SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS
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SECTION 260533.23 – SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SCOPE

A. This specification covers surface raceway systems used for branch circuit wiring or data network, voice, video and other low-voltage wiring. The raceway systems shall consist of raceway, appropriate fittings and device boxes to complete installation per the Electrical Drawings.

B. In finished spaces, where conduit cannot be concealed and/or routed through existing walls, surface raceway shall be used. This applies to devices and equipment under Division 23 (e.g. thermostats, humidistats, control wiring, etc…), Division 26 (e.g. receptacles, switches, branch circuit wiring, etc…) and Division 28 (e.g. fire alarm devices, cabling, etc…)

C. The successful bidder shall visit the site to determine existing wall types and locations.

1.3. CLASSIFICATION AND USE

A. Surface raceway is to be utilized in dry interior locations only as covered in Article 386 of the National Electrical Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute. Surface raceway systems shall be listed by Underwriters Laboratories under File Nos. E4376 Guide RJBT and E41751 Guide RJPR.

1.4. SUBMITTALS

A. Submittals shall include catalog cuts of mounting devices, material sections, accessories, internal area descriptions, and wiring capacity charts. Submit sample of finish colors for final selection and approval.

1.5. EXTRA MATERIALS

A. Touchup Paint: Furnish one (1) standard size canister of manufacturer's touch-up paint, finish to match standard raceway finish as specified herein. Provide one (1) canister for each raceway type and each raceway finish/color.

PART 2. PRODUCTS

2.1. MANUFACTURERS

A. The surface metal raceway system specified herein for branch circuit wiring or low-voltage wiring shall be manufactured by The Wiremold Company, Hubbell, or Steel City. Systems of other manufacturers may be considered equal if, in the opinion, and the written approval of the Engineer, they meet all the performance standards specified herein.

2.2. MATERIALS

A. The raceway and all system components must be UL Listed. They shall be manufactured of steel; zinc plated, galvanized and/or finished in ScuffCoat™ (a polyester topcoat over base) and shall be suitable for field repainting to match surroundings.

2.3. SINGLE-CHANNEL SURFACE METAL RACEWAY

A. Description: The raceway shall be a one-piece design with a base and cover factory assembled. Nominal raceway dimensions shall be 3/4" wide by 21/32" deep, with an approximate cross-sectional area of 0.30 square inches. The raceway base and cover shall have an approximate thickness of 0.040". The raceway shall be available in five and ten foot lengths.

B. Fittings: A full complement of fittings must be available including but not limited to mounting clips and straps, couplings, flat, internal and external elbows, cover clips, tees, entrance fittings, conduit connectors and bushings. The covers shall be painted with an enamel finish, color to match the raceway. They shall overlap the raceway to hide uneven cuts. All fittings shall be supplied with a base where applicable. A transition fitting shall be available to adapt to other raceways.

C. Device Boxes:

1. Device boxes shall be available for mounting standard devices and faceplates. A device box shall be available in single- and multiple-gang configurations, up to six-gang. Single-gang boxes shall allow for snap-on and fastener application. Minimum depth shall be 2-1/4".

2. Provide extra deep boxes (nominal 4” depth) where required to accommodate large devices.

3. Extension boxes shall be available to adapt to existing standard flush switch and receptacle boxes.

4. Round fixture and extension boxes shall be available to mount fixtures and other devices with mounting centers of 1-15/32", 1-5/8", 1-23/32", 1-27/32", 2-3/4", 3-1/2" and 4-1/16" diameters. Round fixture and extension boxes shall be available in depths ranging from 0.47" to 1.00" and in diameters of 3.00", 4.75", 5.50" and 6.38".

D. Finish: Raceway components (e.g. base, cover, boxes, fittings, etc.) shall be painted with an enamel finish, white.

E. Basis of Design: Wiremold V700 Series raceway with 5700 Series device boxes.

PART 3. EXECUTION

3.1. EXAMINATION

A. Examine surfaces to receive surface raceways for compliance with installation tolerances and other conditions affecting performance of surface raceway installation.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2. GENERAL REQUIREMENTS

A. Surface metal raceways shall only be utilized where devices and/or wiring cannot be concealed in existing walls, unless otherwise indicated on the Contract Documents.

1. New devices installed in existing metal stud/GWB walls shall be cut in with conduit/wiring concealed within the wall.

2. New devices installed on existing CMU walls, where devices cannot be concealed, shall be installed in surface-mounted device boxes as specified in this section served by surface metal raceway as specified in this Section.

B. Exposed wiring on existing walls in finished areas, (e.g. offices, corridors, toilets, etc.), shall be installed in surface raceways.

C. Exposed raceways shall be run in corners, adjacent to door trims, and in other ways to be as inconspicuous as possible, even when requiring additional lengths.

D. All exposed raceways shall be installed in a manner approved by the Architect/Engineer.

E. Exposed raceway runs shall not be across an open wall surface.

F. Horizontal runs of raceways shall be kept to an absolute minimum. Exposed raceways shall be run vertically into ceiling spaces above and below.

3.3. INSTALLATION

A. Prior to and during installation, refer to system layout or approval drawings containing all elements of the system. Installer shall comply with detailed manufacturer's instruction sheets which accompany system components as well as complete system instruction sheets, whichever is applicable.

B. Mechanical Security: All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, also in accordance with manufacturer's installation sheets.

C. Electrical Security: All metal raceway shall be electrically continuous and bonded in accordance with the National Electrical Code for proper grounding.

D. Raceway Support: Raceway shall be securely supported at intervals not exceeding 10 feet or in accordance with manufacturer's installation sheets.

E. Completeness: All raceway systems shall be installed complete, including insulating bushings and inserts, appropriate fittings, and mounting hardware. All unused raceway openings shall be closed. All fittings shall be furnished by the raceway manufacturer.

F. Provide grounding per the National Electrical Code and Local Codes. Maintain grounding continuity between raceway components to provide a continuous grounding path.

G. All surface metal raceways shall be installed parallel with and perpendicular to the

structure. All exposed edges where field cut, shall be coated by the Contractor to prevent corrosion, and field-painted to match surface raceway finish.

H. Field cut straight cover sections between specific device covers.

I. Use flat-head screws to fasten channel to surfaces. Mount plumb and level. Channels shall be secured at least every four feet (1220mm) with two-hole straps.

J. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

K. Fastener Option: Use clips and straps suitable for the purpose.

L. Provide UL-approved expansion fittings, complete with grounding jumpers, where raceways cross building expansion joints.

M. Allow a minimum of 6-inches (152 mm) clearance from heat sources.

N. Surface raceways shall be visually seamless, without gaps between sections. Gaps exceeding the width of 1/16-inch shall be corrected to reduce width of gap.

O. Cut ceiling tiles tight to surface raceway, within a ¼-inch tolerance. Ceiling tile not cut tight to raceway shall be replaced at Contractor's expense.

3.4. PAINTING AND FINISHES

A. All exposed surface raceway, boxes, etc. in finished spaces shall be painted to match adjacent surface(s) unless otherwise directed by the Owner.

B. Raceway surfaces damaged during installation shall be touched up with raceway manufacturer's matching paint.

C. Paint all screws and scratches to match surface raceway.

D. Colors shall be as selected by the Owner and shall conform to ANSI Standards.

END OF SECTION

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IDENTIFICATION FOR ELECTRICAL SYSTEMS
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SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 26 Section 260573, “Power System Studies”, for arc-flash hazard labels for electrical equipment.

2. Division 26 Section 262416, “Panelboards”, for circuit directories to be installed in panelboards.

1.2. SUMMARY

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

B. This section includes labeling of all terminations and related subsystems; including, but not limited to, nameplates, wire and cable markers, labeling and identification of cables, equipment and other products.

1.3. SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4. QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

D. Comply with applicable EIA/TIA Standards.

E. Comply with OSHA Standards.

1.5. DEFINITIONS

A. Emergency systems include, but are not limited to, fire alarm systems, etc.

PART 2. PRODUCTS

2.1. RACEWAY AND CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

1. Color: Black letters on orange field.

2. Legend: Indicates voltage and service.

B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend, overlaminated with a clear, weather- and chemical-resistant coating.

C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 3/4 inch wide, in appropriate colors for system voltage and phase.

E. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

2.2. WIRING DEVICE FACEPLATE LABELS

A. Adhesive Labels:

1. Thermal transfer printable, clear polyester material with glossy finish, 1/2" high, width as required. Printed lettering shall be 1/4" high black text.

2. Labels shall be backed with permanent acrylic adhesive and shall exhibit good adhesion to many metal and other types of surfaces, including textured surfaces and low surface energy plastics.

3. Labels shall be resistant to humidity, temperature and UV light.

4. Labels shall meet requirements of UL 969 Labeling and Marking Standard and shall be RoHS compliant.

5. Provide Brady B-432 Series, or approved equal by acceptable manufacturer.

2.3. EQUIPMENT NAMEPLATES

A. General Nameplate Requirements:

1. Use colors prescribed by ANSI A13.1, NFPA 70 and as follows:

a. Normal Power System: White lettering on black background.

2. Backed with adhesive material formulated for the type of surface, intended use and installed location. 1/4-inch grommets in corners for mounting with self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

B. Nameplates for Dry, Interior Locations:

Engraving stock, melamine 3-layer plastic laminate.

1. Minimum 1/16-inch (1.6-mm) thick for signs up to 20 sq. inches (129 sq. cm)

2. Minimum 1/8-inch (3.2-mm) thick for signs larger than 20 sq. inches.

C. Nameplates for Damp/Wet Interior and Exterior Locations:

1. Weather-resistant, UV Resistant, minimum 1/8-inch (3.2-mm) thick.

D. Refer to Contract Drawings for typical nameplate details.

E. Refer to Paragraph "Equipment Identification Nameplates" under Part 3 of this Section for installation requirements.

2.4. MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength: 50 lb (22.3 kg) minimum.

3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

4. Color: According to color-coding.

B. Paint: Formulated for the type of surface and intended use.

1. Primer for Galvanized Metal: Single-component acrylic formulated for galvanized surfaces.

2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.

3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.

4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3. EXECUTION

3.1. INSTALLATION

A. General:

1. Where mixed voltages are used in one building (e.g., 480 volts, 208 volts), each new piece of equipment, including but not limited to, outlet/pull/junction boxes, etc., on each system must be labeled for voltage in addition to other requirements listed herein.

2. Before attaching labels, clean all surfaces with the label manufacturer's recommended cleaning agent.

3. Install all labels firmly, as recommended by the label manufacturer.

4. Labels attached to wiring device faceplates and electrical equipment shall be installed plumb and neatly on all equipment.

5. Install nameplates/labels parallel to equipment lines.

6. Install nameplates/labels on equipment fronts/covers unless otherwise noted.

7. Install nameplates/labels on inside face of equipment door/cover, including junction boxes, where exposed in finished spaces.

8. Embossed tape will not be permitted for any application.

9. Stenciling is prohibited.

10. Labels: All labels shall be permanent and be machine-generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED.

11. Label size shall be appropriate for the conductor/cable size(s), and wiring device faceplate layout. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the conductor/cable sheath. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

B. Miscellaneous Identification:

1. Individual circuit breakers and in distribution panelboards: 1/4-inch (6 mm) text; identify circuit and load served, including location.

2. Individual circuit breakers, enclosed switches, and motor starters: 1/2-inch (13mm) and 1/4-inch (6 mm) text; identify load served, circuit and voltage.

3. Junction boxes: 1/4-inch (6 mm) text; identify load served, circuit and voltage.

C. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

D. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

E. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

F. Self-Adhesive Identification Products: Clean surfaces before applying.

G. Caution Labels for Boxes and Enclosures: Provide pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background.

H. Circuit Identification Labels on Boxes:

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.

2. Concealed Boxes: Plasticized card-stock tags.

3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

I. Branch-Circuit Conductors: Color-code throughout the secondary electrical system. Refer to Division 26 Section 260519, “Low-Voltage Electrical Power Conductors and Cables”, for additional requirements.

J. Power-Circuit and Control Wire Identification: For each conductor, cable and power circuit in panelboard gutters, outlet boxes, junction boxes, pull boxes, and at load connections. Identify branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

1. Self-Adhesive Labels

a. Legend: 1/4-inch letter and number, typewritten

K. Apply identification to conductors as follows:

1. Conductors to be Extended in the Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.

3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

L. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

M. Equipment Identification Nameplates

1. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification.

2. Install on each piece of equipment provided with factory installed disconnecting means, e.g. single zone VAV units, where a separate external disconnecting means is not provided under Division 26.

3. Unless otherwise noted, nameplates shall identify equipment designation(s), voltage rating, and source (including source locations).

4. In general, nameplates requiring one or two lines of text shall be 1-1/2 inches high. Labels requiring three lines of text shall be 2 inches high. The first line of text, which shall indicate equipment designation/load served, shall utilize ½ inch high lettering. Remaining lines of text, which shall indicate voltage ratings and source information shall utilize ¼ inch high lettering. Refer to the Drawings for nameplate examples.

5. Apply nameplates to each unit of the following categories of equipment:

   a. Panelboards
   b. Electrical Cabinets and Enclosures
   c. Access Doors and Panels for Concealed Electrical Items.

N. Fire Alarm: Junction box covers shall be painted red, except in finished spaces where they shall be painted to match adjacent surfaces. Box covers shall have a type written label to read “Fire Alarm” in accordance with requirements of NFPA 72.

O. Surfaces shall be cleaned and painted, if specified, before applying markings.

P. Place markings so that they are visible from the floor.

Q. Protect finished identification to ensure that markings are clear and legible when project is turned over to the Owner.

END OF SECTION

DIVISION 26 SECTION 260573
POWER SYSTEM STUDIES
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SECTION 260573 – POWER SYSTEM STUDIES

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SCOPE

A. Power system studies shall be performed on and include all portions of the electrical distribution system. The power system studies shall include the following:

1. Short-circuit analysis with protective device evaluation

2. Protective device time-current coordination analysis

3. Arc flash hazard analysis

B. The power system studies shall begin at the existing overcurrent protective device ahead of the existing pad-mounted utility-owned medium-voltage transformer, to the 480Y/277V main distribution panelboard (MDP) and continue through the 480Y/277V distribution systems to the existing branch panelboards, including dry-type transformer, to new mechanical equipment.

C. The power system studies shall also include the on-site emergency/standby power supply system, including the on-site generator, transfer switch(es), and associated electrical distribution equipment.

D. The short-circuit analysis shall, at a minimum, include determining the available fault current at the following equipment:

1. Existing service equipment in accordance with NEC Article 110.16(B).

2. Existing panelboards affected by the work in accordance with NEC Article 408.6.

3. New single-zone VAV units in accordance with NEC Article 440.10.

E. The arc flash hazard analysis shall be per the requirements set forth in the current version of NFPA 70E – Standard for Electrical Safety in the Workplace, and shall be performed according to the latest edition of IEEE Standard 1584, the IEEE Guide for Performing Arc-Flash Calculations.

1.3. REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.

2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial

and Commercial Power Systems.

3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.

4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.

5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

6. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.

3. ANSI C37.010 – Standard Application Guide for AC High Voltage Power Circuit Breakers Rated on a Symmetrical Current Basis.

4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)

1. NFPA 70 – National Electrical Code, latest edition.

2. NFPA 70E – Standard for Electrical Safety in the Workplace.

1.4. SUBMITTALS

A. The studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

B. The results of the short circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. Electronic PDF copies of the report shall be

provided upon request.

C. The report shall include the following sections:

1. Executive Summary including Introduction, Scope of Work and Results/ Recommendations.

2. Short-Circuit Methodology Analysis Results and Recommendations.

3. Short-Circuit Device Evaluation Table

4. Protective Device Coordination Methodology Analysis Results and Recommendations.

5. Protective Device Settings Table

6. Time-Current Coordination Graphs and Recommendations

7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.

8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.

9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

D. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineer and Owner, and other information specified.

1.5. QUALITY ASSURANCE

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered State of Maryland Professional Electrical Engineer skilled in performing and interpreting the power system studies. Report shall be signed and sealed by the Engineer on each page.

B. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

C. The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.

D. Engineering Analysis and Coordination Study shall be performed by one of the following,

or an approved and qualified equal.

1. AB Engineering, LLC
   985 Hacienda Court
   Westminster, MD 21157
   Telephone: 443-536-9876
   Fax: 610-785-1319
   Contact: Vincent Walters, P.E.

2. Coordinated Power Engineering, Inc.
   1340-G Charwood Road
   Hanover, MD 21076
   Telephone: 410-694-9494
   Fax: 410-694-0085
   Contact: Carl E. Rager, P.E.

3. IETC
   5410 Mt. Pigsah Road
   York, PA 17406
   Telephone: 717-252-4730
   Fax: 717-252-4793
   Contact: William N. Luddy, P.E.

4. Keystone Engineering Group, Inc.
   590 East Lancaster Avenue, Suite 200
   Frazer, PA 19355
   Telephone: 610-407-4100
   Fax: 610-407-4101
   Contact: Philip M. Gonski, P.E.

5. Potomac Testing, Inc.
   1610 Professional Blvd, Suite A
   Crofton, MD 21114
   Telephone: 301-352-1930
   Toll-Free: 1-800-331-2022
   Contact: Paul Gill, P.E.

6. Premium Power Services, LLC
   505 School House Road
   Kennett Square, PA 19348
   Telephone: 302-369-5420
   Fax: 302-369-5515
   Contact: Todd Bennicas

7. Reuter Hanney
   11620 Crossroads Circle, Suite D-E
   Middle River, MD 21220
   Telephone: 410-344-0300
   Fax: 410-335-4389

8. Schneider Electric

9 East Court, Suite G
Owings Mills, MD 21117
Telephone: 410-559-2917
Contact: Larry Long

PART 2. PRODUCTS

2.1. STUDIES

A. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies.

2.2. DATA

A. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a list of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source contribution may include present and future motors.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3. SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:

1. Calculation methods and assumptions

2. Selected base per unit quantities.

3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.

4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.

5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.

6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings.

2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses.

3. Contractor shall notify Engineer in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.4. PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable.

1. Electric utility’s overcurrent protective device

2. Medium voltage equipment overcurrent relays

3. Medium and low voltage fuses including manufacturer’s minimum melting current, total clearing, tolerance, and damage bands.

4. Low-voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands

5. Transformer full load current, magnetizing inrush current, and ANSI through fault protection curves.

6. Medium voltage conductor damage curves.

7. Ground fault protective devices, as applicable.

8. Pertinent motor starting characteristics and motor damage points, where applicable.

9. The largest feeder circuit breaker in each applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:

1. A one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.

2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.

3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.

4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the devices is located, and the device number corresponding to the device on the system one-line diagram

5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.

6. Contractor shall notify Engineer in writing of any significant deficiencies in protection and /or coordination. Provide recommendations for improvements.

2.5. ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04).

B. The flash protection boundary and the incident energy shall be calculated at all locations in the electrical distribution system (distribution panelboard, branch panelboards) where work could be performed on energized parts.

C. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model.

Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

E. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

F. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 5 cycles.

H. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be check amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584, Section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Provide the following:

1. Results of the Arc-Flash Hazard Analysis shall be submitted to tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash

protection boundary distances, working distances, personal protective equipment classes and AFIE (Arc Flash Incident Energy) levels.

2. The Arc Flash Hazard Analysis shall report incident energy values based on recommended device setting for equipment within the scope of the study.

3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

4. The Arc-Flash Hazard Analysis shall also include copies of arc-flash hazard warning labels specified in Part 3 of this Section, for all pieces of equipment receiving a label, which shall also be included in the O&M Manual specified in Division 01.

PART 3. EXECUTION

3.1. FIELD ADJUSTMENT

A. Contractor shall adjust relay and protective device settings according to the recommended setting table provided by the coordination study.

B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Contractor shall notify Engineer in writing of any required major equipment modifications.

3.2. ARC FLASH HAZARD LABELS

A. Contractor shall provide a 4.0 in. x 4.0 in. (nominal) Brady thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The labels shall be designed according to the following standards:

1. UL969 – Standard for Marking and Labeling Systems

2. ANSI Z535.4 – Product Safety Signs and Labels

3. NFPA 70 (National Electrical Code) – Article 110.16

C. The labels shall include the following information:

1. Equipment Designation

2. Source Designation

3. Fault Current (kA)

4. System Voltage

5. Flash Protection boundary

6. Personal Protective Equipment category

7. Arc Flash Incident energy value (cal/cm2)

8. Limited and restricted Approach Boundaries

9. Study report number and issue date

10. Name of Company who completed study

D. Labels shall be printed by a thermal transfer type printer, with no field markings.

E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

1. Floor Standing Equipment – Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.

2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.

3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Labels shall be field installed by Contractor.

3.3. AVAILABLE FAULT CURRENT LABELS

A. Contractor shall provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester to identify the maximum available fault current at the following equipment:

1. Existing service equipment in accordance with NEC Article 110.16(B).

2. Existing panelboards affected by the work in accordance with NEC Article 408.6.

3. New single-zone VAV units in accordance with NEC Article 440.10.

B. The labels shall be designed according to the following standards:

1. UL969 – Standard for Marking and Labeling Systems

2. ANSI Z535.4 – Product Safety Signs and Labels

3. NFPA 70 (National Electrical Code) – Article 110.24.

C. The labels shall include the following information:

1. Line 1 – “Maximum Available Fault Current”

2. Line 2 – "_____ Amperes"; Contractor shall field mark maximum available fault current available at the line terminals of the equipment.

3. Line 3 – Date of Installation

D. Labels shall be printed by a thermal transfer type printer.

E. Labels shall be field-installed by the Contractor.

END OF SECTION

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PANELBOARDS
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SECTION 262416 - PANELBOARDS

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 26 Section 260500, “Common Work Results for Electrical”, for general materials and installation methods.

2. Division 26 Section 260553, “Identification for Electrical Systems”, for identification materials for labeling panelboards, including, but not limited to equipment nameplates and circuit directories.

3. Division 26 Section 260573, “Power System Studies”, for engineering analysis involving panelboards specified herein, including but not limited to short-circuit analysis.

1.2. SUMMARY

A. This Section includes replacement circuit breakers for existing panelboards affected by the Work.

1.3. REFERENCES

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. American Society of Testing Materials (ASTM):

1. ASTM E 329, “Standard Specification for Agencies Engaged in the Testing and/or inspection of Materials Used in Construction.”

C. Federal Specifications (FS):

1. FS W-C-375, “Circuit Breakers, Molded Case, Branch Circuit and Service.”

D. International Electrical Testing Association (NETA):

1. NETA ATS, “Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.”

E. International Organization for Standardization (ISO):

1. ISO 9001, “Quality Management Systems – Requirements.”

F. National Electrical Contractors Association (NECA):

1. NECA 407, “Standard for Installing and Maintaining Panelboards.”

G. National Electrical Manufacturers Association (NEMA):

1. NEMA PB 1, “Panelboards.”

2. NEMA PB 1.1, “General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.”

3. NEMA PB 1.2, “Application Guide for Ground Fault Protective Devices.”

H. National Fire Protection Association (NFPA):

1. NFPA 70, “National Electrical Code.”

2. NFPA 70B, “Electrical Equipment Maintenance.”

3. NFPA 70E, “Standard for Electrical Safety in the Workplace.”

I. Underwriters Laboratories, Inc. (UL):

1. UL 50, “Standard for Enclosures for Electrical Equipment.”

2. UL 67, “Standard for Panelboards.”

3. UL 489, “Standard for Molded-Case Circuit Breakers and Circuit Breaker Enclosures.”

1.4. SUBMITTALS

A. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.

1. Submit product data for each type of overcurrent protective device, accessory, and component indicated.

2. Include dimensions and manufacturer’s technical data on features, performance, electrical characteristics, ratings, and finishes of individual protective devices and auxiliary components.

B. Contract Closeout Submittals:

1. Operation and Maintenance Data: Submit operation and maintenance data for panelboards to include in operation and maintenance manuals specified in Division 01.

2. Warranty Data: Submit manufacturer’s standard warranty documents.

3. Panelboard Circuit Directories: For installation in existing panelboards affected by the work. Submit final versions in operation and maintenance manuals.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of panelboards of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years. The manufacturer shall be ISO 9001 certified and shall be designed to internationally accepted standards.

B. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing panelboards similar in type and scope to that required for this Project.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms Listed and Labeled: As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory as defined in OSHA Regulation 1910.7.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

PART 2. PRODUCTS

2.1. MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, supply equipment from one of the following manufacturers; no other manufacturers are acceptable:

1. Square D Company. (Basis of Design)

B. Replacement circuit breakers for existing panelboards shall be obtained from the original manufacturer through an authorized factory distributor, complete with full factory warranty. Original manufacturer product data shall be submitted for review.

2.2. OVERCURRENT PROTECTIVE DEVICES

A. Overcurrent protective devices include, but are not limited to, the following:

1. Thermal magnetic circuit breakers.

B. Molded-Case Circuit Breaker Features and Accessories:

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.

2. Lugs: Mechanical style, suitable for quantity, size/gauge, and material of

conductors installed.

3. Application Listing: Appropriate for application, including switching lighting loads (Type SWD) or heating, air-conditioning, and refrigerating equipment (Type HACR).

2.3. IDENTIFICATION

A. Refer to Division 26 Section 260553, "Identification for Electrical Systems", for additional information.

PART 3. EXECUTION

3.1. INSTALLATION

A. Two or three pole circuit breakers shall be common trip type. Single pole breakers with handle ties will not be permitted.

B. Tandem circuit breakers will not be permitted.

3.2. IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section 260553, "Identification for Electrical Systems".

B. Circuit Directories:

1. Panelboards shall have accurate typed circuit directories indicating exactly what each branch circuit serves.

2. The Contractor shall provide up to date circuit directories in new and existing panelboards, indicating all deletions and additions, and to note the date of all changes on the directory.

3. The circuit directories shall reflect the actual room numbers. Directories indicating the reference room numbers on the contract drawings or in the panelboard schedule shall not be acceptable.

4. The circuit directories shall include the name, address, and contact information for the Electrical/Division 26 Contractor.

5. If at any time after occupancy the circuit directories are found to be incorrect due to negligence by the installer, then the Contractor shall trace out circuits, and correct the directories at no additional cost to the Owner.

3.3. FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.

2. Clean devices using Manufacturer's approved methods and materials.

3. Verify that panelboard arc flash hazard labels are installed.

4. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.

5. Check panelboard mounting, area clearances, and alignment and fit of components.

6. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

7. Perform visual and mechanical inspection and related work for over-current protective devices.

END OF SECTION

DIVISION 26 SECTION 262726
WIRING DEVICES
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SECTION 262726 WIRING DEVICES

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section includes the following:

1. Straight-blade receptacles.
2. GFCI receptacles.
3. Tamper-Resistant receptacles.
4. Toggle switches.
5. Device plates.

1.3. DEFINITIONS

A. GFCI: Ground-Fault Circuit Interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. TR: Tamper-Resistant.

D. WR: Weather-Resistant.

1.4. SUBMITTALS

A. Product Data: For each product specified, indicating configurations, finishes, dimensions, and manufacturer's instructions.

B. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 01.

1.5. 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.

B. Comply with NFPA 70.

C. Comply with NECA Standard of Installation.

D. Codes: Provide wiring devices conforming to the following:

1. American National Standards Institute (ANSI): Provide lugs and receptacle devices constructed in accordance with ANSI C73, Attachment Plugs and Receptacles, Dimensions of.

2. Institute of Electrical and Electronics Engineers (IEEE): Construct and install wiring devices in accordance with requirements of IEEE 241, Recommended Practice for Electric Power Systems in Commercial Building.

3. National Electrical Manufacturers Association (NEMA): Provide wiring devices constructed and configured in accordance with the requirements of

   a. WD1: General Requirements for Wiring Devices
   b. WD5: Special Purpose Wiring Devices
   c. WD6: Wiring Devices - Dimensional Requirements.

4. National Fire Protection Association (NFPA): Comply with NFPA 70, National Electrical Code, as applicable to construction and installation of electrical wiring devices.

5. Underwriters Laboratories, Inc. (UL): Provide wiring devices which are UL listed and comply with the requirements of:

   a. 20: General-Use Snap Switches.
   b. 498: Attachments, Plugs and Receptacles
   c. 514A: Metallic Outlet Boxes.
   d. 514B: Fittings for Conduit and Outlet Boxes.
   e. 514C: Non-Metallic Outlet Boxes, Flush-Device Boxes, and Covers
   f. 943: Ground-Fault Circuit Interrupters

1.6. EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

   1. GFCI Receptacles: One for each ten installed, but not less than two of each type.

PART 2. PRODUCTS

2.1. MANUFACTURERS

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. Wiring Devices:

      a. Hubbell, Inc.; Wiring Devices Division
      b. Pass & Seymour/Legrand; Wiring Devices Division
      c. Leviton Manufacturing Co., Inc.
      d. Eaton/Cooper; Wiring Devices Division

e. Lutron Electronics, Inc.

B. Model numbers in the following paragraphs do not include designations for finish/color. An asterisk in any model number in the following paragraphs is in place of a finish designation. Refer to Paragraph “Finishes”, this Section, for additional information.

2.2. STRAIGHT BLADE RECEPTACLES

A. General Requirements

1. Straight blade receptacles shall have the following basic features:

a. One-piece brass mounting strap with integral ground for low resistance of fault currents.
b. Auto-ground clip to assure positive ground.
c. Impact-resistant nylon face and thermoplastic base housing.
d. #10 large head brass terminal and ground screws; back- and side-wired.

B. Tamper-Resistant Duplex Convenience Receptacles

1. Tamper-resistant duplex convenience receptacles shall be extra heavy-duty, specification grade, 20A, 125V, with the following features:

a. “TR” marking on face as required by UL standard.
b. Thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects.

2. Comply with NEMA WD-1, NEMA WD-6 configuration 5-20R, UL 498 and Federal Specification W-C-596.

3. Hubbell HBL5362TR, Pass & Seymour TR63, or approved equal by acceptable manufacturer.

C. Special Purpose Receptacles

1. Special purpose receptacles shall have ratings and NEMA configurations as indicated on the Drawings, or as required to match equipment plug configuration, and shall be black with device plate to match outlet type.

2.3. GFCI RECEPTACLES

A. General Requirements

1. GFCI receptacles shall have the following basic features:

a. Solid-state ground-fault sensing and signaling.
b. Trip time of 0.025 seconds (nominal).
c. Trip threshold of +/- 5mA.
d. Indicator light that is lighted when device is tripped.
e. Auto-ground clip to assure positive ground.
f. Impact-resistant nylon face and thermoplastic base housing.
g. #10 large head brass terminal and ground screws; back- and side-wired.

2. GFCI receptacles shall also have the following functions to comply with UL standard 943:

    a. An auto-monitoring function that will allow for periodic automatic testing (self-test) of the GFCI device and its ability to respond to a ground fault. If a problem is detected one or more of the following will happen:
        i. Power will be denied (trip with the inability to reset).
        ii. Trip with the ability to reset, subject to the next auto-monitoring test cycle or repeatedly trip.
        iii. Visual and/or audible indication
    b. Provisions to ensure that receptacle type GFCIs that contain separate line and load terminals, and that is powered through its load terminals, shall not reset and supply power to its receptacle face or line terminals if mis-wired. This applies both during its initial installation and after reinstallation following a correctly wired installation. If the device is provided with special instructions for removal and reinstallation, the instructions shall be followed during testing.

B. Tamper-Resistant Duplex GFCI Receptacles

1. Tamper-resistant duplex GFCI receptacles shall be heavy-duty, specification grade, 20A, 125V with the following features:

    a. “TR” marking on face as required by UL standard.
    b. Thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects.

2. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 and Federal Specification W-C-596.

3. Hubbell GFTRST20, Pass & Seymour 2097TR, or approved equal by acceptable manufacturer.

C. Tamper-Resistant and Weather-Resistant Duplex GFCI Receptacles

1. Tamper-resistant and weather-resistant duplex GFCI receptacles shall be specification grade, 20A, 125V with the following features:

    a. "WR" marking on face as required by UL Standard.
    b. UV-resistant nylon face for longer life under adverse environmental conditions.
    c. “TR” marking on face as required by UL standard.
    d. Thermoplastic dual mechanism shutter system to help prevent insertion of foreign objects.

2. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498 and Federal Specification W-C-596.

3. Hubbell GFTWRST20, Pass & Seymour 2097TRWR, or approved equal by acceptable manufacturer.

2.4. FINISHES

A. Wiring device catalog numbers in Section text do not designate device color. Device colors shall be as follows, unless otherwise indicated elsewhere in the Specifications and Drawings or as required by NFPA or device listing:

1. Wiring Devices connected to Normal Power System: Finish to match existing devices.

2. Wiring Devices connected to Standby Power System: Finish to match existing devices.

2.5. DEVICE PLATES

A. Device plates shall be provided for all switches and receptacles. Device plates shall be as manufactured to fit each type of single device, to fit devices which are ganged together, and they shall be same manufacturer as wiring devices with finish as follows:

1. Material for Unfinished Spaces: Galvanized steel, unless otherwise noted.

2. Material for Finished Spaces: 0.04-inch-thick, Type 302, satin-finished stainless steel, except as otherwise indicated.

3. Material for Finished Spaces: Unbreakable nylon.

   a. Color: Color to match existing device plates.
   b. Plate-Securing Screws: Metal with heads colored to match plate finish.

B. Covers for Receptacles in Damp and Wet Locations: Heavy-duty die-cast zinc/aluminum construction with hinged lockable lid, designed to be weatherproof while the device is in use, and listed and labeled “extra duty” for use in “wet locations”. All components shall have baked-on electrostatic, polyester, powder paint finish for superior corrosion resistance. Covers shall comply with NEC Article 406.9(B).

1. Duplex/GFCI Receptacles – Pass & Seymour Model No. WIUCAST1 or approved equal by Hubbell, Intermatic, or other listed manufacturer.

C. Expandable Covers for Receptacles in Damp and Wet Locations: Low-profile, heavy-duty die-cast zinc/aluminum construction with hinged lockable lid, designed to be weatherproof while the device is in use, and listed and labeled “extra duty” for use in “wet locations”. Cover shall expand from 2 inches to 3/5 inches for while-in-use needs. All components shall have baked-on electrostatic, polyester, powder paint finish for superior corrosion resistance. Covers shall comply with NEC Article 406.9(B).

1. Horizontal Receptacles – Hubbell-Taymac Model No. MX4380, or approved equal.

2. Vertical Receptacles – Hubbell–Taymac Model No. MX4280, or approved equal.

PART 3. EXECUTION

3.1. EXAMINATION

A. Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Verify that outlet boxes are installed at proper height.

2. Verify that wall openings are neatly cut and will be completely covered by wall plates.

3. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

C. By beginning Work, accepts conditions and assume responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2. INSTALLATION – GENERAL

A. Install devices and assemblies plumb, level, and secure.

B. Arrangement of Devices:

1. Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top or as required by the local Authority Having Jurisdiction.

2. Exception: Mount exterior GFCI weatherproof duplex receptacles horizontally with grounding terminals on the left, or as required by the local Authority Having Jurisdiction. Group adjacent switches under single, multi-gang wall plates.

C. Protect devices and assemblies during painting.

D. Installation of Device Plates/Covers:

1. Install device plates when painting is complete.

2. Install device plates to suit device type and location.

3. Provide wet location covers for wiring devices in exterior locations.

3.3. INSTALLATION – RECEPTACLES

A. All non-locking type, 125 volt, 15 ampere and 20 ampere receptacles installed in the building shall be listed tamper-resistant receptacles in accordance with NEC Article 406.

B. All 15-ampere and 20-ampere, 125-volt, single-phase, non-locking type receptacles installed in the following locations shall have GFCI protection for personnel, in accordance with NEC Article 210.8(B).

1. Bathrooms/Toilet Rooms

2. Outdoors

3. Within six (6) feet (1.8m) of sinks, plumbing fixtures and water piping.

4. Indoor wet locations.

C. Where multiple receptacles are indicated on the Contract Drawings as GFCI type receptacles, each device must be a GFCI type receptacle. Protecting standard receptacles downstream from one GFCI receptacle is not acceptable.

D. All 15-ampere and 20-ampere, 125-volt and 250-volt, non-locking type receptacles installed in damp or wet locations shall be listed weather-resistant type in accordance with NEC Article 406.9(A) and 406.9(B) and shall be installed within an enclosure that is weather proof when an attachment plug is inserted.

3.4. IDENTIFICATION

A. Comply with Division 26 Section 260553, "Identification for Electrical Systems".

1. Receptacles: All device plates shall be labeled to identify panelboard and circuit number from which served. Use machine printed, pressure sensitive, abrasion resistant label tape on face of plate and durable wire markers or tags within outlet boxes. Labels shall be clear with black lettering. Protect label from damage during construction. Replace all damaged and unclear labels.

2. Mark all conductors with the panel and circuit number serving the device at the device.

3. Mark the panel and circuit number serving the device on the back side of the device plate with a permanent marking system, machine-generated, that does not show through the front of the plate.

4. Faceplate labels shall be installed such that they are readable and do not cover any portion of the faceplate securing screw(s) or the wiring device itself.

5. Faceplate labels for exterior receptacle outlets shall be on the inside of the weatherproof covers.

3.5. CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

C. Tighten electrical connectors and terminals according to manufacturers published torque tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6. FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity, continuity, short circuits, and ground continuity. Operate each device at least six times.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.7. CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

DIVISION 28 SECTION 280500
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
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SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.

2. Sleeves for raceways and cables.

3. Grout.

4. Common electronic safety and security installation requirements.

B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all electrical work.

C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Architect and the Engineer.

D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed be-cause of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Article “Submittals” specified below. The right is reserved to make reasonable changes in location of equipment, boxes, conduit/wiring, and devices, up to the time of rough-in or fabrication.

E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.

F. Coordinate the work under Division 28 with the work of all other construction trades.

G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the Contract Documents.

H. Arrange conduit, wiring, equipment, and other work generally as shown, providing proper clearances and access. Carefully examine all Contract Drawings and fit the work in each location without substantial alteration. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Article “Submittals” as hereinafter specified. The right is reserved to

make reasonable changes in location of equipment, conduit and wiring up to the time of rough-in or fabrication.

1.3 CONTRACTOR QUALIFICATION

A. Any Contractor or Subcontractor performing work under Division 28 shall be fully qualified and acceptable to the Architect/Engineer and Owner. Submit the following evidence when requested:

1. A list of not less than five comparable projects which the Contractor completed.

2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.

3. Local and/or State License, where required.

4. Membership in trade or professional organizations where required.

B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.

C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

1.4 PERMITS AND FEES

A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.

B. Permits and fees shall comply with Division 01 Section, General Requirements.

C. Notify Inspection Authorities to schedule inspections of work.

D. Notify Engineer in advance of scheduled inspections.

E. A foreman, superintendent or other supervisor shall be in attendance for all scheduled inspections

1.5 EXAMINATION OF SITE

A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for Contractor’s failure to do so.

B. Examine and verify specific conditions described in individual Specifications sections.

C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

1.6 INTERPRETATION OF DOCUMENTS

A. Any discrepancies between Drawings, Specifications, Drawings and Specifications, or within Drawings and Specifications shall be promptly brought to the attention of the Owner during the bidding period. No allowance shall subsequently be made by reason of failure to have brought said discrepancies to the attention of the Owner during the bidding period or of any error on the Bidder's part.

B. The locations of products shown on Drawings are approximate. Place the devices to eliminate all interference with above-ceiling ducts, piping, etc. Where any doubt exists, the exact location shall be determined by the Owner.

C. All general trades and existing conditions shall be checked before installing any devices, cabling, etc.

D. Equipment sizes shown on the Drawings are estimated. Before installing any cabling, conduit, or boxes obtain the exact equipment requirements and install cabling, conduit, boxes or other item of the correct size for the equipment actually installed.

E. Where variances occur between the Drawings and Specifications or within either document itself, the item or arrangement of better quality, greater quality, or higher cost shall be included in the Contract Price. The Engineer will decide on the item and manner in which the work shall be in-stalled.

F. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions, and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed be-cause of field conditions or other causes, prepare and submit detailed Shop Drawings for approval in accordance with Article "Submittals" as herein after specified. The right is reserved to make reasonable changes in location of equipment, conduit/wiring, and devices, up to the time of rough-in or fabrication.

G. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Engineer and Owner.

H. Perform the work in a first-class, substantial and workmanlike manner. Any materials installed which do not present an orderly and neat workmanlike appearance shall be removed and replaced when so directed by the Engineer, at the Contractor's expense.

I. The complete set of Mechanical and Electrical Drawings and Specifications apply to this work. The successful Bidder shall familiarize himself with all other related documents.

1.7 MATERIALS AND EQUIPMENT

A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality.

B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable

for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.

C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.

D. Substitution will not be permitted for specified items of material or equipment where noted.

E. All items of equipment furnished shall have a service record of at least five (5) years.

1.8 ELECTRONIC SAFETY AND SECURITY WORK UNDER OTHER DIVISIONS

A. HVAC Equipment and Systems

1. In general, any electrically operated or controlled equipment furnished under HVAC divisions shall be supplied with control wiring, transformers, contacts, etc.

2. Division 28 shall provide fire alarm connections to such equipment in accordance with applicable codes and standards.

3. Certain mechanical units are furnished from the factory with motor starters, contactors, transformers, fuses, wiring, etc., required for fans, pumps, etc. When this equipment is supplied from the factory, Division 28 shall coordinate with Division 23 such that only one set of starters, fuses, switches, etc. is provided.

4. In general, control and interlock equipment (including, but not limited to wiring, conduit, trans-formers, relays, contacts, etc.) for HVAC equipment and systems is furnished under Division 23. Division 28 shall install and connect all equipment as necessary.

5. HVAC equipment refers to, but is not limited to the following:

a. Single Zone VAV Units

i. Provide duct-mounted smoke detectors and remote test stations for units over 2,000cfm.

ii. Coordinate detector installation with Division 23.

iii. Coordinate duct-mounted smoke detector sampling tube lengths with duct dimensions.

1.9 FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame

spread of 25 and smoke developed of 50.

1.10 REFERENCED STANDARDS, CODES AND SPECIFICATIONS

A. Specifications, Codes and Standards listed below are included as part of this Specification, latest edition:

1. ADA - Americans with Disabilities Act
2. ANSI - American National Standards Institute
3. ASTM - American Society for Testing and Materials
4. CSA - Canadian Standards Association
5. EPA - Environmental Protection Agency
6. FM - Factory Mutual
7. IBC - International Building Code
8. IEEE - Institute of Electrical and Electronics Engineers
9. MDE - Maryland Department of the Environment
10. MOSH - Maryland Occupational Safety and Health
11. NEC - National Electrical Code
12. NECA - National Electrical Contractors Association
13. NEMA - National Electrical Manufacturers Association
14. NFPA - National Fire Protection Association
15. OSHA - Occupational Safety and Health Act
16. UL - Underwriters' Laboratories

B. Electronic safety and security construction materials shall, where a listing is normal for the particular class of material, be listed in Electrical Construction Materials List of the Underwriters' Laboratories, Inc. (U.L.) and shall bear the listing label. Equipment shall, where a listing is normal for the particular class of equipment, be listed by Underwriters' Laboratories, Inc. (U.L.) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by other nationally recognized testing laboratory, inspection agency or approved organization (such as E.T.L. or Factory Mutual) shall be acceptable.

1.11 SUBMITTALS

A. Product Data: Include complete descriptive product data for items specified in Part 2 of this Section.

1.12 SUBMITTAL PROCEDURES

A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in the best interest of the Owner.

B. After acceptance of Material and Equipment List, submit three (3) copies or more as required under the General Conditions, of complete descriptive data for all items as outlined be-low.

C. Electronic submittals shall be prepared as a Portable Document Format (PDF) file and shall include as page 1 the Contractor's stamp, followed by the submittal contents. Submittal form shall identify the Project, Contractor, Subcontractor or Supplier, and pertinent Contract Document references.

D. Electronic Submittal File Naming: Contractor prepared shop drawings shall be named with reference to project number, specification section, submittal number, brief content description and abbreviated submittal type.

1. Example

a. HH-14-11_07200-01_roof insulation_PD.pdf

b. CA-25-11_Div 8-02R1_windows_SYST.pdf (Division 8 2nd submittal, 1st revision)

c. Submittal Type Abbreviations

d. CERT Certification

e. INSTR Installation Instructions

f. PD Product Data

g. PDID Product and Installation Data

h. QC Qualification/Quality Assurance Data

i. SD Shop Drawing

j. SYST System Package (All Section submittals are bound into one file sized 4 MB or less)

k. TD Test Data

l. WAR Warranty

E. Submittals shall consist of specifications, product data sheets, manufacturer's catalog cuts, dimensional shop drawings, wiring diagrams, installation instructions, samples, and any other information necessary to indicate complete compliance with Contract Documents.

F. Submittals shall include, but not be limited to, the following information: size, type, functional characteristics, compliance with standards in Division 28, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.

G. Identify submittals, indicating intended application, location and service of submitted items. Refer to Specification sections or paragraphs and Drawings where applicable.

H. Clearly indicate exact type, model number, style, size, operating characteristics, ratings, options and special features of proposed item specifically for application to this project. Submittals of a general nature will not be acceptable.

I. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Call attention, in writing, to deviation from contract requirements.

J. Thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission. Coordinate installation requirements and all electrical requirements for equipment submitted. The Contractor shall be responsible for correctness of all submittals.

K. Submittals will be reviewed for general compliance with design concept in accordance with Con-tract Documents, but dimensions, quantities, or other details will not be verified.

L. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold Contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

M. For substituted items, clearly list on the first page of the submittal all differences between the specified item and the proposed item. The Contractor shall be responsible for corrective action and maintaining the Specification requirements if differences have not been clearly indicated in the submittal.

N. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted. Use only final or corrected submittals and data prior to fabrication and/or installation.

O. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct submittal. Identify all submittals by the name of the item/system and the applicable Specification Section and/or Drawing number. Grouping of items/systems that are not related shall be unacceptable.

1. Items and Systems

    a. Conduit and Raceways

    b. Fire Alarm System Components

        i. Initiation Devices (Pull Stations, Smoke Detectors, Heat Detectors, etc.)

ii. Notification Appliances (Horns, Strobes, Speaker Strobes, etc.)

iii. Wire and Cable

c. Firestopping Materials

d. Hangers and Supports

e. Identification Products

f. Operation and Maintenance Manuals

P. Submit for approval any other submittals as required by the Engineer or Owner. No item listed above shall be delivered to the site, or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.

Q. For resubmissions, the Contractor must address in writing all of the Engineer's comments on the original submission to verify compliance.

1.13 DEFINITIONS

A. Approve: To permit use of material, equipment or methods conditional upon compliance with Contract Documents requirements.

B. Building Line: Exterior wall of building.

C. Child Care Facility: A building or structure, or portion thereof for educational, supervisory, or personal services for more than four children seven years old or younger.

D. Concealed: Hidden from sight in chases, formed spaces, shafts, or hung ceilings.

E. Conduits include conduit, all fittings, identification, and other accessories relative to such conduit.

F. Contractor: The Electrical Contractor and any of his subcontractors, vendors, suppliers, or fabricators.

G. EPDM: Ethylene-propylene-diene terpolymer rubber

H. Exposed: Not installed underground or concealed as defined above.

I. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.

J. Furnish and install or Provide: To supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.

K. Location, Damp: Locations protected from water and not subject to saturation with water or other liquids, but subject to moderate degrees of moisture. Examples of such locations include interior locations such as basements, crawlspaces, attics, cold-storage rooms, etc…

L. Location, Dry: A location not normally subject to dampness or wetness. A dry location may temporarily be subject to dampness or wetness during building construction.

M. Location, Wet: Locations subject to saturation with water or other liquids, locations exposed to weather, and installations underground or in concrete slabs or masonry in direct contact with the Earth. Examples of such locations include all exterior locations (including those under canopies, roofed open porches, etc…) commercial kitchens, and vehicle washing areas.

N. NBR: Acrylonitrile-butadiene rubber.

O. Review: Limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

1.14 RECORD DRAWINGS

A. Upon completion of the electrical installations, the Contractor shall deliver to the Engineer one complete set of prints of the electrical Contract Drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.

B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering the same to the Architect.

1.15 WARRANTY

A. Contractor's attention is directed to warranty obligations contained in the General Conditions.

B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer’s warranties shall be included in the operations and maintenance manuals.

C. The Contractor guarantees for a two (2) year period from the time of final acceptance by the Owner:

1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.

3. That the Contractor will re-execute, correct, repair, or remove and replace with proper work, with-out cost to the Owner, any work found to be deficient. The Contractor shall also make good all damages caused to their work or materials in the process of complying with this section.

4. That the entire work shall be water-tight and leak-proof.

1.16 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare three (3) hardcopies and electronic copies of the Operation and Maintenance Manual and shall deliver these copies of the manual to the Owner. Provide one (1) electronic copy for each hard copy set of the O&M manual.

B. The manual shall be as specified herein. The manual must be approved and will not be accepted as final until so stamped.

C. Hard copies of the manual shall be bound in three ring loose-leaf binders similar to National No. 3881 with the following title lettered on the front and spine of the binder: *Operation and Maintenance Manual – Worcester County Recreation Center – HVAC System Replacements – Fire Alarm*.

1. Provide divider tabs and table of contents for organizing and separating information. Tab titling shall be clearly printed under reinforced plastic tabs.

2. If more than one (1) binder is required, volume numbers shall be included on front and spine of each volume.

3. No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out.

D. Electronic copies of the manual shall be saved on USB flash drives, and shall be in searchable PDF format with interactive index tabs. Approved electronic copies shall be stored in flash drive zipper cases in front of volume 1 (if applicable) of hard copies of the manual.

A. Provide the following data in the manual:

1. As first entry, an approved letter indicating the starting/ending time of Contractor’s warranty period.

2. Directory listing names, addresses, e-mail addresses, and telephone numbers for Engineer, Contractor, Sub-contractor(s), equipment suppliers, sales and authorized service representatives.

3. Maintenance operation and lubrication instructions on each piece of equipment furnished.

4. Complete catalog data on each piece of electrical equipment furnished including approved Shop Drawing/Submittal with Engineer’s Comments (if any).

5. Manufacturer's extended limited warranties on equipment.

6. Provide sales and authorized service representatives names, address, and phone numbers of all equipment and subcontractors.

7. Provide supplier and subcontractor’s names, address, and phone number.

8. Catalog data of all equipment, starters, etc. shall include wiring diagrams, parts list and assembly drawing.

9. Access panel charts with index illustrating the location and purpose of access panels.

10. Approved Fire Marshal inspection report and fire alarm system record of completion per NFPA 72.

11. Start-up and test reports for equipment.

B. Submit Operation and Maintenance Manual prior to anticipated date of Substantial Completion for Engineer review and approval. Substantial Completion requires that Operation and Maintenance Manuals be reviewed and approved.

PART 2. PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 GROUT

A. Nonmetallic, Non-Shrink Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3. EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom

consistent with these requirements.

D. Install equipment with working space and dedicated space in strict accordance with NEC Article 110.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

F. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

G. Verify exact requirements for each piece of equipment receiving one or more fire alarm connections.

H. Include any and all items required by the National Electrical Code, NFPA 72, and/or field conditions for the proper connection and installation of each piece of equipment.

I. Make all connections to equipment in accordance with manufacturer's instructions.

J. Right of Way: Give to piping systems installed at a required slope.

K. Coordinate electronic safety and security work under other Divisions in accordance with Part 1 of this Section, Article "Electronic Safety and Security Work Under Other Divisions".

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of

joint.

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements of Division 26 Section 260528, “Firestopping for Electrical Systems”.

J. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and joint sealant/grout.

3.3 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 26 Section 260528, "Electrical Firestopping".

3.4 SUPPORTS, HANGERS AND FOUNDATIONS

A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.

B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

C. Refer to Division 26 Section 260529, “Hangers and Supports for Electrical Systems”, for additional requirements.

3.5 PROVISIONS FOR ACCESS

A. The Contractor shall provide access panels and doors for all concealed equipment, and other de-vices requiring maintenance, service, adjustment or manual operation.

B. Where access doors are necessary, furnish and install manufactured painted steel door assemblies consisting of hinged door, key locks, and frame designed for the particular wall or ceiling construction. Properly locate each door. Door sizes shall be a 12 inches x 12 inches for hand access, 18 inches x 18 inches for shoulder access and 24 inches x 24 inches for full body access where required. Review locations and sizes with Architect prior to fabrication. Provide U.L. approved and labeled access doors where installed in fire rated walls or ceilings. Doors shall be Milcor Metal Access Doors as manufactured by Inland-Ryerson, Mifab, or approved equal.

1. Acoustical or Cement Plaster: Style B

2. Hard Finish Plaster: Style K or L

3. Masonry or Dry Wall: Style M

C. Where access is by means of liftout ceiling tiles or panels, mark each ceiling grid using small color-coded and numbered tabs. Provide a chart or index for identification. Place markers within ceiling grid not on ceiling tiles.

D. Access panels, doors, etc. described herein shall be furnished under the section of Specifications providing the particular service and to be turned over to the pertinent trade for installation. Coordinate installation with installing Contractor. All access doors shall be painted in baked enamel finish to match ceiling or wall finish.

E. Submit shop drawings indicating the proposed location of all access panels/doors. Access doors in finished spaces shall be coordinated with air devices, lighting and sprinklers to provide a neat and symmetrical appearance.

F. Provide sufficient access and working space for repair and maintenance about all lighting and electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with OSHA 29 CFR 1910 Subpart D and 1910.303(g).

3.6 PAINTING AND FINISHES

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 28 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed, as defined herein.

F. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces. Do not paint manufacturer's labels or tags.

G. All exterior equipment and conduits shall be painted to match adjacent surface in color as selected by Owner.

H. All exposed conduit, boxes, equipment, etc. in finished spaces shall be painted. Colors shall be as selected by the Owner and conform to ANSI Standards.

3.7 COLOR SELECTION

A. Color of finishes shall be as selected by the Owner.

3.8 PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and

after installation. Properly store and handle all materials and equipment.

B. Cover temporary openings in conduits and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver conduits with factory applied end caps.

C. Cover or otherwise protect all finishes.

D. Replace damaged materials, devices, finishes and equipment.

E. Protect stored conduits from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

3.9 OPERATION OF EQUIPMENT

A. Clean all systems and equipment prior to initial operation for testing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.

B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.

C. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the commencement of testing.

D. Do not use electronic safety and security systems for temporary services or during construction, unless approved by Owner in writing. Refer to Division 01 Section "Temporary Facilities and Controls".

E. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items.

3.10 TESTING AND ADJUSTMENT

A. Perform all tests which are specified or required to demonstrate that the work is installed and operating properly. Where formal tests are required, give proper notices and perform all necessary preliminary tests to assure that the work is complete and ready for final test.

B. Adjust all systems, equipment and controls to operate in a safe, efficient and stable manner.

C. Provide circuits that are free from ground faults, short circuits and open circuits.

D. Other tests of a specific nature for special equipment shall be as specified under the respective equipment.

E. Submit all test results to the Engineer for approval.

3.11 WALL AND FLOOR PENETRATIONS

A. All penetrations of partitions, ceilings, roofs and floors under Division 28 shall be sleeved,

sealed, and caulked as specified herein.

B. All penetrations of fire rated assemblies shall be sleeved, sealed, caulked and protected to maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized. See Division 26 Section 260528, "Firestopping for Electrical Systems".

C. Provide conduit escutcheons for all exposed conduit penetrations in finished interior spaces and all exposed exterior penetrations. Escutcheons shall match those provided under Division 23.

D. Conduit sleeves:

1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.

2. Twenty-two (22) gauge galvanized steel elsewhere.

3.12 EQUIPMENT BY OTHERS

A. This Contractor shall make all system connections required to equipment furnished and installed under other divisions or furnished by the Owner. Connections shall be complete in all respects to render this equipment functional to its fullest intent.

B. It shall be the responsibility of the supplier of the equipment to furnish complete instructions for connections. Failure to do so will not relieve the Contractor of any responsibility for improper equipment operation.

3.13 PHASING

A. Refer to Architectural Specifications and Contract Drawings for any required phasing.

B. Maintain building egress and traffic ways at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and Authorities Having Jurisdiction (AHJ).

C. Provide dust barriers/partitions, penetration closures, etc, to ensure safety of building occupants and protection of existing surroundings.

D. The Building shall remain watertight at all times.

E. Refer to phasing plans for additional requirements.

F. Within thirty days of Award of Contract, the Contractor shall submit a minimum of six (6) copies of the proposed Phasing Plan (Drawings and detailed written description) to the Owner for review and approval based on the general and specific requirements indicated on the Drawings and Specifications. The phasing plan shall reflect the work of all trades. The phasing plan shall be updated as often as needed (i.e. major deviations and/or modified sequence of events) and re-viewed during each progress meeting so the facility and Owner can be aware of the areas of construction and progress as it relates to the approved schedule.

G. While work is in progress, except for designated short intervals during which connections are made, continuity of service shall be maintained to all existing systems. Interruptions

shall be coordinated with the Owner as to time and duration. The Contractor shall be responsible for any interruptions to service and shall repair any damages to existing systems caused by his operations.

3.14 OUTAGES

A. Provide a minimum of seven (7) days' notice to schedule outages. The Contractor shall include in their bid outages and/or work in occupied areas to occur on weekends, holidays, or at night. Coordinate and get approval of all outages with the Owner.

B. Submit Outage Request Form, attached at the end of this Section, to Owner for approval.

3.15 CUTTING AND PATCHING

A. Accomplish all cutting and patching necessary for the installation of work under Division 28. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and workmanlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.

3.16 PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, sleeves, flashings, fittings and caulking to make penetrations absolutely watertight.

3.17 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

A. Unless otherwise noted on the Drawings, where existing electronic safety and security work is removed, including hangers, to a point below finished floors or behind finished walls and capped, such point shall be far enough behind finished surfaces to allow for installation of normal thickness of required finish material.

B. Where work specified in Division 28 connects to existing equipment, conduits, etc., Contractor shall perform all necessary alterations, cuttings, fittings, etc., of existing work as may be necessary to make satisfactory connections between new and existing work, and to leave completed work in a finished and workmanlike condition.

C. Where the work specified under Division 28, or under other Divisions, requires relocation of existing equipment, conduit etc., Contractor shall perform all work and make necessary changes to existing work as may be required to leave completed work in a finished and workmanlike condition.

Where the relocation of existing equipment is required for access or the installation of new equipment, the Contractor shall temporarily remove and/or relocate and re-install as required to leave the existing and new work in a finished and workman like condition.

3.18 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

5. To provide working space and dedicated space clearances per NEC Article 110.26.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Part 2 of this Section.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 26 Section 260528, "Firestopping for Electrical Systems".

3.19 DEMOLITION

A. Unless otherwise noted all existing equipment, conduit, wire, etc., shall remain.

B. Where existing equipment is indicated to be removed, all associated conduit, power, controls, insulation, hangers, supports and housekeeping pads, etc…, shall also be removed. Patch, paint and repair walls/roof/floor to match existing and/or new finishes.

C. The Contractor shall be responsible for visiting the site and determining the existing conditions in which the work is to be performed.

D. Refer to phasing plans for additional requirements.

E. Where any abandoned conduits in existing floors, walls, ceilings, etc., conflict with new work, remove abandoned conduits as necessary to accommodate new work.

F. The location of all existing equipment, conduits etc., indicated is approximate only and shall be checked and verified. Provide all new electrical work required to connect to or clear existing work as applicable.

G. Maintain egress at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and the Authority(ies) Having Jurisdiction (AHJ).

H. Where required to maintain the existing systems in operation, temporarily backfeed existing systems from new equipment. Contractor shall temporarily extend existing

conduit systems to new conduit systems.

I. At completion of project all temporary conduit, wires, etc., shall be removed in their entirety.

J. Existing conduit, equipment, wiring, etc., not required for re-use or re-installation in this project, shall be removed from the project site.

K. Deliver to the Owner, on the premises where directed, existing equipment and materials which are removed and which are desired by the Owner or are indicated to remain the property of the Owner.

L. All other materials and equipment which are removed shall become property of the Contractor and shall be promptly removed, from the premises, and disposed of by the Contractor, in an approved manner.

M. Where conduit and wiring are removed, remove all conduit hangers which were supporting the removed conduit. Patch the remaining penetration voids with like materials and paint to match existing construction.

N. Where required, provide and coordinate removal and re-installation of existing equipment. Take care to protect materials and equipment indicated for reuse. Contractor shall repair or replace items which are damaged. Contractor shall have Owner's representative present to confirm condition of equipment prior to demolition.

O. Before demolition begins, and in the presence of the Owners representative, test and note all deficiencies in all existing systems affected by demolition but not completely removed by demolition. Provide a copy of the list of system deficiencies to the Owner and the Engineer.

P. The Owner shall have the first right of refusal for all fixtures, devices and equipment removed by the Contractor.

Q. All devices and equipment designated by the Owner to remain the property of the Owner shall be moved and stored by the Contractor at a location on site as designated by the Owner. It shall be the Contractor's responsibility to store all devices and equipment in a safe manner to prevent damage while stored.

R. All existing equipment refused by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor in a timely manner and disposed of in a legal manner.

S. Work Abandoned in Place: Cut and remove conduit a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

T. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

U. Terminate services and utilities in accordance with local laws, ordinances, rules and regulations.

END OF SECTION

OUTAGE REQUEST FORM

DATE APPLIED: _____ BY: _____

DATE FOR OUTAGE: _____ FIRM: _____

START OUTAGE-TIME: _____ DATE:_____

END OUTAGE - TIME: _____ DATE:_____

AREAS AND ROOMS: _____

FLOOR(S): _____

AREA(S): _____

ROOM(S): _____

WORK TO BE PERFORMED: _____

SYSTEM(S): _____

REQUEST APPROVED BY: _____
(FOREMAN OR OTHER PERSON IN CHARGE)

(FOR OWNER'S USE ONLY):

APPROVED: _____

YES ____ NO ___ BY: _____DATE: _____

DATE/TIME-AS REQUESTED: _____ OTHER : _____

OWNER'S PRESENCE REQUIRED: _____

YES: ____ NO: ___ NAME: _____

POINT OF CONTACT: _____ PHONE: _____

DIVISION 28 SECTION 283111
DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM
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SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1. GENERAL

1.1. RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 28 Section 280500, “Common Work Results for Electronic Safety and Security”, for general installation requirements for fire-alarm systems.

1.2. SUMMARY

A. Section includes a non-proprietary digital, addressable fire alarm system, including, but not limited to the following:

1. Manual fire-alarm boxes.

2. System smoke detectors.

3. Device guards.

4. Addressable interface devices.

1.3. DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

1.4. ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.

2. Include rated capacities, operating characteristics, and electrical characteristics.

B. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Architect.

C. Delegated-Design Submittal: For smoke detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.

2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.

3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5. INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.6. MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Smoke Detectors and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.

2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than one unit of each type.

3. Keys and Tools: One extra set for access to locked or tamperproofed components.

1.7. QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Final programming, testing, and commissioning shall be by personnel certified by NICET as fire-alarm Level III (minimum) technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.8. PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

1.9. SEQUENCING AND SCHEDULING

A. Fire alarm will remain active in the construction area. Protect devices as necessary. If alarm needs to be put into test mode coordinate with Owner’s Representative.

1.10. WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2. PRODUCTS

2.1. SYSTEM DESCRIPTION

A. The existing fire alarm system is Potter IPA-100..

B. All components provided shall be listed for use with the selected system.

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.

2.2. MANUFACTURERS

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

2.3. SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, and remote annunciators.

2. Transmit an alarm signal to the remote alarm receiving station.

3. Record events in the system memory.

4. Indicate device in alarm on remote annunciator(s).

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.

2.4. SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.

2. Detectors shall be four-wire type.

3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition.

a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
c. Multiple levels of detection sensitivity for each sensor.
d. Sensitivity levels based on time of day.

B. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.

4. Each sensor shall have multiple levels of detection sensitivity.

5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

7. ATC System Interface: Fully programmable relay/contact for duct detector status to be monitored by the building ATC system.

2.5. CABLING

A. All fire alarm system cabling shall be installed concealed within walls, above ceilings, or concealed in conduit in areas without ceilings, e.g. electrical rooms.

B. Where fire alarm cabling is not installed in conduit, the same shall be type MC-FPLP fire alarm and control cable. Bare cabling will not be acceptable.

C. MC-FPLP fire alarm and control cable shall have the following features:

1. Red lightweight aluminum interlocked armor

2. 600 Volt Type MC and 300 Volt Type FPLP

3. Plenum rated per NEC 300.22(B), 300.22(C) & 760.61(D)

4. Solid copper conductors, 14 AWG THHN/TWHN, or 16 AWG TFN

5. Green insulated copper grounding conductor

6. Film/foil aluminum laminate shielding tape with tinned copper drain wire/grounding conductor wrapped over the conductor assembly.

7. Suitable for power-limited and non-power limited fire alarm circuits.

D. Cable shall meet or exceed the requirements of the following standards and references:

1. UL Standard 83, UL Standard 1063, UL Standard 1424, and UL Standard 1569.

2. Federal Specification A-A59544 Vertical Cable Tray Flame Test

3. NFPA 70 – National Electrical Code

4. Listed for use in UL 1, 2, and 3 hour through penetration firestop systems

5. REACH/RoHS-2 Compliant

E. Refer to Division 26 Section 260519, "Low-Voltage Electrical Power Conductors and Cables", for MC cable connector requirements.

F. Cables shall be supported with appropriate hangers; tie wire will not be accepted.

G. Provide Southwire Red Alert Type MC-FPLP, or approved equal.

2.6. CIRCUIT PROTECTION DEVICES

A. General Requirements for Circuit Protection Devices: Comply with UL 497B, "Protectors for Data Communications and Fire Alarm Circuits" and NFPA 70, "National Electrical Code". Circuit protection devices shall minimize the energy from electrical transients caused by lightning or disturbances on high voltage power lines that can cause damage on low voltage fire alarm circuits.

B. Provide circuit protection for all fire alarm system wiring that is run external to the building, including but not limited to, the following:

1. DC Power (200 mA maximum)

2. Data communications

3. Monitor circuits

4. Audio riser circuits

5. Firefighter telephone circuits

6. DC notification appliance circuits (NACs)

7. Speaker circuit NACs (25 VRMS)

C. Operating Specifications:

1. Line-to-Line Voltage Rating:

a. Continuous: 38 VDC, 28 VAC RMS
b. Clamping: 47 V

2. Line-to-Earth Voltage Rating:

a. Continuous: 45 VDC, 35 VAC RMS
b. Clamping: 56 V

3. Shield-to-Earth Voltage Rating:

a. Continuous: 48 VDC, 33 VAC RMS
b. Clamping: 75 V

4. Line-to-Line Capacitance: 0.006 micro-farads (µF)

5. Continuous Current Rating: 200 mA maximum

6. Series Resistance: 3 ohms (Ω) / line

7. Response Time:

a. Line-to-Line: <1 nanosecond
b. Line-to-Earth: <25 nanoseconds

8. Maximum Current:

a. Line-to-Line: 2000A (10 x 50 µsec pulse)
b. Line-to-Earth: 2000A (8 x 20 µsec pulse)
c. Shield-to-Earth: 5000A (10 x 50 µsec)

D. Mechanical Specifications:

1. Dimensions: 2-7/16”W x 1-3/8”D x 1-1/16”H (62mm x 35mm x 27mm)

2. Package: Beige, epoxy encapsulated

3. Electrical Box Requirement: 4” (102 mm) square box, 2-1/8” minimum depth

4. Temperature Rating: 32°F to 120°F (0°C to 49°C)

5. Humidity Rating: 10-95% relative humidity (RH) at 30 degrees C

6. Signal Leads: Color coded, 18 AWG, 10” long (254 mm)

7. Ground Lead: Green, 14 AWG, 10” long (254 mm)

PART 3. EXECUTION

3.1. EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.

2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.

2. Connect new equipment to existing monitoring equipment at the supervising station.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

2. Provide a remote test station for each duct smoke detector.

D. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

E. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

F. Circuit Protection Devices:

1. Fire alarm system wiring that is run external to the building and is protected by circuit protection devices shall be installed in accordance with the individual system component’s installation instructions including properly grounded, twisted and shielded pairs, and observance of the following precautions:

a. Circuit protection devices shall be located as close as possible to the point

at which the circuits leave or enter the building(s) and shall be installed in dedicated electrical outlet boxes. Outlet boxes shall be painted red and permanently labeled "Fire Alarm".

b. The total maximum wire length shall be determined by the individual application's allowable limit as specified with circuit protection devices, but must not exceed 3270 ft (1 km).

c. The grounding conductor shall be 12 AWG with a maximum length of 28 ft (8.5 m), run in as straight a line as possible and connected to the building grounding electrode system per NFPA 70, the "National Electrical Code".

3.3. PATHWAYS

A. Pathways concealed above accessible ceilings may be routed exposed.

B. Exposed pathways and pathways in non-accessible locations shall be installed in conduit. Refer to Division 26 Section 260533, "Raceways and Boxes for Electrical Systems", for additional information.

C. Exposed conduit shall be red in unfinished spaces (e.g. electrical rooms) and shall be painted to match adjacent surfaces in finished spaces. Refer to Division 26 Section 260553, "Identification for Electrical Systems", for additional information.

3.4. CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.

3.5. IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section 260553, "Identification for Electrical Systems".

B. Junction box covers shall be painted red, except in finished spaces where they shall be painted to match adjacent surfaces. Box covers shall have a type written label to read "Fire Alarm" in accordance with requirements of NFPA 72.

C. Install framed instructions in a location visible from fire-alarm control unit.

D. Label each duct detector remote test station to identify equipment monitored, e.g. "SZVAV-1" and duct type, e.g. "supply" or "return".

3.6. GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7. FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction and Owner's representatives.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.8. DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

B. Provide up to one (1) day of four (4) hours of instruction each for ten (10) persons, to be conducted at the project site with manufacturer's representative.

END OF SECTION