INVITATION TO BID

Haines School
Fans Replacement

Issue Date: December 5, 2013

Bid Deadline: 2:00pm, Monday, January 6, 2014

NOTICE INVITING BIDS AND BIDDER INSTRUCTIONS

Haines School Fans Replacement

Issue Date: December 5, 2013

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NOTICE INVITING BIDS AND BIDDER INSTRUCTIONS

Haines School Fans Replacement

Issue Date: December 5, 2013

The Haines Borough is soliciting sealed bids from qualified and licensed contractors to perform the work for the **Haines School Fans Replacement** project.

RECEIPT OF BIDS / BID DEADLINE: Bids will be accepted until 2:00 p.m., Local Time, Monday, January 6, 2014, at the Office of the Borough Clerk in the Borough Administration Building in Haines, Alaska. Bids must be mailed or hand-delivered and will not be accepted by email or fax.

Submit Bids to:

Physical Address:	Mailing Address:
Office of the Borough Clerk Borough Administration Building 103 Third Ave S. Haines, Alaska	Haines Borough Attn: Borough Clerk PO Box 1209 Haines, AK 99827

BID OPENING: The bid opening will be shortly after 2:00 p.m. on the same date in the Borough Administration Building conference room.

BID DOCUMENTS: A Bid packet including instructions, forms, specs, and drawings is available on the Haines Borough website: www.hainesalaska.gov/rfps for viewing and printing.

If prospective bidders request that borough staff print the documents, the cost will be 25 cents per standard 8½x11 page and 50 cents per 11x17 page. (Each side of a page counts as one.)

QUESTIONS:

For questions regarding viewing and printing:

Attn: Michelle Webb, Interim Borough Clerk
103 Third Ave / P.O. Box 1209, Haines, AK 99827
Phone: 907-766-2231 ext.36
Email: mwebb@haines.ak.us

For technical questions:

Attn: Doug Murray
Murray and Associates, P.C.
907 Capitol Avenue
Juneau, Alaska 99802
Telephone: (907) 780-6151
Email: dougm@murraypc.com

All technical communications and questions must be submitted in writing to the Project Engineer, Doug Murray. All questions and responses will be posted to the Haines Borough website at www.hainesalaska.gov.

DESCRIPTION OF WORK: The work consists of the replacement of the Haines School ventilation units VU-1, VU-2, and VU-3 supply and return fans. The project is located in Haines, Alaska.

PROJECT SCHEDULE: The Haines Borough anticipates the following project schedule:

Request for Bids issued	December 5, 2013
Receive and open bids	January 6, 2014
Borough Assembly Authorization	January 14, 2014
Notice of Intent to Award	January 15, 2014
Notice to Proceed	January 24, 2014 (approximate)
Project Completion	Substantial Completion: August 4, 2014
	Final Completion: September 4, 2014

REQUIRED BID SUBMITTALS: To be considered, all bidders must include the following at the time of the bid opening:

- ☐ One copy of the Bid Form signed in ink by an authorized representative of the business;
- ☐ Non-Collusion Affidavit;
- ☐ Copy of a current Alaska business license;
- ☐ Copy of a current Haines Borough business license;
- ☐ Copy of an Alaska contractor's certificate of registration;
- ☐ Acknowledgement of all addenda;
- ☐ A bid bond of at least five-percent of the amount of the bid or a certified check drawn to the Haines Borough in like amount. Checks and bid bonds will be returned to unsuccessful bidders; and
- ☐ Sealed in an envelope clearly labeled with the bidder's business name and "*Haines School Fans Replacement*."

BID MODIFICATIONS: Any bidder may modify a Bid by mail, telegram, email, or fax (**Fax: 907-766-2716**) up to the scheduled closing time for receipt of Bids, provided that such modification is received by the Haines Borough prior to the time set for opening of Bids. Bidders are strongly advised to telephone the Haines Borough (**Telephone: 907-766-2231**) to confirm the successful and timely transmission of all Bid modifications. A bid modification should not reveal the Bid price but should provide the addition or subtraction or other modification so that the final prices will not be known by the Borough until the sealed Bid is opened. Modifications shall include both the modification of the unit bid price and the total modification of each item modified. The Borough shall not be responsible for its failure to receive modifications, whether such failure is caused by transmission line problems, fax device problems, operator error or otherwise.

Unauthorized conditions, limitations, or provisos attached to the Bid will render it informal and cause its rejection as being non-responsive. The completed bid forms shall be without interlineations, alterations, or erasures in the printed text. All changes shall be initialed by the person signing the Bid. Alternative Bids will not be considered unless called for.

DISCREPANCIES IN BIDS: In the event there is more than one pay item in a Bid Schedule, the Bidder shall furnish a price for all pay items in the schedule, and failure to do so may render the Bid non-responsive and cause its rejection. In the event there are unit price pay items in a Bid Schedule and the "amount" indicated for a unit price pay item does not equal the product of the unit price and quantity, the unit price shall

govern and the amount will be corrected accordingly, and the Bidder shall be bound by said correction. In the event there is more than one pay item in the Bid Schedule and the total indicated for the schedule does not agree with the sum of the prices bid on the individual items, the prices bid on the individual items shall govern and the total for the schedule will be corrected accordingly, and the Bidder shall be bound by said correction.

WITHDRAWAL OF BID: The Bid may be withdrawn by the Bidder by means of a written request, signed by the Bidder or its properly authorized representative. Such written request must be delivered to the place stipulated in the Notice Inviting Bids for receipt of Bids prior to the scheduled closing time for receipt of Bids. Bids may not be withdrawn for sixty days following the date of opening.

QUALIFICATIONS OF BIDDERS: To demonstrate qualifications to perform the work, each Bidder must be prepared to submit evidence within 5 days after Bid opening, and upon the Borough's written request, such as financial data, previous experience, and present commitments. Nothing indicated herein will prejudice the Borough's right to seek additional pertinent information as evidence of Bidder's qualifications for the work prior to contract award.

EXAMINATION OF BID DOCUMENTS AND SITE: It is each Bidder's responsibility, before submitting a Bid, to:

1. Examine thoroughly the Bid Documents and other related data identified in the Bidding Documents (including "technical data" referred to below);
2. Inspect the site to become familiar with and satisfy Bidder as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the work;
3. Consider federal, state, and local laws and regulations that may affect cost, progress, performance, or furnishing of the work;
4. Study and carefully correlate Bidder's knowledge and observations with the Bid Documents and such other related data; and
5. Promptly notify, in writing, the Borough Clerk or Director of Public Facilities of all conflicts, errors, ambiguities, or discrepancies which Bidder has discovered in or between the Bid Documents and such other related documents.

The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this section; that without exception the Bid is premised upon performing and furnishing the work required by the bidding Documents and applying the specific means, methods, techniques, sequences, or procedures of construction (if any) that may be shown or indicated or expressly required by the Bidding Documents; that Bidder has given the Haines Borough written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has found.

OWNER'S RIGHTS RESERVED: The Haines Borough reserves the right to reject any or all Bids, to waive any informality in a Bid, and to make award to the lowest responsive, responsible Bidder as it may best serve the interests of the Borough.

RETURN OF BID BOND: Within 14 days after award of the contract, the Borough will return the Bid securities accompanying such Bids not considered in making the award. All other Bid securities will be held until the Agreement has been executed. They will then be returned to the respective Bidders whose Bids they accompanied.

GENERAL CONTRACT CONDITIONS

- **PRODUCT**: All Plans, original drawings, electronic files, specifications, reports, photographs, and other documents relative to a project which the respondent prepares or causes to be prepared in connection with services performed shall be delivered to and become the property of the Borough.
- **INSURANCE**: The professional services provider to whom a contract is awarded may be required to furnish to the borough evidence of insurance coverage(s) including general liability, professional liability, and workers compensation insurance, as appropriate.
- **INSURANCE NOT LIMITING CONTRACTOR'S LIABILITY**: The provisions of this contract requiring insurance shall not limit the liability of the Contractor or anyone acting on behalf of the Contractor.
- **INDEMNITY**: Contractor agrees to defend, indemnify and hold the Borough harmless from any and all claims, demands or liability for bodily injury or death of any person, or damage to property arising out of the Contractor's execution of the contractual duties of the Contractor, its agents, employees or assigns.
- **DAMAGE TO BUILDINGS OR EQUIPMENT**: Any problems, including building or equipment damage, caused by or discovered by the Contractor during the execution of the contractual duties of the Contractor should be reported immediately.
- **COMPLIANCE WITH LAWS**: The Contractor and all persons acting on behalf of the Contractor shall comply with all applicable laws and regulations of Federal, State or Local government agencies with respect to the activities of the Contractor or anyone acting on behalf of the Contractor. This includes minimum rates of pay for public improvement projects exceeding $25,000.
- **LIENS AND ASSESSMENTS**: The Contractor agrees that it will pay all employment security contributions required to be paid as a result of any services performed for the Borough regardless of whether they are performed by the Contractor or someone engaged by the Contractor. The Contractor shall not allow any lien to be placed against the Borough by reason of non-payment of such contributions or any other reason, and shall indemnify the Borough against any such lien.
- **EXPENSES AND ATTORNEY'S FEES UPON DEFAULT**: Contractor agrees to pay all actual costs, expenses and actual attorney's fees incurred by the Borough upon an Event of Default.
- **DEFAULT**: The Contractor shall be declared in default of the contract if the Contractor fails to adequately perform the contract services. If, in the opinion of the Borough, the Contractor's services do not adequately fulfill the intent of the contract, the Borough Clerk shall notify the Contractor in writing of service deficiencies. If the Contractor fails to correct such deficiencies within ten days of receiving this written notice, or consistently fails to provide adequate services as documented in writing by the Borough, the contractor shall be in default of the contract and the Borough shall terminate the contract.
- **BILLING/PAYMENT**: Requests for payment for performed services shall be submitted to the Borough and will be processed for payment at the time of the next accounts payable check run.
- **INSURANCE**: Without limiting the Contractor's indemnification, the Contractor shall purchase at its own expense and maintain in force at all times during the performance of services under Contract the following policies of insurance. The Haines Borough shall be named as "additional insured." Where specific limits are shown, it is understood that they shall be the minimum acceptable limits. If the Contractor's policy contains higher limits, the Haines Borough shall be entitled to coverage to the extent of such higher limits. Failure to maintain insurance is a material breach and grounds for termination of the Contractor's services.

(a) Worker's Compensation Insurance: The Contractor shall provide and maintain, for all employees of the Contractor engaged in work under this Contract, Worker's Compensation Insurance as required by AS 23.30.045. The Contractor shall be responsible for Worker's Compensation Insurance for any subcontractor who directly or indirectly provides services under this Contract. If the Contractor does not have employees, this insurance requirement is waived.

(b) General Liability Insurance: The Contractor must maintain General Liability Insurance in an amount sufficient to cover any suit that may be brought against the Contractor. This amount must be at least five-hundred thousand dollars ($500,000) combined single limit. The Contractor must assume all insurable risks and bear any loss or injury to property or persons occasioned by neglect or accident during the terms of this Contract, except for sole negligence on the part of the Borough.

(c) Comprehensive Automobile Liability Insurance: Covering all vehicles utilized in connection with this project with coverage limits not less than $100,000 per person, $300,000 per occurrence bodily injury, and $50,000 Property damage.

- **PERFORMANCE AND PAYMENT BONDS**: Performance and payment bonds in the amount of the contract or a certified check to the Haines Borough in like amount are required by AS 36.25.010. Each bond shall be in the amount of 100% of the contract price, with a corporate or other surety approved by the Borough, will be required for the faithful performance of the contract. Attorneys-in-fact who sign bonds must file with each bond a certified and effected dated copy of the power of attorney.
- **CONDUCT OF THE WORK**: The conduct of the bid and the conduct of the Work will be governed by Haines Borough Code, the Contract Documents, and, where the contract documents are silent, the Standard General Conditions of the Construction Contract (available on the borough's website: www.hainesalaska.gov/rfps). Information obtained from an officer, agent or employee of the Borough or any other person shall not affect the risk or obligations assumed by the Contractor or relieve the contractor from fulfilling any of the conditions of the contract.
- **RATES OF PAY AND REPORTING PAYROLL**: This project is governed by Alaska Statute Title 36, Public Contracts. The Contractor is required to compensate employees in accordance with Alaska Department of Labor & Workforce Development Wage and Hour Administration Pamphlet No. 600 (available on the borough's website: www.hainesalaska.gov/rfps). The Contractor is required to report and certify payroll in accordance with instructions contained in the Pamphlet.

HAINES BOROUGH

Haines School Fans Replacement

BID SCHEDULE

Bid of _____ (hereinafter called *Bidder*), doing business as (underline one) a corporation, partnership or individual, to the Haines Borough (hereinafter called *Borough*). The Bidder agrees to furnish to the Haines Borough all information and data that may be requested to give evidence that the undersigned is properly qualified to carry out the obligations of the Contract Documents.

The undersigned Bidder agrees, if this bid is accepted, to furnish all tools, equipment, supplies, manufactured articles, labor, materials, services and incidentals, and to perform all work necessary to complete the work required under the Invitation to Bid by the completion dates and to accept as full payment the Contract Price stated on this Bid Form, and in the manner stipulated by the Request for Bids, subject to any negotiated changes in the work that might increase or decrease the contract amount. The Borough reserves the right to reject any and all bids and negotiate with the responsible bidder submitting the lowest bid amount.

Bidder accepts all of the terms and conditions of the Request for Bids and, if this bid is accepted, will furnish, within ten calendar days after the Notice of Intent to Award letter, the following documents required by borough code for this project:

1. *Contract document or Agreement;*
2. *[Proof of insurance: general liability, auto insurance, worker's compensation];*
3. *Any overdue unpaid debts owed the borough must be current prior to award;*
4. *Payment and Performance bonds, if applicable; and*
5. *Subcontractor report, if applicable.*

Bidder acknowledges receipt of the following addenda: Addendum #.____ Initials:____ Addendum #._____ Initials:____

Total BASE BID (Price in Digits): _____

BIDDER INFORMATION:

Principal Contact: _____

Business Name: _____

Business Physical Address: _____

Business Mailing Address, if different: _____

Phone: _____ Fax: _____ Email:_____

_____
Bidder's Authorized Signature

_____ _____
Printed Name Date

HAINES BOROUGH

Haines School Fans Replacement

NON-COLLUSION AFFIDAVIT

UNITED STATES OF AMERICA)

STATE OF ALASKA)

I, _____ of _____,
(Printed Name of Person Signing) (Printed Name of Business)

being duly sworn, so depose and state:

That I, or the firm, association or corporation of which I am a member, a BIDDER on the contract to be awarded, by the Assembly of the HAINES BOROUGH for the contract services designated as:

Haines School Fans Replacement

Located in Haines, Alaska, have not, either or indirectly, entered into any agreement, participate in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such contract.

_____ _____
Signature Date

Subscribed and sworn to this ___ day of _____, 2014.

Notary Public_____

My Commission Expires:_____

HAINES BOROUGH

Haines School Fans Replacement

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned

_____ as Principal and

_____ as Surety,

are hereby held and firmly bound unto the HAINES BOROUGH, as OWNER, in the penal sum of _____ Dollars ($_____) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this _____ day of _____**, 2014**.

The condition of the above obligation is such that whereas the Principal has submitted to the HAINES BOROUGH, ALASKA a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for:

Haines School Fans Replacement

NOW, THEREFORE

(a) If said BID shall be rejected, or

(b) If said BID shall be accepted and the Principal shall

execute and deliver a contract in the Form of Contract attachment hereto (properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor furnishing materials or equipment in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety of any and all claims hereunder shall in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by an extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, and day and year first set forth above. *Note: Surety companies executing BONDS must appear on the Treasury Department's most current list and be authorized to transact business in Alaska.*

_____

Principal

(SEAL) BY:_____

_____

Surety

(SEAL) BY:_____

HAINES BOROUGH

Haines School Fans Replacement

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

That we _____, a _____

(Name of Contractor) (Corporation, Partnership, Individual)

hereinafter called "Principal" and

_____ of _____,

(Surety) (Address/State)

hereinafter called the "Surety",

are held and firmly bound unto the HAINES BOROUGH, hereinafter called "OWNER", in the penal sum of _____ dollars ($_____) in lawful money of the united States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally firmly by these presents. THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal has or is about to enter into a certain contract with the OWNER, a copy of which is hereto attached and made a part hereof for:

Haines School Fans Replacement

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all undertakings, covenants, terms, conditions and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety, and if it shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed hereunder or the specifications accompanying the same shall in any wise affects its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or the specifications.

PROVIDED, FURTHER, that no final settlement between the OWNER and the principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in two (2) counterparts, each one of which shall be deemed an original, this the ___ day of _____, 2014.

_____

Principal

(SEAL) BY:_____

_____

Surety

(SEAL) BY:_____

Note: This Performance Bond must comply with Alaska Statute 36.25.010(a)(1).

HAINES BOROUGH

Haines School Fans Replacement

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS:

That we _____, a _____

(Name of Contractor) (Corporation, Partnership, Individual)

hereinafter called "Principal" and

_____ of _____,

(Surety) (Address/State)

hereinafter called the "Surety",

are held and firmly bound unto the HAINES BOROUGH, hereinafter called "OWNER", in the penal sum of _____ dollars ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally firmly by these presents. THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal has or is about to enter into a certain contract with the OWNER, a copy of which is hereto attached and made a part hereof for:

Haines School Fans Replacement

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for, or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools consumed or used in connection with the construction of such work, and all insurance premiums on said work and for all labor performed in such work, whether by sub-CONTRACTOR or otherwise, then this obligation shall be void: otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed hereunder or the specifications accompanying the same shall in any wise affects its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alternation or addition to the terms of the contract or to the work or the specifications.

PROVIDED, FURTHER, that no final settlement between the OWNER and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in two (2) counterparts, each one of which shall be deemed an original, this the ___ day of _____, 2014.

_____

Principal

(SEAL) BY:_____

_____

Surety

(SEAL) BY:_____

Note: This Performance Bond must comply with Alaska Statute 36.25.010(a)(2).

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SECTION 230510 - GENERAL MECHANICAL HVAC

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Mechanical Work is governed by the entire Specifications and not just Division 23. The entire Specifications must be examined for requirements relating to the Work hereunder. The Work covered by this and all other Mechanical sections consists of furnishing labor, equipment, and materials in accordance with the Specifications or Drawings, or both, together with any incidental items not shown or specified which can be reasonably inferred or taken as belonging to the Work and necessary in good practice to provide a complete system described or shown as intended.

B. Coordinate shutdown of systems with Haines School District Maintenance Personnel. Contact name and phone number will be available through ARCHITECT.

C. Continuity of Mechanical Systems for the Building: Continuity of Mechanical systems for building sprinkler, plumbing, heating, and ventilation systems during demolition and new work shall be the responsibility of the CONTRACTOR. Building sprinkler, plumbing, heating, and ventilation systems shall be operational during occupied periods when school is in session. Shutdown of systems shall not affect Occupied portions of the building except when coordinated with the School District and the ARCHITECT. Shutdown to Occupied portions of the building to occur after school hours and upon approval of the School District.

D. Demolition of and Connection to Existing Material, Equipment, and Systems:

1. Mechanical drawings (MD200) show reported as-built and contract document locations.
2. Where select piping and ductwork systems are shown to be partially removed for connection, prepare and protect the connection points appropriately to ensure later continuity of Work. CONTRACTOR shall provide all temporary supports as required and completely replace material and equipment that are not suitably protected during construction and becomes damaged.
3. CONTRACTOR shall provide all temporary caps for ductwork and piping as required. CONTRACTOR shall provide all temporary partitions such as air-tight air plenum separations as required to maintain continuity of systems and to not contaminate existing systems or finishes. CONTRACTOR shall remove all temporary provisions when the phase of Work is completed or earlier if required.
4. All material and equipment that are to be removed for relocation is the CONTRACTORS responsibility to suitably protect and store in a location that protects from damage. CONTRACTOR shall completely replace all relocated material and equipment that are damaged from storage and other misuse between demolition and reinstallation.
5. Where items are shown to be removed such as piping or ductwork it is to be assumed that this includes the removal of the respective system including but not limited to pipe and duct hangers, supports, conduit, wiring, valves, and other related trim and appurtenances. Piping to be removed through a floor assumes that the piping is to be capped below floor and the floor finished smooth.
6. Mechanical Contractor shall locate, isolate, and drain piping systems to be removed.
7. Concrete wall and floor penetrations are not required. If they become necessary saw cut or core drill as required. Sleeve penetrations as specified.

1.2 WORDING OF THE SPECIFICATIONS

A. These Specifications are of the abbreviated or streamlined type and frequently include incomplete sentences. However, periods are used for clarity. Words such as "shall", "shall be", "the CONTRACTOR shall", and similar mandatory phrases shall be supplied by inference in the same manner, as they are required for the notes on the drawings.

1.3 CODES AND REGULATIONS

A. All Work hereunder shall be strictly in conformance with applicable codes and regulations. All Work shall be in accordance with the 2009 Uniform Plumbing Code, 2009 International Mechanical Code, 2009 International Building Code, 2009 International Fire Code, the most recent edition of NFPA, City & Borough of Haines and State of Alaska code modifications insofar as minimum requirements are concerned, but the Drawings and Specifications shall govern in case the minimum requirements are exceeded. All electrical equipment shall bear the UL label.

1.4 SUBMITTALS

A. General: Provide submittals according to Conditions of Contract, Division 1 Specifications Sections, and as required hereunder. Drawings and general provisions of the Contract, including General, Supplementary Conditions, and all Division 1 Specification Sections, apply to this Section. Approval of the data shall not eliminate responsibility for compliance with the Drawings or Specifications unless specific attention has been called in writing to proposed deviations at the time of transmittal of the data and such deviations have been approved, nor shall it eliminate the responsibility for freedom of errors of any sort in the data. All Mechanical submittal data for Project construction is to be turned in for approval at the same time in order for an efficient review process. Partial submittals may be rejected until the full submittal is received.

B. Specified Products: Trade names and catalog numbers of manufactured products included herein are intended to indicate the type, size, and grade of quality of equipment and materials required and such equipment and materials are approved for installation, subject to full compliance with the Specifications. Except where single manufacture is specified for standardization, requests for approval of other manufacturers than those specified must be accompanied by complete descriptions including overall dimensions, performance data, and, if catalog material, identification of specific products or items proposed.

C. Submittal Format: All data shall be submitted at one time in neatly bound loose-leaf three ring binders with pockets and tabulated in the same order of Specification Division section. All data shall be typed, minimum 10 point font, no exceptions. Data submitted that is not conforming to these specification requirements will be returned without reviewing and will need to be resubmitted at Contractors sole complete cost.

1. Each binder shall have a set of separators with index tabs A to Z. Tabs are to be printed type. Slip-in tabs not acceptable.
2. The first page shall be a cover sheet with project name, address, date, submittal product name, all applicable contractors and contact information, and all applicable consultants and contact information.
3. Second page shall be a submittal manual index of all project Specification sections with

respective tab numbers, and respective book number, if applicable.

4. The first page of each manuals section shall be an index of that respective project Specification section and number with each product name, manufacturer name and model number.
5. Each manuals section shall be labeled and certified by mechanical Subcontractor that the data presented is in accordance with project Specifications. Index sheet in front of completed binder listing each piece of equipment or material submitted.
6. Product Data to be utilized shall be flagged and noted and all other data shall be crossed out or otherwise flagged that it is not in the project.
7. Data shall be inserted in binders in order of Specification number. Specification number shall be clearly labeled on each submittal page.

D. As-built Drawings: As-built drawings shall be required from all Mechanical Subcontractors and shall accurately show all changes from Contract Documents for all piping, ductwork, and equipment. As-built drawings shall be updated daily and available for inspection on-site by the Owner.

E. Operating and Maintenance Data: See Division 1 for the number of sets of data to be provided for submittal and additional requirements. Provide a minimum of four (4) copies. The following data shall be provided to the Owner for approval 30 days prior to the request for Commissioning or Substantial Completion inspection, whichever comes first. Except for the valve directory and nameplate directory, the data shall be provided complete at one time. Partial or separate data will be returned for completion. The valve directory and nameplate directory may be provided for approval previous to the other data. The first section of the O&M manual shall be as listed in the following subparagraphs in order presented hereunder. All of the following subparagraphs sections shall be furnished with permanent plastic see through covers. See requirements under 1.4.C for additional submittal and formatting requirements.

1. Cover and Index sheets as in 1.4.C. above.
2. Description of systems and operating instructions: The Contractor shall prepare a brief type written description of all new and modified systems, explaining how the systems operate and indicating the proper settings of controls and switches. The instructions are to include all information required for the proper settings of controls and switches. The instructions are to include all information required for the proper operation of the systems. Technical knowledge on controls or adjustments requiring specialized technicians should not be included in the instructions.
3. Nameplate directory: List of all new air handlers, fans, and other equipment nameplates, giving manufacturer's nameplate data, nameplate designation, location of equipment, area served, switch location, and normal position of the switch. Motor data must include the horsepower, voltage, full load amperage, phase, etc. See Section 220553 - Mechanical Identification.
4. Manufacturers' literature: Manufacturers' instructions for operation and maintenance of all mechanical equipment and specialties, including replacement parts lists, capacity curves or charts, equipment data sheets, manufacturers' literature on the equipment, and as-built wiring diagrams and control drawings, all suitable for side binding to 8-1/2 x 11 inch size. All data not applicable to the job is to be crossed out or deleted. Manuals turned in for review with non-applicable data not crossed out shall be returned to the Contractor.
5. Maintenance instructions: Typewritten instructions for the maintenance of the systems, listing each service required on all of the mechanical equipment, including inspections, lubrication, cleaning, checking, and all other operations required. The list is to include all types of bearings installed on the equipment and the type of lubricant required.

6. Maintenance schedule: List of each item of mechanical equipment requiring inspection, lubrication, cleaning, or service including the type of bearings and type of lubricating means for each piece of equipment. Each item of equipment is to be listed separately with the service required. List to include the times during the year when such inspection and maintenance shall be performed. The specific maintenance required shall be referenced back to the maintenance instructions.
7. Valve directory: Indicating valve number, size, location, function, and normal position for each numbered valve. The directory shall be correlated with the existing directory and approved before installation of the valve tags. A sample arrangement will be furnished upon request. Two copies required for the preliminary list. See Section 220553 - Mechanical Identification.

F. Guide Documents: Sample operating and maintenance instructions and maintenance schedule may be obtained from the Owner upon request, to assist in properly setting up the data.

G. Instructions To Personnel and Training: The mechanical Subcontractor shall instruct operating personnel in the operation and maintenance of the systems before accepting the responsibility of operation and maintenance of the systems. Each training session shall be signed off by Project Manager.

H. Qualification Data: For sheet metal installers. For pipe fitters.

I. Submit prior to Substantial Completion Inspection and Final Inspection a detailed list of equipment and systems that will not be completed for the completion date. Include status and information of deficiencies from all previous inspection reports.

J. Submit prior to Re-inspections of Substantial Completion Inspections, if applicable, and the Final Inspection a marked copy of the previous Engineers Inspection Reports detailing all items that have been completed and all items that have not been completed with reasons thereof. Re-inspection or Final Inspection will not occur until receipt of this list.

1.5 COOPERATIVE WORK

A. The Work hereunder shall be coordinated between various mechanical Sections and with the Work specified under other divisions or contracts toward rapid completion of the entire Project. If any cooperative Work must be altered due to lack of proper supervision hereunder, or failure to make proper provisions in time, then the Work hereunder shall include all expense of such changes as are necessary to be made in the Work under other divisions and contracts, and such changes shall be directly supervised by the Owner and shall be made to the satisfaction of the Owner.

B. In general pitched piping and ductwork shall take preference in location within the Project area. Coordination of all drain valves, duct access doors, and other equipment requiring access and maintenance procedures is required with all building components during construction for maximum accessibility and proper location as intended.

C. Protection of existing mechanical material and equipment during selective demolition shall be the responsibility of the CONTRACTOR and coordinated with the respective Contractors. The CONTRACTOR shall provide temporary supports for all material and equipment. The CONTRACTOR at no cost to the Owner shall replace any existing material or equipment damaged during selective demolition due to insufficient protection. Coordination with all

disciplines is required.

1.6 QUALITY ASSURANCE

A. Perform Work in conformance with all applicable codes, regulations, local ordinances, contract documents, and generally accepted good practice. If discrepancies exist between Specifications and Contract Drawings then the solution that provides the Owner with the highest quality of product or installation shall be deemed as intended by the Contract Documents.

B. All sheet metal workers shall have a minimum documented sheet metal fabrication and installation experience in commercial or industrial facilities of three years or be enrolled in an Alaska Department of Labor approved Sheet Metal Apprentice program. The ratio of on-site workers shall not exceed 3 apprentices or sheet metal workers for every one foreman. A foreman is defined as a sheet metal worker with minimum 3 years experience as detailed above or is an approved Journeyman.

C. All Plumbers and Pipe Fitters shall have a minimum documented installation experience in commercial or industrial facilities of three years or be enrolled in an Alaska Department of Labor approved Plumbers and Pipe Fitters Apprentice program. The ratio of on-site workers shall not exceed 2 apprentices or pipe fitters for every one Journeyman.

1.7 FIELD MEASUREMENTS

A. See Division 1 for specific requirements.

B. Verifications: All measurements shall be verified at the site and prior to fabrications of equipment and systems. The existing conditions shall be fully observed before beginning the Work hereunder, and the Work hereunder executed in full coordination with the existing conditions observed. All hazardous material including asbestos materials that are discovered during the course of construction shall be immediately brought to the attention of the Owner for action. All Work performed with hazardous materials not approved by the Owner shall be at the full responsibility of the contractor and not the Owner.

C. Changes: Variations apparently necessary due to existing conditions shall be made only on approval in writing by the Owner.

1.8 WARRANTY

A. See Division 1 for specific requirements regarding: Product warranties and product Bonds.

B. The contractor shall provide continuous and generally trouble-free operation of the mechanical systems for the time period listed in Division 1 or for one year after Substantial Completion whichever time period is longer. The operation and maintenance of systems other than incidental operations such as room thermostat settings or changing of air filters, shall be the sole responsibility of the contractor and shall be addressed by the contractor immediately if deficiencies are present. Leaking of valves, flanges, or air vents shall be addressed immediately by the contractor during the warranty period. Control settings, noise problems, and other deficiencies resulting in unsatisfactory environmental conditions shall be addressed immediately.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 230510

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Thermometers and thermometer wells.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 0926 - Building Automation System and Controls.

1.3 REFERENCE STANDARDS

A. ASTM E1 - Standard Specification for ASTM Thermometers; 2007.

B. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2007.

1.4 SUBMITTALS

A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1. Manufacturer's data indicating use, operating range, total range, accuracy, and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
4. Submit schedule of pressure gage and thermometers detailing service and scale.

B. Project Record Documents: Record actual locations of components and instrumentation.

C. Operation and Maintenance Data.

1.5 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.1 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc
2. Omega Engineering, Inc
3. Weksler Glass Thermometer Corp

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

2.4 DIAL THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc
2. Omega Engineering, Inc
3. Weksler Glass Thermometer Corp

B. Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.

1. Size: 5 inch diameter dial.
2. Lens: Clear Lexan.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

C. Thermometers: Dial type vapor or liquid actuated; ASTM E1; stainless steel case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.

1. Size: 4-1/2 inch diameter dial.
2. Lens: Clear Lexan.
3. Length of Capillary: Minimum 5 feet.
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.5 SOLAR POWERED THERMOMETERS

A. Manufacturers:

1. Weiss
2. Weksler
3. FNW brand not acceptable.

B. Thermometer: Adjustable angle, digital solar powered thermometer, with positive locking device.

1. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
2. Accuracy: 2 percent.
3. Calibration: Both degrees F and degrees C.

2.6 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C. Install thermometers in air duct systems on flanges.

D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

E. Coil and conceal excess capillary on remote element instruments.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION 230519

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2001 (Reapproved 2007).

1.3 SUBMITTALS

A. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Kolbi Pipe Marker Co
2. Seton Identification Products.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Plastic: Conform to ASTM D709.

2.2 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving
2. Brady Corporation
3. Kolbi Pipe Marker Co
4. Seton Identification Products

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.3 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation
2. Kolbi Pipe Marker Co
3. MIFAB, Inc
4. Seton Identification Products

B. Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed. For un-insulated piping only.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Symbols, numbers, and all mechanical identification shall match and be in accordance with Contract Documents.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

G. Identify air handling units and fans with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers.

1. Plastic pipe markers are to be used on uninsulated piping only.
2. Identify service, flow direction, and pressure.
3. Install in clear view and align with axis of piping.
4. Locate identification not to exceed 15 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
5. Inaccessible piping need not be indentified if piping is identified at nearest accessible or exposed locations.
6. Install identifying devices after completion of coverings and painting.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems: AHU-1, AHU-2, AHU-3, and EF-6.

B. Testing, adjustment, and balancing of hydronic systems: AHU-1, AHU-2, and AHU-3.

C. Measurement of final operating condition of HVAC systems.

1.2 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988, with 1997 Errata.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.3 SUMMARY

A. Scope of Work: Adjust and balance all listed AHU supply fan and rturn fans overall air volumes. Individual grilles are nto required to be measured except building air systems. Adjust and balance all building hydronic systems. Air volumes are located on the diffuser and grille schedules. Flow rates for all hydronic systems are shown on the schedules. Testing and balancing of new and existing systems at the end of Phase I work is required prior to occupancy for the school year. TAB is also required to be onsite when commissioning occurs. Coordinate with contract document requirements.

1. Ventilation and Exhaust Systems:

   a. AHU-1 SF & RF System Fans Only.
   b. AHU-2 SF & RF System Fans Only.
   c. AHU-3 SF & RF System Fans Only.
   d. EF-6 System Fan Only.
   e. Grilles and Diffusers for Classroom Career Tech 126 and Storage 126-A.

2. Hydronic Heating Systems for heating coils of the respective AHU systems.
3. Coordination during Controls Start-up and Testing.

1.4 SUBMITTALS

A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for ARCHITECT and for inclusion in operating and maintenance manuals.
3. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in both I-P (inch-pound) units.
7. Include the following on the title page of each report:

a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project ARCHITECT.
g. Project Engineer.
h. Project CONTRACTOR.
i. Project altitude.
j. Report date.

H. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:

a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.
d. Professional mechanical engineer with documented TAB experience within the last five years.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 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. Filters have been replaced immediately prior to adjustment of air system.
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.
12. Hydronic systems are flushed, filled, and vented.
13. Proper strainer baskets are clean and in place.
14. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.3 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at the fan inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not

create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. AHU, EF, RF, and SF Adjustment: Perform in the following sequence.

1. Achieve the design flow rates for all outlets.

a. AHU, SF, and RF: Adjust the sheave so that design cfm is achieved.

1) Balancing dampers in the longest run wide open.

b. EF: Adjust the sheave so that design cfm is achieved.

1) Balancing dampers in the longest run wide open.

c. Measure and adjust minimum OSA volumes. See Section 230923 and Sequence of Operations on drawings for minimum OSA volumes.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and

fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.7 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

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

B. V-Belt Drives:

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

C. Heating Coils:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Water flow, design and actual
7. Water pressure drop, design and actual
8. Entering water temperature, design and actual
9. Leaving water temperature, design and actual
10. Entering air temperature, design and actual
11. Leaving air temperature, design and actual
12. Air pressure drop, design and actual

D. Air Moving Equipment:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual

10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

E. Return Air/Outside Air:

1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow

F. Exhaust Fans:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

G. Duct Traverses:

1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.2 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for HVAC Piping and Equipment.

1.3 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2008.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2010.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 1985 (Reapproved 2007).

E. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation.

2. Johns Manville Corporation.
3. Owens Corning Corp.
4. CertainTeed Corporation.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 1200 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

2.3 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation.
2. Johns Manville Corporation.
3. Owens Corning Corp.
4. CertainTeed Corporation.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum service temperature: 450 degrees F.
3. Maximum Water Vapor Sorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Do not insulate ductwork exposed in finished spaces.

F. Ducts Exposed in Mechanical Equipment Rooms: Finish with canvas jacket sized.

3.3 SCHEDULES

A. Duct System Insulation:

1. Ducts Connected to Louvers and plenums located in Mechanical Rooms: Rigid Mineral Fiber Duct Board Insulation, 2 inches thick.

a. Exhaust Air: Insulate duct from edge of plenum to the exhaust air damper.
b. Outside Air: Insulate duct from edge of plenum to fan inlet connection.
c. Plenums: Repair to existing plenums.

2. Ducts Connected to AHU-3 Serving Gym in Mechanical Rooms: Flexible Mineral Fiber Duct Board Insulation, 1-1/2 inches thick.

a. AHU-3 Supply Air: Insulate duct from edge of supply fan connection to connection with existing ductwork.
b. AHU-3 Return Air: No insulation required.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2010.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007.

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007.

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2008.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2007e1.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 GLASS FIBER

A. Manufacturers:

1. Knauf Insulation
2. Johns Manville Corporation
3. Owens Corning Corp
4. CertainTeed Corporation

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum service temperature: 850 degrees F.
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:

1. Water based insulation adhesive, UL classified. Compatible with insulation.

2.3 JACKETS

A. PVC Plastic.

1. Manufacturers:

a. Johns Manville Corporation
b. Proto/Knauf
c. Speedline

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive.

3. Covering Adhesive Mastic:

a. Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

E. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 7 feet above finished floor): Finish with PVC jacket and fitting covers.

F. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

G. Fill joints, cracks, seams, and depressions with cement to form smooth surface.

H. Finish insulation at supports, protrusions, and interruptions.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

K. Factory Insulated Equipment: Do not insulate.

L. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3.3 SCHEDULE

A. Piping Systems:

1. Heating Water Supply and Return: Mineral fiber pipe insulation: Up to and including 3" pipe diameter; thickness of 1-1/2 inch.

END OF SECTION 230719

SECTION 230926
BUILDING AUTOMATION SYSTEM AND AUTOMATIC CONTROLS

PART 1 - GENERAL

1.1 OVERVIEW

A. Furnish all labor materials, equipment, and service necessary for a renovation and replacement of the HVAC control system for the Haines School Fans Replacement Project. Work includes a replacement of the Direct Digital Controls (DDC) control associated with the VU systems and EF systems with new and relocated controls for AHU systems and EF systems replaced in Project.

1.2 QUALITY ASSURANCE

A. The control Subcontractor shall maintain an office in Juneau or Anchorage with repair parts and maintenance personnel to ensure prompt response to an emergency call during the warranty period. The contractor shall maintain a complete sales, engineering, installation, and service organization.

B. All WORK described in this section shall be installed, wired, circuit tested and calibrated by factory trained electricians and mechanics qualified for this WORK. The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying that installation experience. Installation shall not be subcontracted. Supervision, calibration and checkout of the system shall be by personnel with documented experience with specified manufacturer.

C. All materials and equipment used shall be standard components, of regular manufacture for this application. All systems and components shall have been thoroughly tested and proven in actual use.

D. The automatic control system shall be installed by trained, qualified personnel and commissioned by factory-trained technicians.

E. Perform work in accordance with NFPA 70.

F. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.3 SYSTEM DESCRIPTION

A. Scope of WORK:

1. This specification describes the primary products and performance of the automatic control system.
2. All control equipment abandoned or no longer required due to this renovation shall be removed.

3. Existing wiring may be reused, however all final wiring shall be installed without splices.
4. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. In the event of a network failure, or the loss of any other controller, the control system shall continue to operate under independent control.
5. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.
6. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, balancing, inspection, and commissioning.
7. Provide a comprehensive operator and technician training program as described herein.
8. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation including technical manuals, on approved media, the sum total of which accurately represents the final system.

1.4 COORDINATION

A. Equipment: Control Subcontractor shall supply control equipment for installation by equipment suppliers and mechanical Subcontractor where required. This includes all control equipment installed in piping systems such as thermostat wells and automatic valves. Control Subcontractor shall also coordinate locations of control equipment, including, but not limited to, thermostats, and valve actuators, thermostat bulbs and averaging elements.

B. During the adjustment of the mechanical systems, air and water, the BAS Subcontractor shall provide a trained technician on-site to help the adjuster with their balancing procedures including any software required to interface with the control sequences. Responsibility for coordination of the times is included under the automatic controls.

1.5 ACCEPTABLE MANUFACTURERS

A. Alerton (ATS Alaska) for standardization and continuation of an existing DDC system.

1.6 SUBMITTALS

A. Submittal of the entire control system design shall be provided. Submittal shall consist of shop drawings, a complete list of equipment and materials, manufacturer's catalog data sheets, and installation instructions. Terminal identification for all control wiring shall be shown on the shop drawings. Prior to installing the automatic control systems, submit the following for review and approval:

B. Shop Drawings: Control system installation drawings showing the equipment controlled, the locations of field devices, field wiring, layout drawings, riser diagrams, sequence of operation, and bill of materials, in addition to the following:

1. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
2. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
3. List connected data points, including connected control unit and input device. List all input/output object listings and an alarm point summary listing.

4. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
5. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
6. Indicate description and sequence of operation of operating, user, and application software.
7. Bill of materials for all control equipment and components. Provide valve and damper schedules.
8. Drawings shall detail all control panels, control devices, and all other field devices on building floor plans.
9. Drawings shall be submitted in the following standard sizes: 11” x 17” (ANSI B).

C. Product data/specification sheets for control system components and field devices.

D. Manufacturer's Instructions: Provide and indicate manufacturer's installation instructions for installation, maintenance, and operation of all manufactured components.

E. Project Management: The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases at the beginning of the project and updated as required. Schedule shall show all phases of the project. Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.

F. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.

1.7 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be submitted for review and approved before the final inspection and Owner training.

B. The operation and maintenance manuals shall include the following information:

1. A user's guide to operate the building management system. The guide shall include the following: log on procedure; viewing system information; viewing and acknowledging alarms; changing a setpoint; printing a trend or report; overriding a point.
2. Manufacturer's data for all control components and maintenance information for all control components requiring periodic maintenance.
3. Complete system “As-Built” control drawings. Complete software “As-Built” diagrams. As-built control drawings and sequences shall be re-submitted as necessary for changes made during commissioning process.

1.8 WARRANTY

A. A warranty period of one year shall commence upon acceptance of the systems by the OWNER. The warranty shall consist of providing parts and labor as required to repair or replace parts of the control system that prove to be faulty due to defective materials or improper installation practices or troubleshooting control sequences that are not operating as specified. Included is reprogramming of the system software to include changes in the point descriptions as requested by the Owner. This warranty excludes normal routine maintenance.

1.9 MAINTENANCE SERVICE

A. Provide service and maintenance of energy management and control systems for one year from date of the final phase Substantial Completion.

B. Provide two complete inspections per year, one in each season, of approximately 4 hours duration, to inspect, calibrate, and adjust controls as required, and submit written reports.

C. Maintenance Service only applies to Work performed under this contract.

1.10 ACCEPTANCE TESTING

A. Point Verification:

1. All control points shall be tested and included in point-to-point testing report provided to Engineer prior to inspection. To verify end-to-end operation of the system, the Subcontractor shall provide a hard copy of an All Points Summary Listing to the Owner of each part or system and verify that each point has been successfully tested. Successful testing report must be received prior to being placed in warranty by the Owner. For CHS systems, the Subcontractor 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 of systems which perform all specified sequences. The Contractor shall provide a report to the Engineer detailing all sequences have been testing and determined to be operating properly prior to inspection. The ARCHITECT shall verify all sequences of operation and place the system into warranty acceptance test.

C. Prepare and start logic control system under provisions of this section.

D. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

1. Control system functional tests shall be successfully completed minimum 2weeks prior to commissioning. During this two week period, the Control Contractor shall run trends of the system operation to accumulate data that can be used during commissioning.
2. Control Contractor shall be available on-site during balancing and during testing/start-up.
3. Control system point-to-point check-out and functional tests shall be successfully completed minimum 2 weeks prior to substantial completion. Provide point-to-point test

summary to Engineer. During this two week period, Control Contractor shall run trends of system operation to accumulate data that can be used during inspection.

1.11 TRAINING

A. After substantial completion and prior to final completion of the installation, operating personnel of the School District Maintenance shall be instructed on site in the sequence of operation and maintenance of the system hardware and software by the Subcontractor's qualified representative. A minimum 4 hours of training is to be provided. Coordinate with owner to determine the nature of training to be provided.

B. Subcontractor is to provide minimum of 7 days notice to the School District Maintenance Director prior to training and warranty visits.

C. Provide application engineer to instruct owner in operation of systems and equipment.

PART 2 - PRODUCTS

2.1 BUILDING AUTOMATION SYSTEM (BAS) COMMUNICATIONS

A. The distributed stand-alone DDC controller trunk communications shall consist of a multi-drop RS-485 bus architecture. The distributed DDC controllers shall provide communication transient protection. BACNet communication protocol required.

B. A high-speed Network Interface Module (NIM) shall be provided to support either Ethernet or Echelon communication. (BAS LAN) The NIM shall support a variety of cabling types. Minimum connectivity shall be provided for 10 Base 2 (ThinNet RG-58 A/U Coaxial cabling with BNC connectors) or 10BaseT (Twisted - Pair RJ-45 UTP cabling).

2.2 FACILITY MANAGEMENT SYSTEM HOST STATION SOFTWARE (CHS)

A. Graphics shall be provided for the Host computer workstation. The software shall provide the following functions and features:

1. Run in a Microsoft Windows operating environment.
2. Provide color graphics of controlled systems, facility wide access and coordination of global control strategies, and centralized documentation.
3. Provide for assigned password names and codes to limit the access into particular applications and functions of the system. Allow discrete menus into the system for each user.
4. Provide dynamic graphics with “system penetration” method of obtaining system information. Provide dynamic graphic screens of mechanical equipment and DDC controlled systems. Maximum of 128 dynamic points displayed on one screen.
5. Provide display and modification of individual dynamic system points from within any specific dynamic graphic display.
6. Provide help window displays for each point displayed on the screen. User editable

information specific to the point and its' relationship to the system currently displayed.

7. Provide centralized scheduling and modification of the time clock functions.
8. Provide alarm management and system exception annunciation with real time trending and reports.
9. CONTRACTOR shall provide a 2 year subscription service for any and all software upgrades that are available from the manufacturer following the final acceptance of the BAS system. Service shall include installation of the software on-site and all necessary equipment to upgrade the system. Copies of the software shall be provided to the OWNER and the Operating and Maintenance manuals shall be updated appropriately.

B. Dynamic Graphics:

1. Equipment Diagrams: Modify existing graphics. Provide a diagram of each piece of equipment similar to the schematic diagrams shown on the drawings. Display all monitored points, setpoints, control points, schedules, and alarms. Setpoints and schedules shall be adjustable from the equipment diagram. Provide a colored status indicator for the filters with green indicating green and red indicating dirty.

C. Systems Integration:

1. The CHS shall integrate the automation system being installed as a part of this contract with the current automation system now in use at this facility. Systems integration shall be defined as the following:

   a. All point data from the different systems shall be viewed and manipulated through one common format (see previous section "dynamic graphics" for definition of "viewed and manipulated"). Therefore, from the user's perspective, interaction with either of the two or more systems shall be identical in every way.
   b. Points from any of the different systems may be monitored concurrently on one graphic screen.
   c. Alarms shall be viewed and handled in a common format.
   d. Trended data shall be stored in a common database. This shall allow the data to be viewed or manipulated in common reports or charts.
   e. Panel database Upload and Download shall be supported directly by this CHS for each system being integrated and stored to the hard disk.

D. Centralized Scheduling and Modification:

1. Calendars shall be provided for displaying and modification of any of the Mechanical Systems Controller (MSDCs) time clock functions. The user shall be able to view an entire month's scheduling at a time. Holidays and Special functions shall be clearly marked on the calendar. Calendars shall be displayed by area served. A list of "served areas" shall be displayable at any time by clicking on a button on the calendar. The user shall only have to click on a "served area" to view its time clock schedule. A dynamic graphic shall be attached to each calendar allowing the user to view this "served area's" real time statistics, a link shall be provided on this same graphic screen to take the User back to the schedule.
2. Schedule changes may be made by clicking on a day or week and entering the new schedule. Changes shall be permanent or for "one time" or multiple occurrences of varying parameters. Global changes shall be allowed for similar or dissimilar schedules. There shall be no limit to the number of calendars allowed.

E. Alarm and System Exception Annunciation:

1. All alarms shall be displayed on the main alarm screen and be tied into the fire alarm sequence. Alarms shall be acknowledge by the operator in a manner equal to the existing alarm interface.

F. Trend Management and Reports:

1. The BAS system shall be provided with the ability to trend and produce reports with the new points installed under this project.
2. The CHS shall automatically perform time based periodic collection of real time point data and subsequently store it to the systems hard disk. There shall be two modes of operation; local collection shall allow the CHS to directly query the MSDCs for individual point samples; remote collection shall mean that the MSDCs collect and store trend data on individual points and then release the entire trend table(s) upon a request from the CHS. Manipulation and archiving of both types of data collection shall be treated commonly.
3. The report section of the CHS shall be the "gateway" to the CHS's database for all solicited and unsolicited data collected, and shall provide an easy means of reporting and information management.
4. The report generator shall be an integral part of the CHS, systems that use third party packages (such as Excel) for report manipulation shall not be acceptable.
5. Reports on historical trend data shall allow for daily, weekly, monthly and yearly reporting. These reports shall be completely flexible on the data items to be reported on. The user shall be able to select from a list of predefined reports or select data items on-the-fly. The selection of data items shall not be restricted by panel source. Reports may be up to 25 columns and infinite in length. Reports must be capable of reporting on data that has been collected at varying time intervals. Line interpolation shall be used when data samples are not present for a specific time placement, blank data rows for any time slot in the data columns will not be accepted. Report generator shall allow an operator to easily and quickly define the contents of a report as well as define a print time and date if so desired. Information contained in the reports shall be derived from alarm history, CHS or SDC generated exceptions, trend data and timed overrides.

G. Multi-tasking:

1. The CHS shall be capable of true multi-tasking capabilities. The User shall be able to use other non-related programs in the CHS while still running all CHS applications with no interruptions. This shall include the use of real time data in other applications. This CHS shall allow Spread Sheet programs to gather data from the MSDCs dynamically while running a dynamically updating Graphic screen. Up to 16 applications may collect data dynamically and simultaneously from the MSDCs. The CHS shall have the ability to allow the passing of data freely to MS Windows applications which incorporate the use of Dynamic Data Exchange.

2.3 MECHANICAL SYSTEMS CONTROLLERS (MSDCs)

A. General:

1. Subcontractor shall use existing spare points in AHDC if possible. Otherwise, Controls

shall be microprocessor based, Air Handler Digital Controllers (AHDC's). AHDC's shall be provided for Air Handling Units and other applications as shown on the drawings. 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.

2. The BAS Subcontractor 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 Sub Control Contractor.
3. 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.
4. AHDC's shall be in continuous direct communication with the network which forms the facility wide Building Automation System. The AHDCs shall communicate with the SDC at a baud rate of not less than 19,200 baud.

B. Non-Volatile Memory:

1. 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.
2. 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. Service Port:

1. 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 in the HHOT section of this specification. From the interface port, the HHOT shall be able to directly access any AHDC, LIDC, UDC or VAVDC in the network.

D. Trending:

1. 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.

2. 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. Diagnostics:

1. The AHDC shall provide LED indication of transmit/receive communications performance, as well as for the proper/improper operation of the controller itself.

F. Controller Location:

1. To simplify controls and mechanical service troubleshooting, the AHDC shall be mounted adjacent to the air handling system. The AHDC shall be provided in a NEMA approved enclosure. 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.
2. 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 Degree F (Degrees Fahrenheit) to 140 Degree F.
3. Subcontractor shall submit description of location of AHDC's on all mechanical and air handling equipment.

2.4 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.5 CONTROL PANELS

A. Reuse existing if possible. Otherwise, Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.6 SENSING AND CONTROL OUTPUT REQUIREMENTS

A. Sensing: All sensing inputs shall be provided via industry standard signals. Temperature, humidity, differential pressure signals, and other signal inputs shall be one of the following types: 0-20 mA; 4-20 mA; 0-5 VDC; 0-12 VDC; 1000 ohm platinum (at O C, 2.62 ohms/ºC); 1000 ohm Balco (2.2 ohms/ºF); 10 k ohm Thermistor (at 25ºC/77ºF). 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:

1. The control panel shall internally provide test points for the circuits driving the equipment Subcontractor, for the purpose of troubleshooting the 120 VAC circuit to the Subcontractor. All such relays shall be of modular construction that can be easily and quickly replaced on an individual basis if the module were to be damaged.
2. 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 for selected terminal unit control.

2.7 SENSORS

A. General:

1. Provide sensors with specified output type for remote sensing of temperature, humidity, pressure, and flow rate. Suitable for medium where used, system conditions, and ambient temperature.
2. Provide two wire temperature and humidity sensors.

B. Space Temperature:

1. Accessible adjustment (55-85F range) standard wall sensor shall use solid-state sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall contain a backlit LCD digital display. Minimum 0.1% accuracy. Removable covers. BAS monitoring and remote temperature override capability on ALL thermostats. Port for plug-in of Field Service Tool for field adjustments. Locking guards on all thermostats located in Commons, Hallways, Vestibules, and Public Restrooms.

C. Duct Air Temperature, Probe Type: For supply air, return air, and exhaust air.

1. With separable, perforated bulb guard. Thermistor or RTD with minimum 32-150 F range, accuracy of +/-0.4 F over full range, and maximum drift of 0.1F/year.

D. Duct Air Temperature, Averaging Type: For mixed air, Heat Exchanger inlet/discharge, and low limit temperature sensor.

1. Provide averaging bulb thermostats with element installed to cover twice the cross-section of the duct, typically a minimum of 20 feet. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range
2. RTD continuous sensing element with appropriate range, accuracy of +/- 0.75 F over full range, and maximum drift of 0.1 F/year.

E. Low Temperature Limit Switch: 4-wire, two SPDT switches, main contacts open on temperature below setpoint, pilot contacts close. Auto-reset unless otherwise indicated. Extended length capillary type element with any one foot at setpoint causing trip. Freeze protection low limit minimum range 0-60ºF. Suitable for ambient temperatures -40 to 140ºF.

F. Fluid Temperature:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range. Thermistor or RTD with minimum 30-230 F range, accuracy of +/-1.0 F over full range, and maximum drift of 1F per year. Provide appropriate thermal well for the pressure application to allow removal of the sensing element without draining the system. Wells filled with heat conductive compound.

G. Outside Air Temperature:

1. Platinum RTD with minimum -58-110 F range, Accuracy of +/-1.0 F over full range, and maximum drift of 1F per year. Hy-Cal RTS-5737-W or equal. Provide sunshield and weatherproof box for exterior location as required.

H. Fluid Pressure:

1. Semi-conductor strain gauge pressure transducer with range 150% of operating pressure and over pressure tolerance of 200% of range pressure, +/-2% accuracy over full range, and maximum drift of 1% full range per year. Kele PTX1E, Mamac PR262, or equal.
2. Provide with brass or stainless steel snubber and pigtail on steam applications.
3. Coordinate tap requirements with the mechanical contractor. Provide with gate or ball valve isolation.

I. Static Pressure Sensors:

1. Unidirectional Semi-conductor strain gauge pressure transducer with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 - 5 vdc with power at 12 to 28 vdc.

J. Air Differential Pressure:

1. Semi-conductor strain gauge pressure transducer with range 150% of operating pressure and over pressure tolerance of 200% of range pressure, +/-2% accuracy over full range, and maximum drift of 1% full range per year.
2. Provide static pressure tips with integral compression fittings for reference tubing at duct penetrations.

K. Equipment Operation Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
2. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

3. Current Sensing Switches: Current operated solid state switch with adjustable set-point from 1 to 135 amps. Power and status LED's, non-polarity sensitive.

L. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

M. Carbon Dioxide Sensor:

1. Unit shall monitor indoor carbon dioxide levels in Accordance with ASHRAE Standard 62-1989. 4-20 ma linear output over a range of 0-2000 ppm of CO2. Programmable analog output of 0-190v/4-20ma and RS 232 interface. Digital display at the unit included. Duct mounted aspiration box and transformer included. Easily verified and recalibrated. Minimum (2) required for each system. Wall mounted type for room sensor. Duct type for return duct.
2. Accuracy of plus or minus 2.5% or 50 ppm whichever is greater. Alarm threshold adjustment range of 50-5000 ppm. Measuring range 0-2000 ppm. Maximum drift 25 ppm.
3. Complete recalibration kit and spare calibration gas refill included.

2.8 SWITCHES

A. Differential Pressure Switch - Liquid: Brass bellows operated single pole double throw switch. Where differential pressure is 10 PSI or less provide United Electric J21K Series or equal. Where differential pressure is greater than 10 PSI provide Penn P-74FA-5 or equal. Provide with gate or ball valve isolation.

B. Current Sensing Switches:

1. Current operated solid state switch, 0.5 to 200 amp amperage range. Mini solid-core or split-core for fixed loads. Veris H-800 series or equal.
2. Current operated solid state switch with adjustable set-point from 1 to 135 amps. Power and status LED's, non-polarity sensitive. For detecting belt loss and motor failure. Veris H-708 solid-core, H-908 split-core or equal.

2.9 CONTROL VALVES

A. Automatic Valves: Relocate existing automatic valves. Test and verify operation.

2.10 VALVE ACTUATORS

A. General: Reuse existing valve actuators. Test and verify operation. Otherwise use the following:

1. Where exposed to outdoor air or air temperatures lower than 50ºF, provide completely weatherproof actuators with internal heaters to allow normal operation at -50ºF. The valve actuator shall be capable of providing the minimum torque required for proper valve close off for the required application.

B. Modulating Electronic Actuators: Self contained, linear motorized actuator with approximately 3/4 inch stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC, 6 watt maximum input.

C. Two-Position Electronic Actuators: Synchronous motor with enclosed gear train, dual return springs, valve position indicator; 2-10v DC, 4-20ma. Valves shall spring return to normal position for temperature protection.

2.11 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
2. Provide one operator for maximum 36 sq ft damper section.
3. Electric damper actuators shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
4. Where exposed to outdoor air or air temperatures lower than 50ºF, provide completely weatherproof actuators with internal heaters to allow normal operation at -50ºF.
5. With auxiliary end switch or sensor for monitoring damper position.

2.12 WIRING

A. Includes all control wiring to complete the system and provide control arrangements specified or shown on the drawings. Power or interlock wiring shall be run in separate conduits from sensor and communications wiring.

1. Low-voltage Control Wiring (12-24v): Protected in exposed locations including, but not limited to, mechanical rooms and storage rooms. Plenum rated cable installed in ceiling plenums above accessible ceilings only. Motor disconnect switch shall also disconnect control circuit. Indicating lights wired from the motor terminals or from the last controlling device to the motor to show actual operation. All low voltage control wiring 18 AWG minimum.
2. 110-volt and larger Control Wiring: 12 AWG minimum if directly operating a motor, and 14 AWG minimum if controlling relays and holding coils.

B. Control Power: Control Power will be provided here under for new panel locations. It is intended that existing power to existing panels be reused.

2.13 FIRE STOP SYSTEMS

A. Manufacturers

1. Hilti
2. Dow Corning

3. Fyre Putty

B. General purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours per ASTM E814 and UL 1479.

C. Fire rated Stuffing: Non-combustible mineral wool insulation.

2.14 GLOBAL DIGITAL CONTROLLER (GDC)

A. Reuse the existing controllers otherwise provide a microprocessor based, direct digital controller to integrate and communicate with all microprocessor based controllers on the network. All communication interface programs shall be resident within the global controller. The following functions and features shall be provided:

B. Multi-tasking, 16-bit microprocessor operating from software program memory resident in the controller. 80186 Microprocessor with 12 MHZ clock frequency. Global controllers shall exist at the LAN level with the stand-alone digital controllers.

C. 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. 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 minimum of 128 samples per point. Trending frequency for each report shall be operator definable from a sample once a second to a sample one 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, or any other device capable of receiving a formatted ASCII data file.

D. 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.

E. 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.

F. The GDC shall have a complete set of energy and facility management capabilities including maintenance time reminders, energy reports, and trend reports. The energy management functions shall include duty cycle, temperature compensated duty cycling, optimum start/stop, electric demand limiting, enthalpy changeover, and calendar scheduling.

G. The GDC shall have a keypad and display.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions before starting work.

B. Verify that systems are ready to receive work.

C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount freeze protection thermostats using flanges and element holders.

C. Provide separable sockets for liquids and flanges for air bulb elements.

D. Provide stainless steel thermowells suitable for respective application and for installation under other sections-sized to suit pipe diameter without restricting flow.

E. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures unless approved.

F. 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.

3.3 WIRING AND RACEWAYS

A. General:

1. Provide wiring, conduits and raceway complying with the National Electrical Code, Division 26, 27, 28, State and Local Codes and Ordinances.
2. Unenclosed low voltage wiring shall be plenum rated cabling type and shall be acceptable for installation only above accessible suspended ceilings. All other wiring/cabling shall be installed in conduit.
3. Remove all existing controls as indicated.
4. Use EMT, metal duct, IMC, rigid conduit, surface metal raceways, or totally enclosed metal through with flexible metal tubing as required by Division 16. Paint all exposed conduit in occupied areas two coats of enamel paint selected by ARCHITECT.
5. Provide wire with copper stranded conductors. Provide color or number coded jackets.
6. Provide 20 gauge minimum foil-shielded cable rated 100 VDC at 80 C. for input/output wiring.
7. Provide communications network wiring meeting the gauge, impedance, capacitance, resistance and shielding requirements specified by the manufacturer of the connected

devices.

8. Install wiring in a neat an orderly manner generally running piping and wiring along building lines.
9. Seal conduit penetrations at rated walls with fire-stopping installed in accordance with fire-stopping manufacturers UL listed installation requirements.
10. Wire all electrical controls and switches furnished under this section of the Specifications.

3.4 COORDINATION

A. Coordinate this WORK with the WORK of other trades, and make arrangements for the complete and proper accomplishment of all related WORK. Coordinate required control interlocks with HVAC manufacturers or local representatives as necessary.

B. Mechanical Subcontractor Responsibilities: Installs automatic valves and separable wells that are supplied by the Temperature Control Subcontractor.

3.5 TESTING AND ADJUSTING

A. Upon completion of the control installation, start up the system, perform necessary testing, and adjust the system to ensure proper operation.

B. Coordinate the final adjustments and "fine tuning" of control functions and devices so the mechanical systems and the control systems operate and respond as an integrated comfortable and energy efficient component of this facility.

C. Contractor shall help coordinate the necessary testing of the system, and help coordinate the adjustment the system to ensure proper operation.

3.6 WARRANTY ACCESS

A. The Owner shall grant to the Subcontractor, reasonable access to the BAS system during the warranty period. The owner shall provide, at no cost to the Subcontractor, an internet connection to the DDC system computer.

3.7 START-UP AND TRAINING

A. Additional return trip by system supplier shall be provided 6 months after Final Completion for adjustment and additional training. 4 total hours of additional training required. Provide minimum 15 working days notice to OWNER prior to return trip.

3.8 SEQUENCE OF OPERATIONS

A. See Sequence of Operations on Sheet M400.

END OF SECTION 230926

SECTION 232113 -HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings for:

1. Heating water piping system.
2. Equipment drains and overflows.

B. Valves:

1. Gate valves.
2. Ball valves.
3. Check valves.
4. Flowsetters

1.2 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for HVAC Piping and Equipment.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 23 2114 - Hydronic Specialties.

1.3 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

E. ASTM B32 - Standard Specification for Solder Metal; 2008.

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005.

H. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

1.4 SUBMITTALS

A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

C. Project Record Documents: Record actual locations of valves.

D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

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 system.

PART 2 - PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.

3. Grooved mechanical joints may be used in accessible locations only.

   a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by ARCHITECT.
   b. Use rigid joints unless otherwise indicated.

4. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated and as follows:

1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
2. For throttling, bypass, or manual flow control services, use globe or ball valves.
3. For shut-off and to isolate parts of systems or vertical risers, use gate or ball valves.

2.2 HEATING WATER, ABOVE GROUND

A. Copper Tube: ASTM B 88, Type L, hard drawn. – Up to and including 4-inch size

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
2. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
3. Mechanical press fit joint with gasket equivalent to PROPRESS acceptable.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B 306, Type DWV, drawn.

1. Fittings: ASME B123, cast bronze, or ASME B 129 wrought copper.
2. Joints: Solder, lead free, ASTM B 32, grade 50B.

2.4 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

H. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

I. Vertical Support: Steel riser clamp.

J. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

K. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded. Cadmium or zinc plated.

2.5 UNIONS, FLANGES, AND COUPLINGS

A. Unions for Pipe 2 Inches and Under:

1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 Inches:

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.

C. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

D. Dielectric Connections: Union thermoplastic-lined steel construction, water impervious isolation barrier, end types to match pipe joint types used. IAMPO/UPC Listed.

2.6 BALL VALVES

A. Manufacturers:

1. Tyco Flow Control
2. Conbraco Industries
3. Nibco, Inc
4. Milwaukee Valve Company

B. Up To and Including 3 Inches:

1. Bronze two piece body, chrome plated brass ball, full port, teflon seats and stuffing box

ring, blow out proof stem, lever handle threaded ends. 1 inch and smaller may have soldered ends. 15% or less zinc content.

2.7 SWING CHECK VALVES

A. Manufacturers:

1. Hammond Valve.
2. Nibco, Inc.
3. Milwaukee Valve Company.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, threaded ends. 1 inch and smaller may have soldered ends.

C. Over 2-1/2 Inches and larger:

1. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.8 FLOWSETTERS

A. Manufacturers:

1. Armstrong International, Inc.
2. ITT Bell & Gossett.
3. Myson, Inc.

B. Angle or straight pattern, rising stem, inside screw globe valve for 125 psi working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lockshield key cap and set screw memory bonnet for balancing service.

C. Spare: Provide minimum of two spare caps and one set of probes suitable to test the valve

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or

caps.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09 9000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. All hangers are to be installed on the outside of the insulated piping.
11. Seal around hanger rods and supports penetrating resilient ceiling in 1st floor ceiling space.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 0719.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

L. Use eccentric reducers to maintain top of pipe level.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and

apply one coat of zinc rich primer to welds.

N. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

O. Install valves with stems upright, not inverted.

P. Branch piping connected to sides of mains. Connections off of top or bottom not permitted. When approved by the Engineer, branch piping may be connected to side of mains at a 45 degree angle when limited by space.

Q. Where piping penetrates wall, run insulation through penetration. Seal penetration with fire stopping insulation and seal with fire stopping sealant. If sleeve is used as required in concrete penetrations, seal opening between pipe and sleeve with fire stopping insulation and seal with fire stopping sealant. Seal as required by manufacturers UL fire rated assembly listing.

R. Piping Tests: All heating piping tested hydrostatically at 125 psi for minimum of four hours. System shall remain tight for test period without leaks, displacement, or straining. Equipment, gages, and thermometer wells rated for a lesser pressure suitably protected during tests. Leaks developed during tests shall be corrected without caulking and test restarted until a perfectly tight system is obtained. Enclosed piping tested before concealing. Test performed in presence of Owner.

S. At CONTRACTOR'S option, piping over and including 2-1/2" size may have mechanically extracted collars. Entire installation is to strictly follow manufacturer's instructions. Any deviation will require reinstallation of the collars. Mechanically extracted collars are not acceptable on connections to existing piping. Similar or equal to T-DRILL of T-DRILL Industries.

T. 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.

U. 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. Flanged gasket material shall meet or exceed temperature and pressure rating of system.

V. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

W. Use gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

X. Use globe or ball valves for throttling, bypass, or manual flow control services.

Y. Use spring loaded check valves on discharge of pumps.

Z. Use 3/4 inch gate valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

AA. Install flowsetters with ports fully accessible.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.

END OF SECTION 232113

SECTION 232114 - HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Relief valves.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.

1.4 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

C. Project Record Documents: Record actual locations of flow controls.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 AUTOMATIC AIR VENTS

A. Manufacturers:

1. Spirotherm Spirotop

B. Brass body, solid non-metallic float, brass vented head threaded for connection of drain. Viton seal and o-ring. 150 psig working pressure. Automatic air vent suitable for system operating temperature and pressure; with isolating valve.

2.3 STRAINERS

A. Manufacturers:

1. Hoffman.
2. Spiray/Sarco
3. Mueller.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:

1. Flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

END OF SECTION 232114

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

1.2 RELATED REQUIREMENTS

A. Section 23 0713 - Duct Insulation: External insulation.

B. Section 23 3300 - Air Duct Accessories.

C. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2009.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications; 2011a.

D. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2011a.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2011.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength; 2010.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2009.

J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2009.

K. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and

Air Conditioning Contractors' National Association; 2005.

L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.7 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 DUCT ASSEMBLIES

A. All Ducts: Galvanized steel, unless otherwise indicated.

B. AHU Supply: 4 inch w.g. pressure class, galvanized steel.

C. Return and Relief: 2 inch w.g. pressure class, galvanized steel.

D. General Exhaust: 2 inch w.g. pressure class, galvanized steel.

E. Outside Air Intake: 2 inch w.g. pressure class, galvanized steel.

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating. Minimum 24 gage.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
3. For Use With Flexible Ducts: UL labeled.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

D. 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 must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

H. Flanged closures must be SMACNA “J” rated with minimum 1-3/8 inch flange. Flange shall be gasketed. Corners bolted. Metal cleat for application around perimeter of transverse joint.

I. Transverse joints: Ductmate proprietary duct connections will be accepted. Ductwork constructed using these systems will refer to manufacturers guidelines for sheet gage, intermediate reinforcement size and spacing, and joint reinforcement. TDF shall be constructed in accordance with SMACNA – HVAC Duct Construction Standards Manuals T-24 flange. Basis for evaluating a substitution shall be Ductmate Joining System, all steel construction. Ductmate system shall utilize minimum 20 gage steel companion angles, 12 gage steel corner pieces, and an integral polymer mastic seal. Acceptable joining systems: Ductmate 35, Nexus,

Accuduct, or TDF. TDC is not acceptable.

J. Longintudinal seams and fitting: Pittsburgh lock or snap lock shall be used on all longitudinal seams. Use Pittsburgh only on fittings, snap lock is not acceptable.

2.4 DUCT, CASING AND PLENUM SEALANTS

A. Sealant: UL listed vinylacrylic or copolymer based duct sealer. Similar to Durodyne DDS-181, Uni-mastic 181.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Coordinate all hood requirements with Food Service Equipment Contractor. Test and provide certification. Provide training to Owner.

C. Install in accordance with manufacturer's instructions.

D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Check daily or more frequently that sealing of ducts is intact.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Provide openings in ductwork where required to accommodate thermometers and controllers.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use double nuts and lock washers on threaded rod supports.

J. Duct Sealing:

1. Seal all longitudinal and latitudinal joints of metal ducts with two coats of sealant. Apply sealant in accordance with manufacturer’s recommendations. Apply second coat of sealant after first coat has completely cured. Inspect seams with ductwork pressurized and reapply as required for an airtight application.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Provide openings in ductwork where required to accommodate thermometers and controllers.

3.4 CLEANING

A. If supply, exhaust, or return air ductwork is found to be dirty during construction due to inadequately capped/sealed ductwork or operating fans without filters, the CONTRACTOR shall clean all affected duct systems with high power vacuum machines to the satisfaction of the ARCHITECT. Return air plenums not sealed off during construction shall be cleaned by the CONTRACTOR to the satisfaction of the OWNER. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. All construction debris is to be removed by CONTRACTOR prior to cleaning.

END OF SECTION 233100

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct access doors.

B. Flexible duct connections.

1.2 RELATED REQUIREMENTS

A. Section 23 0713 - Duct Insulation: External insulation.

B. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2009.

B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

1.4 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies.

B. Project Record Drawings: Record actual locations of access doors.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 DUCT ACCESS DOORS

A. Manufacturers:

1. Air Balance
2. Durodyne
3. Ventlock
4. Ruskin Company

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Submittal is required.

C. Fabrication: Rigid and close fitting of reinforced galvanized steel with closed cell neoprene sponge rubber sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch thick insulation with sheet metal cover.

1. Less Than 12 inches square, secure with sash locks.
2. Up to 18 inches Square: Provide two small hinges or one continuous hinge and one compression latch.
3. Up to 24 x 48 inches: Three large hinges or one continuous hinge and two compression latches with outside and inside handles.
4. Sash Lock: Similar to Ventlock Model 90.
5. Compression Latch: Similar to Ventlock Model 140, 202, or 310.
6. Hinge: Small hinges to be zinc plated steel, minimum 2 x 1-1/2 inches wide or 1-1/2 inch wide piano hinge. Large hinges to be zinc plated steel, minimum 3 x 2 inches wide or 2 inch wide piano hinge. Similar to Ventlock Model 150, 157 or 167, 250.
7. Access panels with sheet metal screw fasteners are not acceptable.

2.2 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:

1. Carlisle HVAC
2. Elgen Manufacturing
3. DuroDyne.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

a. Net Fabric Width: Approximately 2 inches wide.

2.7 SLEEVES

A. Sleeves for Ductwork: Galvanized steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify ducts and equipment installations are ready for accessories.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, and elsewhere as indicated. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Set sleeves in position in forms. Provide reinforcing around sleeves. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

F. Where ductwork penetrates floor, ceiling, or wall, close off space between duct and adjacent WORK with stuffing or fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Demonstrate re-setting of fire dampers to OWNER's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Motors.

1.2 RELATED REQUIREMENTS

A. Section 26 2726 – Wiring Devices: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

C. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/licenses/search.aspx.

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.

F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2011.

H. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical

characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

D. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Fan Belts: Two sets for each individual fan.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Greenheck

B. Loren Cook Company

C. Twin City Fan

2.2 POWER VENTILATORS - GENERAL

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99.

D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.3 ROOF EXHAUST FANS (EF-6)

A. Performance

1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. Performance Base: Sea level conditions. Pressure Class I, Arrangement 10.
5. Temperature Limit: Maximum 300 degrees F.
6. Static and Dynamic Balance: Wheels shall be static and dynamically balanced to balance grade G6.3 per ANSI S2.19.
7. Capacity: See Schedules.

B. Wheel and inlet

1. Backward inclined wheel, steel construction with smooth curved inlet flange, heavy back plate, backward curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

C. Housings

1. Steel housings, air-tight locking seams or fully welded, braced, designed to minimize turbulence with spun inlet bell and shaped cut-off. EF-3 is to be for grease Type I hood applications.
2. Coatings: Factory finish with a thermosetting polyester urethane. Prepare steel with a phosphatized treatment.

D. Bearings and sleeves

1. Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with AFBMA 9 L-10 life at 200,000 hours or roller bearings, with ABMA 11, L-10 life at 200,000 hours.
2. Shafts: Hot rolled steel, precision ground and polished, with key way, protectively coated with lubricating oil, and shaft guard.
3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

F. Sound Level Requirements.

1. Maximum bare fan at design flow rate: AMCA Standard No. 300 Sound Power Levels dB.

Fan	Octave Band	125	250	500	1000	LwA
EF-6	Inlet	78	75	72	69	75

2.4 MOTORS

A. Manufacturers:

1. Baldor
2. General Electric
3. Reliance

B. Constructed and rated in accordance with current NEMA standards. The frame size, enclosures, and all appurtenances shall be suited to the application. 1.15 Service factor. Class F insulation.

1. Single phase motors: NEMA Design N for fractional horsepower
2. Three phase motors: NEMA Design B. Motors 1hp and over and listed in schedules as 480 volt shall be 480 or 460 volt, not 208-230/460.

C. Electrical Requirements: At a minimum, motors must meet the following premium efficiency criteria as defined by (CEE) Consortium for Energy Efficiency for motors 1 hp and above.

HP	EFFICIENCY (1200 RPM)	EFFICIENCY (1800 RPM)
1	82.5	85.5
1.5	86.5	86.5
2	87.5	86.5
3	88.5	89.5
5	89.5	89.5

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb. Modify as required.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Install flexible connections between connecting ductwork and exhaust fan inlet/outlets. Ensure metal bands of connectors are parallel with minimum 1 inch flex between casing and fan while running.

E. Provide sheaves required for final air balance.

END OF SECTION 233423

SECTION 23 7313 - AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Factory fabricated assembly of modular sections consisting of housed fans with belt drives, coils, filters, and other necessary modules to perform one or more of the functions of circulating, cleaning, heating, and mixing of air with construction suitable for indoor applications.

1.02 RELATED REQUIREMENTS

A. Section 23 0719 - HVAC Piping Insulation.

B. Section 23 3300 - Air Duct Accessories: Flexible duct connections.

C. Section 26 2726 - Wiring Device: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).

C. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2011.

D. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute; 2001 (R2005) .

E. AHRI 430 - Standard for Central-Station Air-Handling Units; Air-Conditioning, Heating, and Refrigeration Institute; 2009.

F. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

G. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

H. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

I. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc; 1990.

J. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.

K. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

L. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2007.

M. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2012.

N. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2012.

P. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

Q. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current edition, including all revisions.

R. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data:
   1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
   2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
   3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
   4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
   5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Contractor to coordinate split sections for access through existing double door on roof for access to Fan Room.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

F. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: Two sets for each unit.
   3. Extra Filters: Four sets for each unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Daikin McQuay: www.mcquay.com.

B. Trane Inc: www.trane.com.

C. York by Johnson Controls Inc: www.johnsoncontrols.com.

2.02 GENERAL DESCRIPTION

A. Components (AHU-1, AHU-2, & AHU-3):
   1. Casing construction.
   2. SF and RF Fan sections.
   3. Filter and air cleaner section.
   4. Mixing Box Damper section.
   5. Hot Water Heating Coil section.
   5. Access section.

B. Fabrication: Conform to AMCA 99 and AHRI 430. Fan units are to be shipped in split sections suitable for access through double door entrance to Fan Room.

C. AHU-1 SF Performance: Sea level conditions:
   1. Air Flow: 7,000 cfm.
   2. External Static Pressure: 1.0 inch wg external static pressure.
   3. Motor: 5.0 hp, 208 volt, three phase, 60 Hz.

D. AHU-1 RF Performance: Sea level conditions:
   1. Air Flow: 6,060 cfm.
   2. External Static Pressure: 0.875 inch wg external static pressure.
   3. Motor: 5.0 hp, 208 volt, three phase, 60 Hz.

E. AHU-2 SF Performance: Sea level conditions:
   1. Air Flow: 5,860 cfm.
   2. External Static Pressure: 1.0 inch wg external static pressure.
   3. Motor: 5.0 hp, 208 volt, three phase, 60 Hz.

F. AHU-2 RF Performance: Sea level conditions:
   1. Air Flow: 5,550 cfm.
   2. External Static Pressure: 0.875 inch wg external static pressure.
   3. Motor: 3.0 hp, 208 volt, three phase, 60 Hz.

G. AHU-3 SF Performance: Sea level conditions:
   1. Air Flow: 15,000 cfm.
   2. External Static Pressure: 1.0 inch wg external static pressure.
   3. Motor: 15.0 hp, 208 volt, three phase, 60 Hz.

H. AHU-3 RF Performance: Sea level conditions:
   1. Air Flow: 13,950 cfm.
   2. External Static Pressure: 0.75 inch wg external static pressure.
   3. Motor: 7.5 hp, 208 volt, three phase, 60 Hz.

2.03 CASING CONSTRUCTION

A. Full Perimeter Base Rail:

1. Construct of galvanized steel.
2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:
1. Construct of one piece, insulated, double wall panels.
2. Provide mid-span, no through metal, internal thermal break.
3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
4. Casing Air Pressure Performance Requirements:
   a. Able to withstand up to 8 inches w.g. positive or negative static pressure.

C. Access Doors:
1. Construction, thermal and air pressure performance same as casing.
2. Provide surface mounted handles on hinged, swing doors.

D. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

E. Casing Leakage: Seal all joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

F. Insulation:
1. Provide minimum thermal thickness of 12 R throughout.
2. Completely fill all panel cavities in all directions preventing voids and settling.
3. Comply with NFPA 90A.

2.04 FAN SECTION

A. Type:

1. All SF and RF-3: Plenum Type Class II

2. RF-1 & RF-2: Centrifugal DWDI Airfoil fan, Class II

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

E. Mounting: Locate fan and motor internally on welded steel base coated with corrosion resistant paint. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors. Provide built-in inertia base of welded steel with bottom sheet and reinforcing grid for concrete ballast. Mount base on vibration isolators; refer to Section 23 0548.

F. Flexible Duct Connections: For separating fan and coil, and adjacent sections; refer to Section 23 3300.

G. Supply Fan Performance: See Schedule on M001

H. Return Fan Performance: See Schedule on M001

I. Drives:
1. Bearings: Heavy duty pillow block type, roller bearings with ABMA 11 L-50 life at 400,000 hours.

2. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
4. Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards; 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.05 COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410. Refer to Section 23 8216.

C. Fabrication: Seamless copper header, Copper tube minimum 0.20 inches thickness, Aluminum fin minimum of 0.0075 inch thickness. Galvanized steel track.

D. Water Heating Coils Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

E. Hot Water Heating Coil:
1. Size: To be selected by AHU manufacturer.
2. Rows: See drawing schedule.
3. Capacity: See drawing schedule.
4. Entering Air Temperature: 45 degrees F.
5. Leaving Air Temperature: See drawing schedule.
6. Air Static Pressure Drop: 0.15 inch wg.
7. Water Flow Rate: See drawing schedule.
8. Entering Water Temperature: 180 degrees F.
9. Leaving Water Temperature: See drawing schedule..
10. Water Pressure Drop: See drawing schedule.

2.06 FILTER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Pleated Media Filters:
1. Media: 2 inch, 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
2. Frame: Steel wire grid.
3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE 52.2.

C. Differential Pressure Gage: Install across filters and mount on outside of unit.

2.07 DAMPER SECTION

A. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor and exhaust air.

B. Dampers with rods extended for exterior actuator placement.

C. Damper Blades:
   1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on all blades.
   2. Self-lubricating stainless steel or synthetic sleeve bearings.
   3. Comply with ASHRAE 90.1 for rated maximum leakage rate.
   4. Base all leakage testing and pressure ratings on AMCA 500-D.
   5. Arrange in parallel or opposed-blade configuration.

2.08 ACCESS SECTION

A. Provide where indicated on the Drawings to allow for inspection, cleaning, and maintenance of field installed components.

B. Construct access doors same as previously specified within this Section.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Isolate fan section with flexible duct connections.

D. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads.

F. Provide sheaves required for final air balance.

G. Make connections to coils with unions or flanges.

H. Hydronic Coils:
   1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
   2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
   3. Locate water supply at bottom of supply header and return water connection at top.
   4. Provide manual air vents at high points complete with stop valve.
   5. Ensure water coils are drainable and provide drain connection at low points.

3.02 SCHEDULES

A. Drawing Code (AHU-1)
   1. Sound Power
      a. Fan Discharge

1)	1st Octave	84
2)	2nd Octave	75
3)	3rd Octave	85
4)	4th Octave	79

5) 5th Octave 78
6) 6th Octave 77
7) 7th Octave 74
8) 8th Octave 64

b. Casing Radiated
1) 1st Octave 80
2) 2nd Octave 81
3) 3rd Octave 82
4) 4th Octave 72
5) 5th Octave 65
6) 6th Octave 59
7) 7th Octave 44
8) 8th Octave 35

c. Unit Return
1) 1st Octave 87
2) 2nd Octave 89
3) 3rd Octave 87
4) 4th Octave 88
5) 5th Octave 82
6) 6th Octave 76
7) 7th Octave 72
8) 8th Octave 64

B. Drawing Code (AHU-2)

1. Sound Power

a. Fan Discharge
1) 1st Octave 83
2) 2nd Octave 74
3) 3rd Octave 84
4) 4th Octave 78
5) 5th Octave 77
6) 6th Octave 76
7) 7th Octave 73
8) 8th Octave 65

b. Casing Radiated
1) 1st Octave 78
2) 2nd Octave 79
3) 3rd Octave 81
4) 4th Octave 70
5) 5th Octave 64
6) 6th Octave 58
7) 7th Octave 43
8) 8th Octave 34

c. Unit Return
1) 1st Octave 85
2) 2nd Octave 87
3) 3rd Octave 85
4) 4th Octave 86
5) 5th Octave 80
6) 6th Octave 74
7) 7th Octave 70
8) 8th Octave 62

C. Drawing Code (AHU-3)

1. Sound Power

a. Fan Discharge

1)	1st Octave	87
2)	2nd Octave	80
3)	3rd Octave	88
4)	4th Octave	83
5)	5th Octave	79
6)	6th Octave	77
7)	7th Octave	75
8)	8th Octave	68

b. Casing Radiated

1)	1st Octave	82
2)	2nd Octave	78
3)	3rd Octave	89
4)	4th Octave	72
5)	5th Octave	66
6)	6th Octave	60
7)	7th Octave	46
8)	8th Octave	38

c. Unit Return

1)	1st Octave	81
2)	2nd Octave	75
3)	3rd Octave	83
4)	4th Octave	72
5)	5th Octave	70
6)	6th Octave	70
7)	7th Octave	66
8)	8th Octave	60

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Stranded.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

A. Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

B. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

C. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

END OF SECTION 260519

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Atkore International.
g. Wesanco, Inc.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

2. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
3. Toggle Bolts: All-steel springhead type.
4. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To Light Steel: Sheet metal screws.
3. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Boxes, enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. EMT: Comply with ANSI C80.3 and UL 797.

C. FMC: Comply with UL 1; zinc-coated steel.

D. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew or compression.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
3. Boxes and Enclosures: NEMA 250, Type 1.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Install no more than the equivalent of three 90-degree bends in any conduit run. Support within 12 inches (300 mm) of changes in direction.

E. Support conduit within 12 inches (300 mm)of enclosures to which attached.

F. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

G. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

H. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

END OF SECTION 260533

SECTION 262419 - MOTOR-CONTROL CENTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes MCCs for use with ac circuits rated 600 V and less having the following components:

1. Full-voltage magnetic controllers.
2. Auxiliary devices.

1.2 DEFINITIONS

A. CPT: Control power transformer.

B. LED: Light-emitting diode.

C. MCC: Motor-control center.

D. MCP: Motor-circuit protector.

E. NC: Normally closed.

F. NO: Normally open.

G. OCPD: Overcurrent protective device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of controller.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain controllers from single source to mount in existing MCC.

B. 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.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Square D; a brand of Schneider Electric.

2.2 FUNCTIONAL FEATURES

A. Controller Units: Combination controller units.

1. Install units on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
2. Equip units in Type B with pull-apart terminal strips for external control connections.

B. Coordinate to mount in existing motor control center.

2.3 COMBINATION CONTROLLERS

A. Full-Voltage Controllers:

1. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
2. Magnetic Controllers: Full voltage, across the line, electrically held.

a. Configuration: Nonreversing.

B. Disconnecting Means and OCPDs:

1. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

C. Control Power:

1. Control Circuits (verify): 24 -V ac; obtained from integral CPT, with primary and secondary fuses.

2.4 ENCLOSURES

A. Compartments: Modular; individual doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.

2.5 AUXILIARY DEVICES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.

a. Push Buttons: Covered types; momentary contact unless otherwise indicated.
b. Pilot Lights: LED types; push to test.
c. Selector Switches: Rotary type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in each fusible switch.

B. Install fuses in control circuits if not factory installed.

C. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

D. Comply with NECA 1.

3.2 IDENTIFICATION

A. Provide identification for MCC components, and wiring.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each cubicle with engraved nameplate.

3.3 CONNECTIONS

A. Comply with requirements for installation of conduit in Section 260533 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Test each motor for proper phase rotation.
5. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
7. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 262419

HAINES SCHOOL DISTRICT
HAINES SCHOOL
FANS REPLACEMENT

HAINES ALASKA

100% CONSTRUCTION DOCUMENTS

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DRAWING INDEX

M000 COVER SHEET
M001 SYMBOLS & SCHEDULES
M200 ENLARGED FAN ROOM PLAN - LOWER
M201 ENLARGED FAN ROOM PLAN - UPPER
M202 PART FLOOR PLAN - DUCTWORK
M203 PARTIAL ROOF PLAN
M300 SECTIONS
M400 CONTROLS
M500 DETAILS
MD200 ENLARGED FAN ROOM PLAN - LOWER - DEMOLITION
MD201 ENLARGED FAN ROOM PLAN - UPPER - DEMOLITION

E200 LEGEND, SCHEDULE, AND DEMOLITION PLANS
E201 ENLARGED FAN ROOM PLANS

FAN SCHEDULE

EQUIPMENT	AREA SERVED	CFM	TSP, INCHES OF WATER*	DESIGN MANUFACTURE & MODEL	MIN. HP	VOLTS / PHASE	FEATURES AND ACCESSORIES
AHU–1	PERIMETER ROOMS	SF 7,000 RF 6,060	2.25 1.25	DAIKIN MAQUAY CAH014GHDC	5.0 5.0	208V/3ø 208V/3ø	CUSTOM SUPPLY AND RETURN FAN AIR HANDLING UNIT. PLENUM TYPE CLASS 2 – SF & CENTRIFUGAL DWDI AIRFOIL TYPE CLASS 2 – RF. MIXING BOX WITH BACK OUTDOOR AIR INLET AND RETURN AIR INLET, FILTER SECTION, HEATING COIL, FAN SECTION. INTERNALLY ISOLATED. INTERNAL SOLID METAL WALLS ON FAN AND MIXING BOX SECTION. 2–INCH THICK 1–1/2 LB INSULATED WALLS. HOUSING TO CONSIST OF PRIME COATED 16 GAGE GALVANIZED STEEL. PANELIZED CONSTRUCTION WITH DRIVE SCREW ASSEMBLY. MIXING BOX WITH LOW LEAKAGE RETURN AND OUTDOOR AIR DAMPERS. HINGED ACCESS DOORS WITH HEAVY DUCT HANDLES FOR FAN, FILTER, AND MIXING BOX ACCESS. UNIT TO BE MOUNTED ON CAPTIVE SPRING VIBRATION ISOLATORS WITH INTEGRAL NEOPRENE SNUBBERS. SEE DRAWING FOR CONFIGURATION.
AHU–2	INTERIOR ROOMS	SF 5,860 RF 5,550	2.00 1.125	DAIKIN MAQUAY CAH012GHDC	5.0 3.0	208V/3ø 208V/3ø	CUSTOM SUPPLY AND RETURN FAN AIR HANDLING UNIT. PLENUM TYPE CLASS 2 – SF & CENTRIFUGAL DWDI AIRFOIL TYPE CLASS 2 – RF. MIXING BOX WITH BACK OUTDOOR AIR INLET AND RETURN AIR INLET, FILTER SECTION, HEATING COIL, FAN SECTION. INTERNALLY ISOLATED. INTERNAL SOLID METAL WALLS ON FAN AND MIXING BOX SECTION. 2–INCH THICK 1–1/2 LB INSULATED WALLS. HOUSING TO CONSIST OF PRIME COATED 16 GAGE GALVANIZED STEEL. PANELIZED CONSTRUCTION WITH DRIVE SCREW ASSEMBLY. MIXING BOX WITH LOW LEAKAGE RETURN AND OUTDOOR AIR DAMPERS. HINGED ACCESS DOORS WITH HEAVY DUCT HANDLES FOR FAN, FILTER, AND MIXING BOX ACCESS. UNIT TO BE MOUNTED ON CAPTIVE SPRING VIBRATION ISOLATORS WITH INTEGRAL NEOPRENE SNUBBERS. SEE DRAWING FOR CONFIGURATION.
AHU–3	GYMNASIUM	SF 15,000 RF 13,950	1.75 1.125	DAIKIN MAQUAY CAH031GHDM	15.0 7.5	208V/3ø 208V/3ø	CUSTOM SUPPLY AND RETURN FAN AIR HANDLING UNIT. CENTRIFUGAL PLENUM TYPE CLASS 2 – SF & RF. MIXING BOX WITH BACK OUTDOOR AIR INLET AND RETURN AIR INLET, FILTER SECTION, HEATING COIL, FAN SECTION. INTERNALLY ISOLATED. INTERNAL SOLID METAL WALLS ON FAN AND MIXING BOX SECTION. 2–INCH THICK 1–1/2 LB INSULATED WALLS. HOUSING TO CONSIST OF PRIME COATED 16 GAGE GALVANIZED STEEL. PANELIZED CONSTRUCTION WITH DRIVE SCREW ASSEMBLY. MIXING BOX WITH LOW LEAKAGE RETURN AND OUTDOOR AIR DAMPERS. HINGED ACCESS DOORS WITH HEAVY DUCT HANDLES FOR FAN, FILTER, AND MIXING BOX ACCESS. UNIT TO BE MOUNTED ON CAPTIVE SPRING VIBRATION ISOLATORS WITH INTEGRAL NEOPRENE SNUBBERS. SEE DRAWING FOR CONFIGURATION.
EF–6	ART ROOM	1950	0.625	GREENHECK GB–161	1/2	115V/1ø	CENTRIFUGAL BELT DRIVE ROOF MOUNTED EXHAUST FAN. ALUMINUM CONSTRUCTION WITH ADJUSTABLE MOTOR PULLEYS. NEMA 4 DISCONNECT AND EXTERIOR UTILITY OUTLET.

* SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS INCLUDING MINIMUM EXTERNAL STATIC PRACTICE, ESP.

AHU HEATING COIL (HC) SCHEDULE

COIL	UNIT SERVED	SIZE	CAPACITY (BTU/HR)	DESIGN AIR VOLUME	MAXIMUM VELOCITY	DESIGN MAX APD	ROWS / FPI	WATER TEMPERATURES EWT/LWT	AIR TEMPERATURES EAT/LAT	MAX WATER PRESSURE DROP (FT WATER)	FEATURES
HC–1	AHU–1 HEATING COIL	BY AHU MANUFACTURER	231,000	7000 CFM	400 FPM	0.15" W.G.	1 / 11	180F/150F	45F/70F	4 FT	WATER, NO GLYCOL.
HC–2	AHU–2 HEATING COIL	BY AHU MANUFACTURER	193,000	5860 CFM	400 FPM	0.15" W.G.	1 / 11	180F/150F	45F/70F	3 FT	WATER, NO GLYCOL.
HC–3	AHU–3 HEATING COIL	BY AHU MANUFACTURER	825,000	15000 CFM	400 FPM	0.15" W.G.	2 / 8	180F/160F	45F/95F	5 FT	WATER, NO GLYCOL.

FLOWSETTER AND AUTOMATIC VALVE SCHEDULE

NUMBER	UNIT SERVED	LOCATION	DESIGN GPM	SETTER SIZE (INCHES)	AUTOMATIC VALVE TYPE	AUTOMATIC VALVE OPERATION	CONTROL TYPE	NORMAL POSITION
D22	HC–1	201–MECHANICAL/FAN ROOM	15	Ⓔ 1–1/4	Ⓔ TWO–WAY	MODULATING	DDC	NO
D23	HC–2	201–MECHANICAL/FAN ROOM	13	Ⓔ 1–1/4	Ⓔ TWO–WAY	MODULATING	DDC	NO
D24	HC–3	201–MECHANICAL/FAN ROOM	83	3	Ⓔ TWO–WAY	MODULATING	DDC	NO

NOTE: WHERE INDICATED, FLOWSETTERS AND AV'S ARE EXISTING. INFORMATION SHOWN FOR REFERENCE AND TESTING AND BALANCING.

GENERAL MECHANICAL NOTES:

1. EXISTING CONDITIONS WERE TAKEN FROM RECORD DRAWINGS AND SELECTIVE FIELD MEASUREMENTS. ACTUAL CONDITIONS AND DIMENSIONS OF PIPING, DUCTWORK AND OTHER APPURTENANCES ARE TO BE FIELD VERIFIED BY THE CONTRACTOR AND ADJUSTMENTS MADE AS REQUIRED.
2. CONTRACTOR SHALL COORDINATE WITH HAINES SCHOOL ALL SHUTDOWN OR INTERRUPTION OF SERVICE REQUIREMENTS FOR CONNECTIONS TO EXISTING SYSTEMS. PROVIDE HAINES SCHOOL WITH 10 DAYS WRITTEN NOTICE FOR PROPOSED SHUTDOWN TIMES AND DURATION.
3. WHERE OPENINGS IN WALLS OR FLOORS EXIST AFTER REMOVAL OF EXISTING DUCTWORK, PIPING, AND ACCESSORIES, CONTRACTOR SHALL COORDINATE WITH GENERAL TO PATCH AND REPAIR OPENINGS TO MATCH EXISTING CONSTRUCTION AND RATING. UTILIZE FIRE RATED SEALANT AS REQUIRED. SEAL ALL PENETRATIONS OF WALL ASSEMBLY VAPOR BARRIER AIR TIGHT. COORDINATE EXTERIOR FLASHING REQUIREMENTS WITH ROOF AND WALL PRODUCTS AND GENERAL CONTRACTOR.
4. CARE SHALL BE TAKEN DURING DEMOLITION AND CONSTRUCTION THAT CONSTRUCTION DEBRIS AND DUST SHALL NOT ENTER DUCT SYSTEM OR OCCUPIED FUNCTIONAL AREAS. IF DUCT OR CONSTRUCTION DEBRIS IS OBSERVED BY OWNER'S REPRESENTATIVE, SYSTEM SHALL BE CLEANED TO THE SATISFACTION OF THE OWNER AT THE EXPENSE OF THE CONTRACTOR.
5. TEST AND BALANCE SF & RF FANS ONLY FOR AHU–1, AHU–2, AND AHU–3. TEST AND BALANCE EF–6 FAN SYSTEM. TEST AND BALANCE SYSTEM BY TAB CONTRACTOR, PROVIDE STANDARD ADJUSTMENT LOG REPORT.
6. PROVIDE TRAINING FOR ALL MECHANICAL SYSTEMS WHEN COMPLETED.
7. PROVIDE AS–BUILT DRAWINGS, TRAINING, CONTROL SYSTEMS AND OPERATION AND MAINTENANCE MANUALS TO OWNER.
8. COORDINATE SELECTION AND PROVISION OF EQUIPMENT WITH ACTUAL CONSTRUCTION CONDITIONS.
9. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

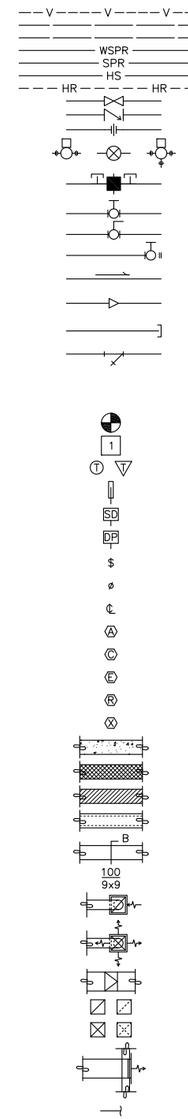
CODE NOTES:

1. CODES & REGULATIONS: ALL WORK HEREUNDER SHALL BE STRICTLY IN CONFORMANCE WITH APPLICABLE CODES AND REGULATIONS. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2009 INTERNATIONAL BUILDING CODE, 2009 INTERNATIONAL MECHANICAL CODE, 2009 UNIFORM PLUMBING CODE, NFPA, AND STATE OF ALASKA MODIFICATIONS. ALL ELECTRICAL EQUIPMENT SHALL BEAR THE UL LABEL. ALL SHEET METAL WORK TO BE DONE IN ACCORDANCE WITH SMACNA REQUIREMENTS.

SCOPE OF WORK:

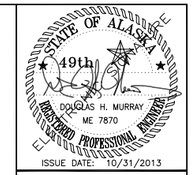
SCOPE OF WORK SHALL INCLUDE THE FOLLOWING:

1. THE REMOVAL AND REPLACEMENT OF VU–1, VU–2, AND VU–3 SUPPLY AIR VENTILATION UNITS AND ASSOCIATED SA AND OSA DUCTWORK, SENSORS, ACTUATORS AND DAMPERS LOCATED IN THE PENTHOUSE MECHANICAL ROOM.
2. THE REMOVAL AND REPLACEMENT EF–1, EF–2, AND EF–3 EXHAUST AIR FANS AND ASSOCIATED EA DUCTWORK, SENSORS, ACTUATORS AND DAMPERS LOCATED IN THE PENTHOUSE MECHANICAL ROOM.
3. THE REMOVAL OF CONTROLS AND STARTERS FOR VU–1, VU–2, VU–3, EF–1. EF–2. AND EF–3 FAN SYSTEMS AND REPLACEMENT OF DDC CONTROLS FOR AHU–1, AHU–2, AND AHU–3 SYSTEMS.
4. INSTALL NEW ROOF MOUNTED EXHAUST FAN EF–6.



V	VENT
W	WASTE, SOIL, DRAINAGE
RD	ROOF DRAINAGE
WSPR	WET SPRINKLER
SPR	SPRINKLER
HS	HEATING SUPPLY
HR	HEATING RETURN
	GATE VALVE
	CHECK VALVE
	UNION
AV	AUTOMATIC VALVE
1	FLOWSETTER W/NO.
	GLOBE VALVE OR ISOLATING BALL VALVE
	BALL VALVE
DV	DRAIN VALVE
	PITCHED DOWN
	REDUCER
	CAPPED OR PLUGGED
	STRAINER
	POINT OF CONNECTION OR REMOVAL
	CONSTRUCTION NOTE
	THERMOSTAT – IMMERSION, ROOM
	THERMOMETER
	SMOKE DETECTOR
	DIFFERENTIAL PRESSURE SWITCH
	CONTROL SWITCH
	DIAMETER
	CENTER LINE
	ACCESS DOOR
	CONNECT TO EXISTING
	EXISTING
	TO BE RELOCATED
	TO BE REMOVED
	CONCRETE WALL OR FLOOR
	INSULATED DUCT
	SOUND ATTENUATED DUCT
	SOUND ATTENUATED DUCT
B	MANUAL BUTTERFLY DAMPER
	AIR VOLUME / DIFFUSER/GRILLE SIZE
	CEILING RETURN/EXHAUST GRILLE
	CEILING SUPPLY DIFFUSER
	RECTANGULAR TO ROUND DUCT TRANSITION
	RETURN/EXHAUST DUCT UP, DOWN
	SUPPLY DUCT UP, DOWN
	WALL SUPPLY GRILLE
	LINE BREAK

AAV	AUTOMATIC AIR VENT
AHU	AIR HANDLING UNIT
AFF	ABOVE FINISHED FLOOR
AV	AUTOMATIC VALVE
B	BUTTERFLY DAMPER
BBD	BACK BLADE DAMPER
BOD	BOTTOM OF DUCT
C	COMMON
CFM	CUBIC FEET PER MINUTE
DDC	DIRECT DIGITAL CONTROL
DV	DRAIN VALVE
EA	EXHAUST AIR
EAD	EXHAUST AIR DAMPER
EAT	ENTERING AIR TEMPERATURE
EF	EXHAUST FAN
EG	EXHAUST GRILLE
ESP	EXTERNAL STATIC PRESSURE
EWT	ENTERING WATER TEMPERATURE
HC	HEATING COIL
IEW	IN ELECTRICAL WORK
LAT	LEAVING AIR TEMPERATURE
LWT	LEAVING WATER TEMPERATURE
MA	MIXED AIR
MAT	MIXED AIR TEMPERATURE
MBH	1,000 BTU PER HOUR
MCC	MOTOR CONTROL CENTER
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NIM	NOT IN MECHANICAL
NO	NORMALLY OPEN
OAD	OUTSIDE AIR DAMPER
OC	ON CENTER
OSA	OUTSIDE AIR
PD	PLENUM DRAIN
PSI	POUNDS PER SQUARE INCH
RA	RETURN AIR
RAD	RECIRCULATING AIR DAMPER
RF	RETURN FAN
RG	RETURN GRILLE
SA	SUPPLY AIR
SAT	SUPPLY AIR THERMOSTAT
SF	SUPPLY FAN
SG	SUPPLY GRILLE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
VU	VENTILATING UNIT



ISSUE DATE: 10/31/2013

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HAINES SCHOOL
FANS REPLACEMENT
HAINES, ALASKA

SHEET TITLE:

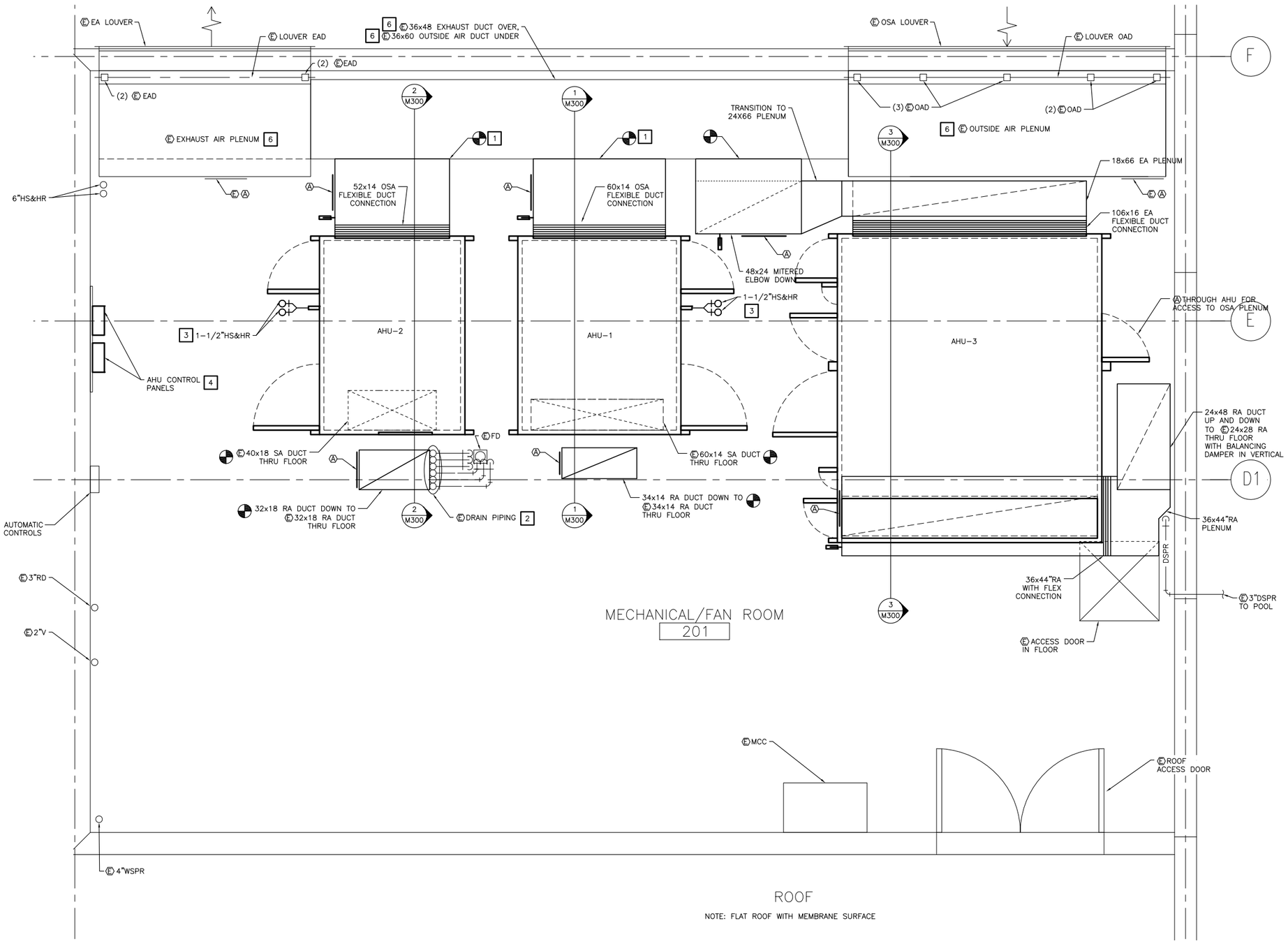
SYMBOLS & SCHEDULES

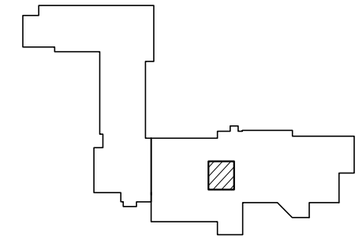
SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.

M001

JOB NO. M–473.1





KEY PLAN
HAINES SCHOOL

CONSTRUCTION NOTES:

1. CUT AND PATCH NEW OSA DUCTWORK CONNECTION TO EXISTING PLENUM. REINSULATE AS REQUIRED.
2. PROVIDE SUPPORT FOR EXISTING DRAIN PIPING.
3. CONNECT TO EXISTING PIPING ABOVE. INSTALL NEW HS & HR PIPING AND INSULATE.
4. REUSE AND MODIFY AHU CONTROLLERS ON EXISTING MOUNTING BOARD.
5. INSTALL NEW AHU STARTERS – IEW.
6. CLEAN EXISTING DUCTWORK AND PLENUMS THAT ARE ACCESSIBLE FROM FAN ROOM ONLY.

1 ENLARGED FAN ROOM PLAN – LOWER

SCALE: 0 1' 2' 4'

PROJECT NORTH

STATE OF ALASKA 49th DOUGLAS H. MURRAY ME 7870 REGISTERED PROFESSIONAL ENGINEER
ISSUE DATE: 10/31/2013

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HAINES SCHOOL FANS REPLACEMENT

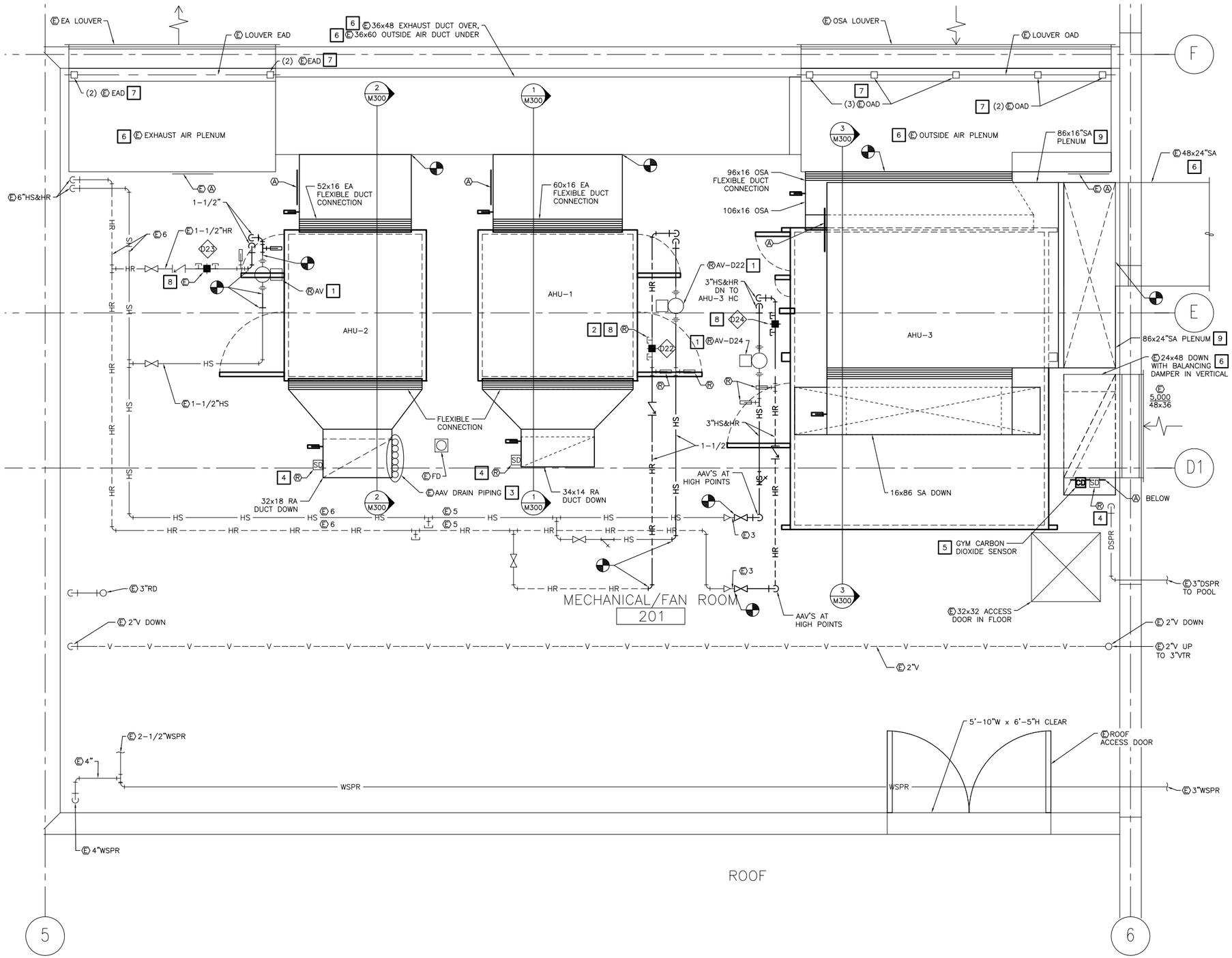
HAINES, ALASKA

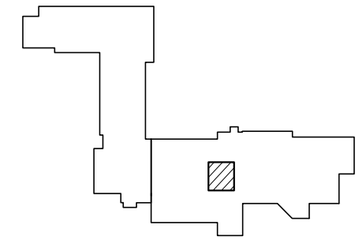
SHEET TITLE:
ENLARGED FAN ROOM PLAN – LOWER

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.
M200

JOB NO. M-473.1





KEY PLAN
HAINES SCHOOL

CONSTRUCTION NOTES:

1. REINSTALL EXISTING AUTOMATIC VALVE
2. REINSTALL EXISTING FLOWSETTER
3. PROTECT PIPING AND REINSTALL.
4. REMOVE AND REINSTALL. VERIFY OPERATION. PROVIDE ACCESS DOOR ADJACENT TO SMOKE SENSOR FOR SERVICE.
5. INSTALL NEW CARBON DIOXIDE SENSOR.
6. CLEAN EXISTING DUCTWORK AND PLENUMS THAT ARE ACCESSIBLE FROM FAN ROOM ONLY.
7. VERIFY OPERATION
8. MEASURE AND ADJUST. SEE SCHEDULE ON SHEET M001.
9. COORDINATE DIMENSIONS ONSITE, MAXIMIZE AREAS AS AVAILABLE.

SHEET NOTES:

1. SPRINKLER SYSTEM NOT SHOWN. COORDINATE ONSITE. PROTECT SYSTEM DURING CONSTRUCTION.

1 ENLARGED FAN ROOM PLAN – UPPER

SCALE: 0 1' 2' 4'

PROJECT NORTH

STATE OF ALASKA 49th DOUGLAS H. MURRAY ME 7870 REGISTERED PROFESSIONAL ENGINEER
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HAINES SCHOOL FANS REPLACEMENT

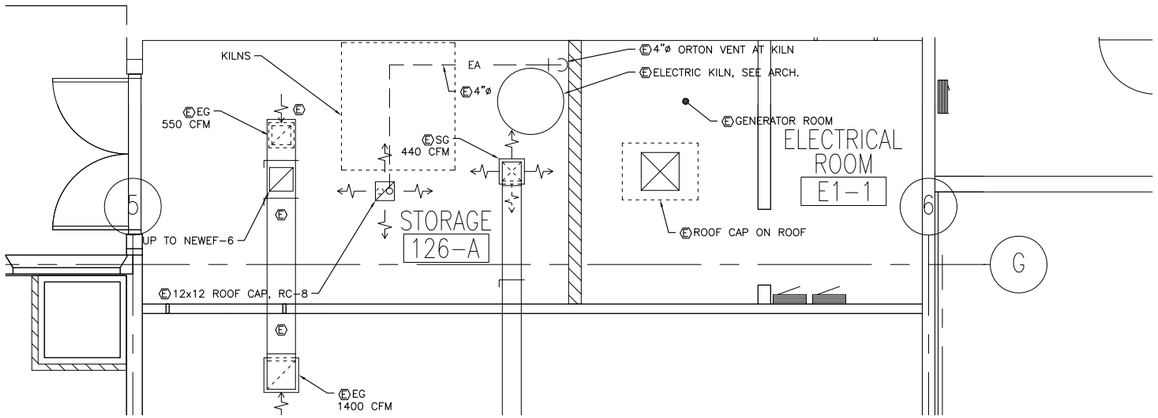
HAINES, ALASKA

SHEET TITLE:
ENLARGED FAN ROOM PLAN – UPPER

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.
M201

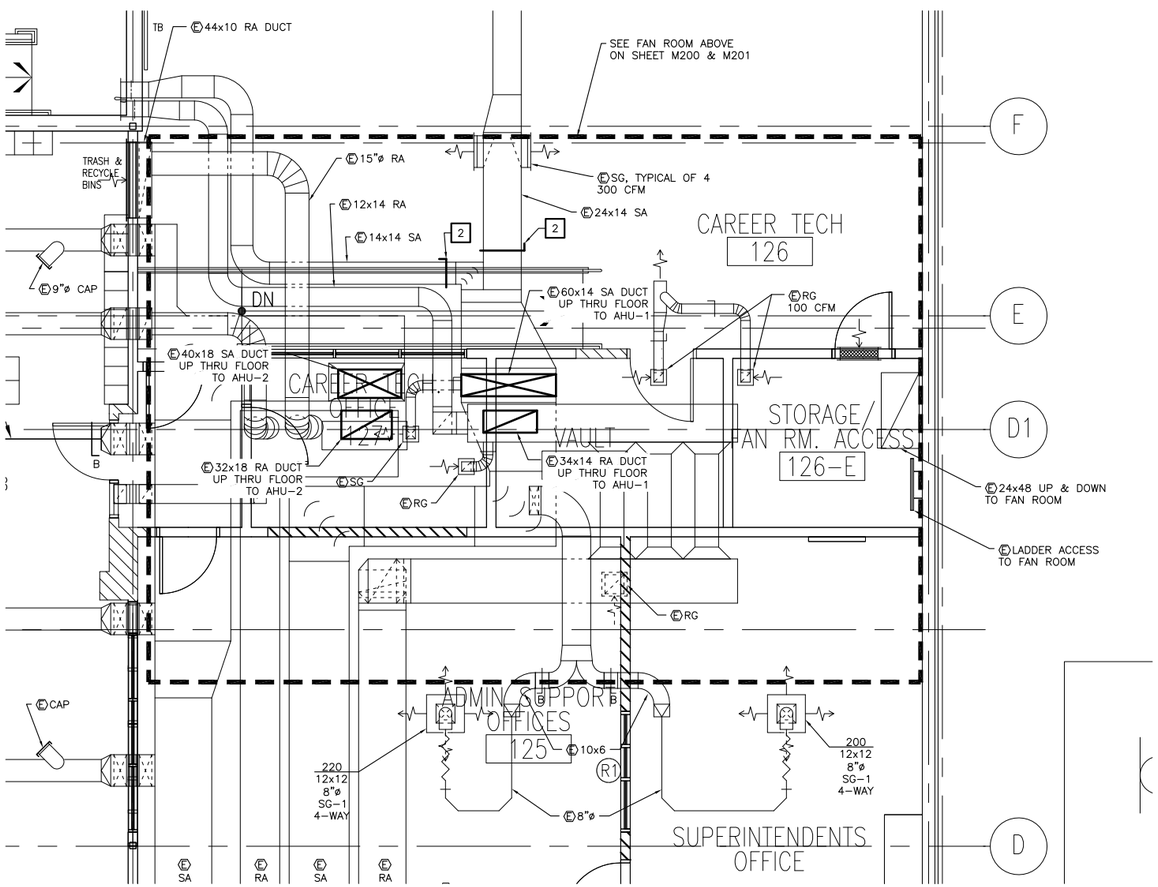
JOB NO. M-473.1



2 PART FLOOR PLAN – DUCTWORK

SCALE: 0 2' 4' 8'

PROJECT NORTH

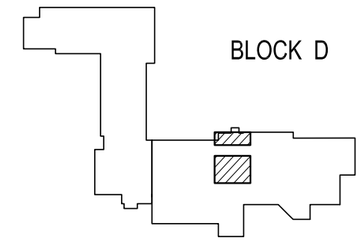


1 PART FLOOR PLAN – DUCTWORK

SCALE: 0 2' 4' 8'

PROJECT NORTH

KEY PLAN



CONSTRUCTION NOTES:

1. TEST AND MEASURE.
2. INSTALL NEW BALANCING DAMPERS. PATCH INSULATION AS NECESSARY.

STATE OF ALASKA
49th
DOUGLAS H. MURRAY
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HAINES SCHOOL FANS REPLACEMENT

HAINES, ALASKA

SHEET TITLE:

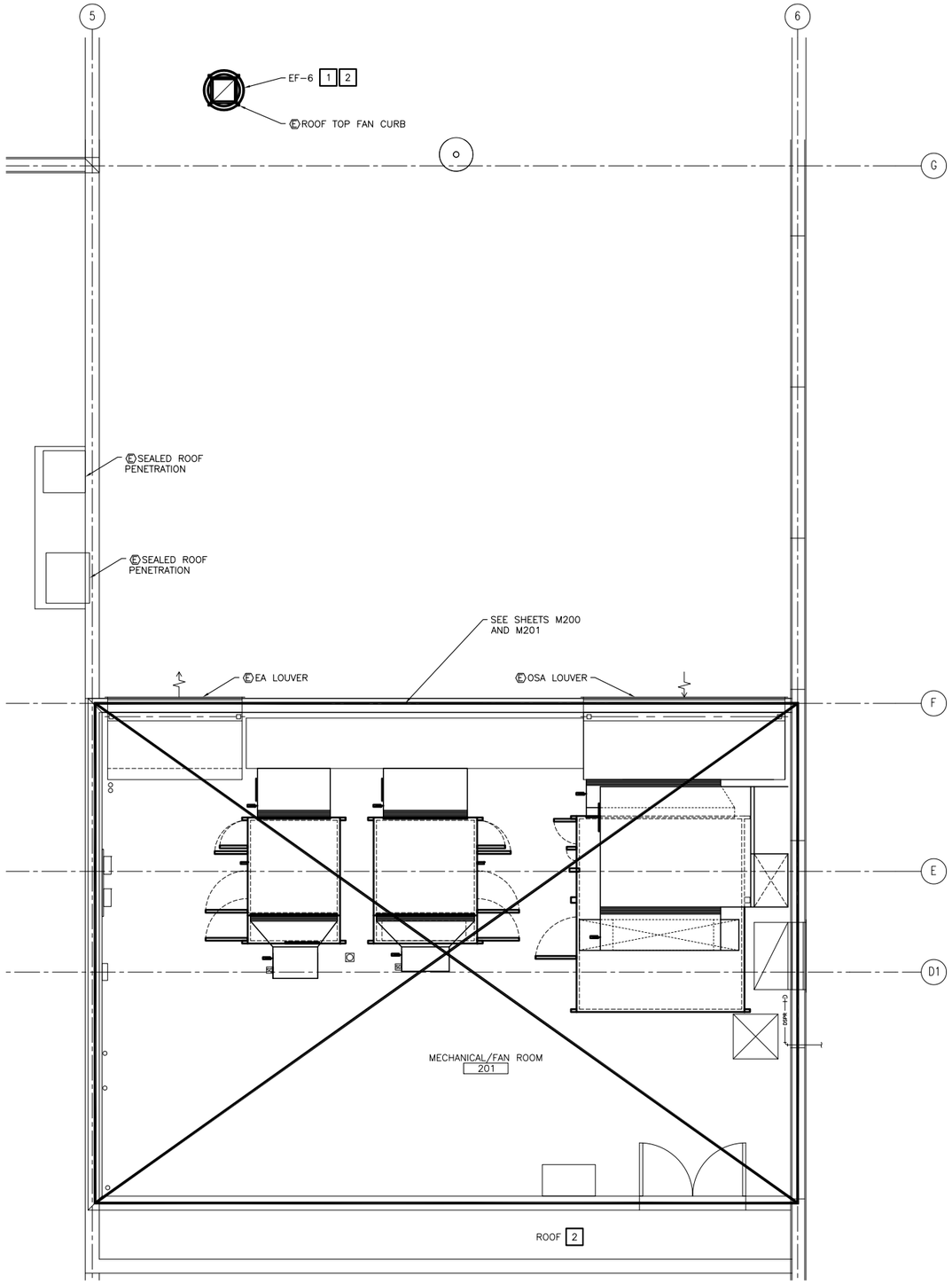
PART FLOOR PLAN – DUCTWORK

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.

M202

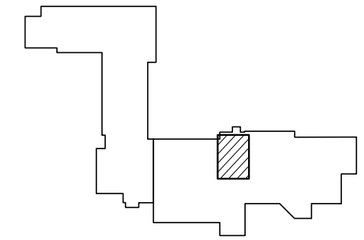
JOB NO. M-473.1



1 PARTIAL ROOF PLAN

SCALE: 0 2' 4' 8'

PROJECT NORTH



KEY PLAN
HAINES SCHOOL

CONSTRUCTION NOTES:

1. INSTALL EXHAUST FAN ON EXISTING ROOF CURB. MODIFY CURB WITH TRANSITION TO EF INLET AS REQUIRED.
2. PROTECT ROOF SURFACE DURING CONSTRUCTION.

STATE OF ALASKA 49th DOUGLAS H. MURRAY ME 7870 REGISTERED PROFESSIONAL ENGINEER

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HAINES SCHOOL FANS REPLACEMENT

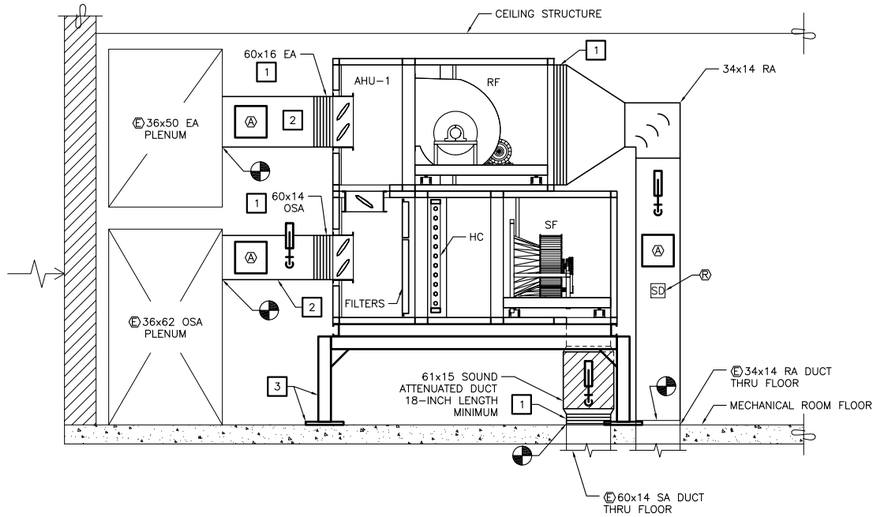
HAINES, ALASKA

SHEET TITLE:
PARTIAL ROOF PLAN

SCALE:	AS SHOWN:
DATE:	10/31/2013
DRAWN:	KB
DESIGNED:	DM
CHECKED:	DM

SHEET NO.
M203

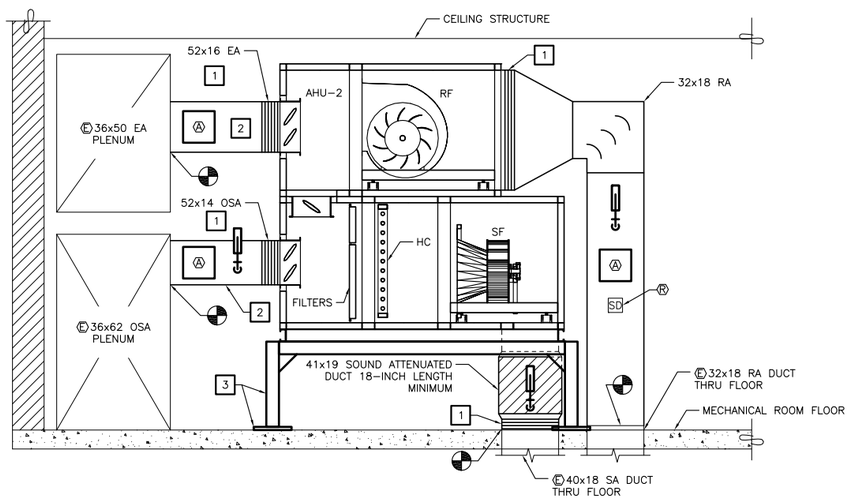
JOB NO. M-473.1



1 SECTION – AHU-1

SCALE: 0 1' 2' 4'

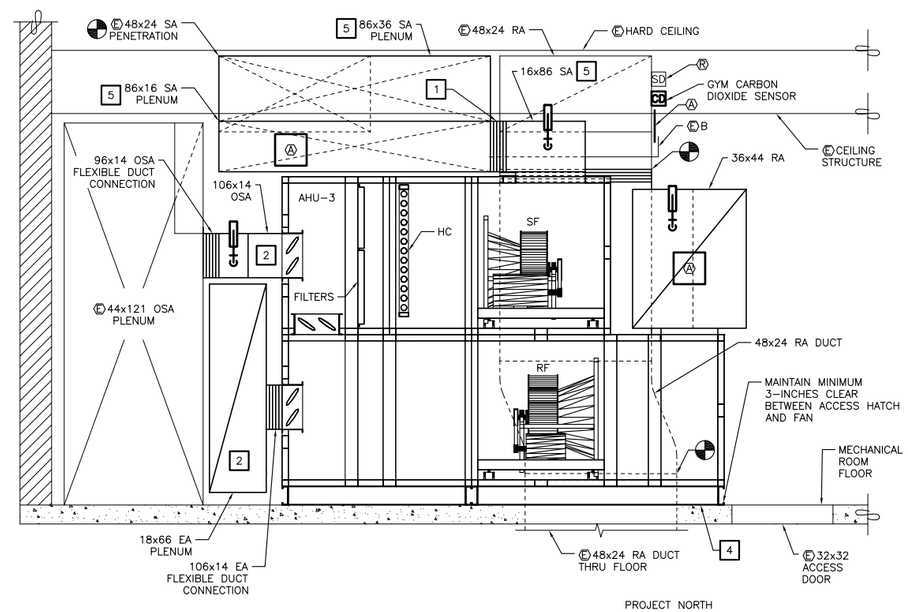
PROJECT NORTH



2 SECTION – AHU-2

SCALE: 0 1' 2' 4'

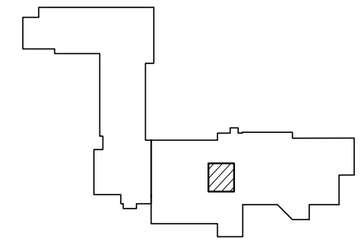
PROJECT NORTH



3 SECTION – AHU-3

SCALE: 0 1' 2' 4'

PROJECT NORTH



KEY PLAN
HAINES SCHOOL

CONSTRUCTION NOTES:

1. FLEXIBLE CONNECTION
2. INSULATE DUCT.
3. STEEL SUPPORT FRAME WITH 3x3 ANGLE WELDED STAND SUPPORTS. NEOPRENE VIBRATION ISOLATION PADS INSTALLED UNDER EACH LEG. COORDINATE HEIGHT AND DIMENSIONS WITH ACTUAL AHU PROVIDED. PROVIDE SHOP DRAWING.
4. INSTALL VIBRATION ISOLATION PADDING UNDER ALL SUPPORTS.
5. COORDINATE DIMENSIONS ONSITE, MAXIMIZE AREAS AS AVAILABLE.

SHEET NOTES:

1. SEE SHEET M400 FOR CONTROL DEVICES.
2. EXTEND DAMPER RODS FOR EXTERNAL ACTUATOR INSTALLATION – NO EXCEPTIONS.

STATE OF ALASKA 49th
DOUGLAS H. MURRAY
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HAINES SCHOOL FANS REPLACEMENT

HAINES, ALASKA

SHEET TITLE:
SECTIONS

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.
M300

JOB NO. M-473.1

SEQUENCE OF OPERATIONS:

A. AIR HANDLING UNITS – EXTERIOR HIGH SCHOOL ROOMS (AHU–1), INTERIOR HIGH SCHOOL ROOMS (AHU–2): Magnetic Starter with a Hand–Off–Auto switch on the cover. In the AUTO position, the supply fan operates according to the Occupied/Unoccupied schedule of the BAS and safety functions such as the low–limit thermostat and the smoke sensor. In the Hand position, the fan operates at the command of the low–limit thermostat and smoke sensor. Existing hard wired connection of smoke sensor directly to fire alarm panel with general fire alarm point is acceptable. Verify operation.

1. Mixed air temperature: Mixed air dampers to modulate to provide minimum outdoor air volume as shown below. Averaging bulb duct thermostat in the mixed air to modulate the modulating outside air damper (OAD), the recirculating air damper (RAD), and exhaust air damper (EAD) to maintain the adjustable supply air setpoint listed below as long as minimum outdoor air volume is attained. Dampers to modulate cooperatively, with the outside air damper OAD and the exhaust air damper EAD closed when the recirculating air damper RAD is open. Dampers to position to the full recirculating positions when the unit is not operating.

2. During the Occupied schedule, Modulating outside air damper (OAD) to maintain minimum open position at full recirculation mode as needed to provide the required minimum outside air. Outdoor air damper position to be set by Control Contractor and Balancing Contractor. Minimum OSA volumes are as follows and are to be manually verified during initial adjustment of Mechanical systems:

AHU–1	1,600 CFM
AHU–2	1,000 CFM

3. Night Setback: There is not a Night Setback mode for AHU–1 or AHU–2 fan units. Fans shall remain off during Unoccupied mode.

4. AHU–1 SF (Exterior Zone): Supply air temperature: Duct thermostat in the supply air discharge to control the mixing dampers and automatic valve in series to supply an adjustable air temperature set by the supply air reset; 55°F supply air at 55°F outside air temperature modulating to 65°F supply air at 0F outside air temperature and below. AHU–1 room sensor to override supply air temperature reset schedule as necessary if room temperature is 3 degrees above or below room temperature setpoint. AHU–1 sensor located in Career Tech Clean Room 125.

5. AHU–2 SF (Interior Zone): Supply air temperature: Duct thermostat in the supply air discharge to control the mixing dampers and automatic valve in series to supply an adjustable air temperature set by the supply air reset; 60°F supply air at 60°F outside air temperature modulating to 65°F supply air at 0F outside air temperature and below. AHU–2 room sensor to override supply air temperature reset schedule as necessary if room temperature is 3 degrees above or below room temperature setpoint. AHU–2 sensor located in District Office 124.

6. Return fan (RF–1, RF–2): Magnetic starter with a Hand–Off–Auto switch on the cover. In the Auto position, Respective return fan to operate whenever supply fan operates. In the Hand position, the fan operates.

7. Louver automatic dampers: The exhaust air and outdoor air louvers each contain existing damper actuators which serve the common outdoor air and exhaust air louver/plenum. These dampers are to be positive type and shall open fully prior to AHU–1, AHU–2, or AHU–3, or respective return fan (RF–1, RF–2, or RF–3) operation during Occupied period utilizing end switch as required. Louver dampers to remain closed when AHU–3 systems are in full recirculation mode during Night Setback mode. Test and verify operation.

8. Verify operation of existing Low–Limit Control, Smoke Sensors, Filter Alarm, and Fan Operation Status.

B. GYM FAN (AHU–3): Magnetic Starter with a Hand–Off–Auto switch on the cover. In the AUTO position, the supply fan operates according to the Occupied/Unoccupied schedule of the BAS and safety functions such as the low–limit thermostat and the smoke sensor. In the Hand position, the fan operates at the command of the low–limit thermostat and smoke sensor. Existing hard wired connection of smoke sensor directly to fire alarm panel with general fire alarm point is acceptable. Verify operation.

1. Mixed air temperature: Carbon dioxide sensor located in the return air duct to modulate the outside air damper, the recirculating air damper, and exhaust air damper to maintain an adjustable 800 ppm. The BAS system shall default to an averaging bulb mixed air temperature set at 55°F upon failure of carbon dioxide sensor. An additional carbon dioxide sensor in the mixed air duct to send an analog signal to the BAS. Dampers to modulate cooperatively, with the outside air damper OAD and the exhaust air damper EAD closed when the recirculating air damper RAD is open. Dampers to position to the full recirculating positions during the Night setback mode and when the unit is not operating. Mixed air dampers shall not modulate lower than a 38°F mixed air temperature during carbon dioxide sensor control operation.

2. Maintain pressure sensor located in High School gym. Verify operation of existing controls.

3. Maintain humidity sensor located in High School gym. Verify operation of existing controls.

4. Provide and maintain additional carbon dioxide sensor located in Gym. Verify operation of existing controls.

5. Night Setback: Fan activated when zone temperatures drop below 60°F. Fan operates with OAD and EAD fully closed and RAD in the open position until the minimum zone temperature rises above 68°F.

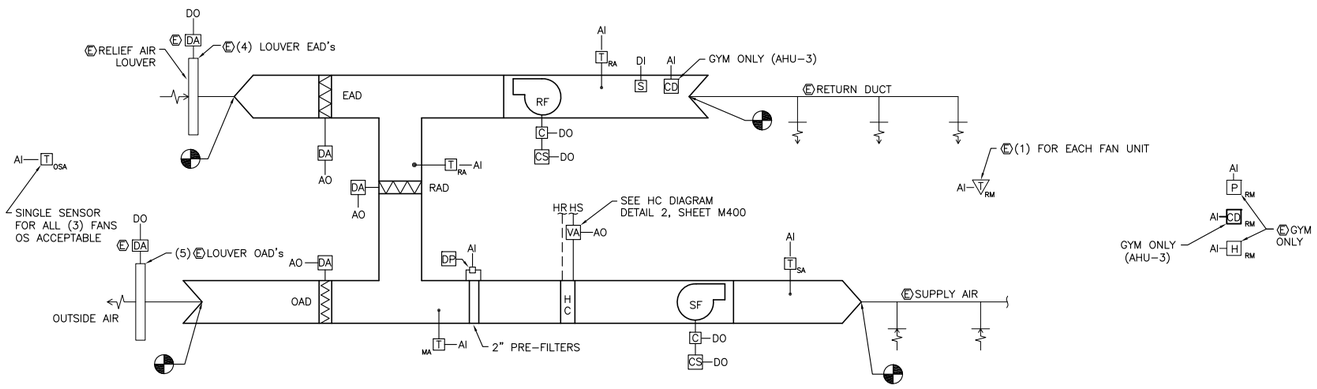
6. Supply air: Averaging bulb duct thermostat in the supply air discharge to modulate two–way modulating valve to supply an adjustable air temperature in order to maintain an adjustable 65°F room temperature. Supply air temperature discharge to be set by the supply air reset schedule according to PID loop control. PID loop shall reset the supply air discharge setpoint between 55°F and 100°F as required to maintain room temperature setpoint. Automatic valve to close on an outside air temperature above an adjustable 65°F OSA.

7. Return fan (RF–3): Magnetic starter with a Hand–Off–Auto switch on the cover. In the Auto position, Return fan to operate whenever supply fan operates. In the Hand position, the fan operates.

8. Louver automatic dampers: The exhaust air and outdoor air louvers each contain existing (4) and (5) damper actuators, respectively, which serve the common outdoor air and exhaust air louver/plenum. These dampers are to be positive type and shall open fully prior to AHU–1, AHU–2, or AHU–3, or respective return fan (RF–1, RF–2, or RF–3) operation during Occupied period utilizing end switch as required. Louver dampers to remain closed when AHU–3 systems are in full recirculation mode during Night Setback mode. Test & verify operation.

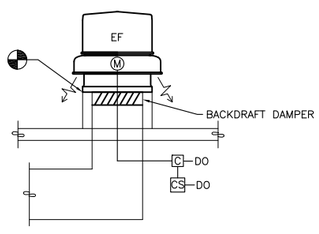
9. Verify operation of existing Low–Limit Control, Smoke Sensors, Filter Alarm, and Fan Operation Status.

C. EXHAUST FAN (EF–6): Magnetic Starter with a Hand–Off–Auto switch on the cover. In the AUTO position, the supply fan operates according when AHU–1 operates. In the Hand position, the fan operates at the command of an ON–OFF switch independent from the operation of AHU–1.



1 CONTROL SCHEMATIC FOR AHU–1, AHU–2, AHU–3

NO SCALE



3 CONTROL SCHEMATIC FOR EF–6

NO SCALE

GENERAL NOTES:

1. The notes, diagrams, and points shown here are schematic only. Refer to sequence of operations and section 230926 of the specifications and all contract drawings for complete requirements and configuration of the systems. Coordinate with all other disciplines to achieve results as shown and intended hereunder in the documents. General notes apply to all controls drawings hereunder.

2. See floor plans and piping diagrams for respective room thermostat, immersion thermostat, and pressure switch locations. See plans for other control equipment locations. Coordinate with division 22 and 23 for equipment interface requirements, including piping tees and wells, sensor locations, and interconnections.

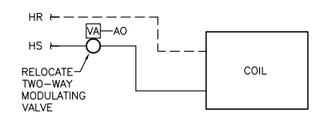
3. All systems abbreviations, functions, and equipment names shall be listed in all submittal data, O&M data, and as–builts, as shown hereunder.

4. Provide (4) spare damper actuators, 133 in–lb, with external adjustment.

5. See division 260533 for additional requirements concerning raceways and boxes.

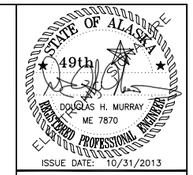
CONTROLS LEGEND

C	CONTROLLER	AHU	AIR HANDLING UNIT
S	SMOKE SENSOR	AI	ANALOG INPUT
T	IMMERSION THERMOSTAT OR THERMOSTATIC SENSOR	AO	ANALOG OUTPUT
		BAS	BUILDING AUTOMATION SYSTEM
		COM	COMMON
P	PRESSURE SENSOR	DI	DIGITAL INPUT
VA	VALVE ACTUATOR	DO	DIGITAL OUTPUT
DA	DAMPER ACTUATOR	EAD	EXHAUST AIR DAMPER
DP	DIFFERENTIAL PRESSURE GAGE	EF	EXHAUST FAN
CS	CURRENT SENSOR	HC	HEATING COIL
FS	FLOW SWITCH	HR	HEATING RETURN
P	PUMP	HS	HEATING SUPPLY
T	ROOM THERMOSTAT	IEW	IN ELECTRICAL WORK
	AIR DIRECTION	MA	MIXED AIR
	THERMOMETER	NC	NORMALLY CLOSED
M	MOTOR	NO	NORMALLY OPEN
		OAD	OUTSIDE AIR DAMPER
		OSA	OUTSIDE AIR
		RA	RETURN AIR
		RAD	RETURN AIR DAMPER
		RF	RETURN FAN
		SA	SUPPLY AIR



2 TYPICAL CONTROL SCHEMATIC FOR AHU HEATING COIL

NO SCALE



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HAINES SCHOOL FANS REPLACEMENT

HAINES, ALASKA

SHEET TITLE:

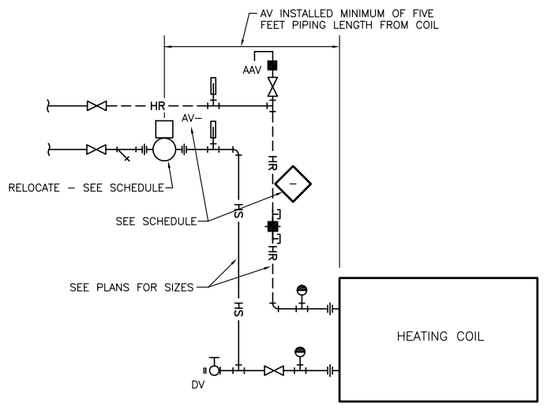
CONTROLS

SCALE:	AS SHOWN:
DATE:	10/31/2013
DRAWN:	KB
DESIGNED:	DM
CHECKED:	DM

SHEET NO.

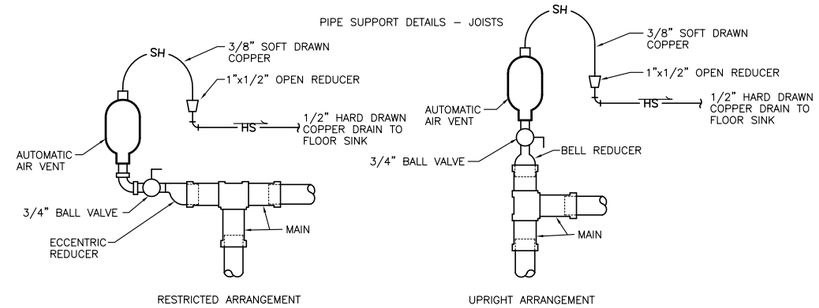
M400

JOB NO. M–473.1



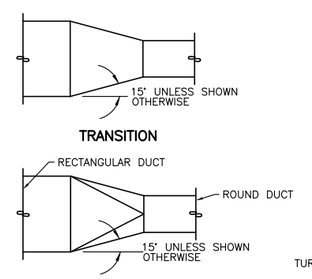
2 HEATING COIL DIAGRAM

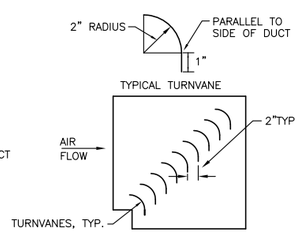
NO SCALE

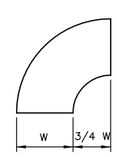


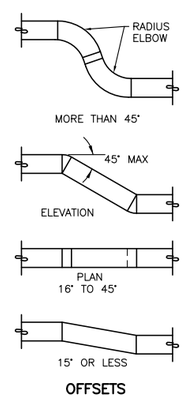
3 AUTOMATIC AIR VENT DETAILS

NO SCALE









RECTANGULAR DUCTS

RECTANGULAR AND ROUND DUCTS

NOTE: ALL DUCTWORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THESE DETAILS AND THE SPECIFICATIONS.

1 TYPICAL DUCT CONSTRUCTION DETAILS

NO SCALE

STATE OF ALASKA 49th DOUGLAS H. MURRAY ME 7870 REGISTERED PROFESSIONAL ENGINEER

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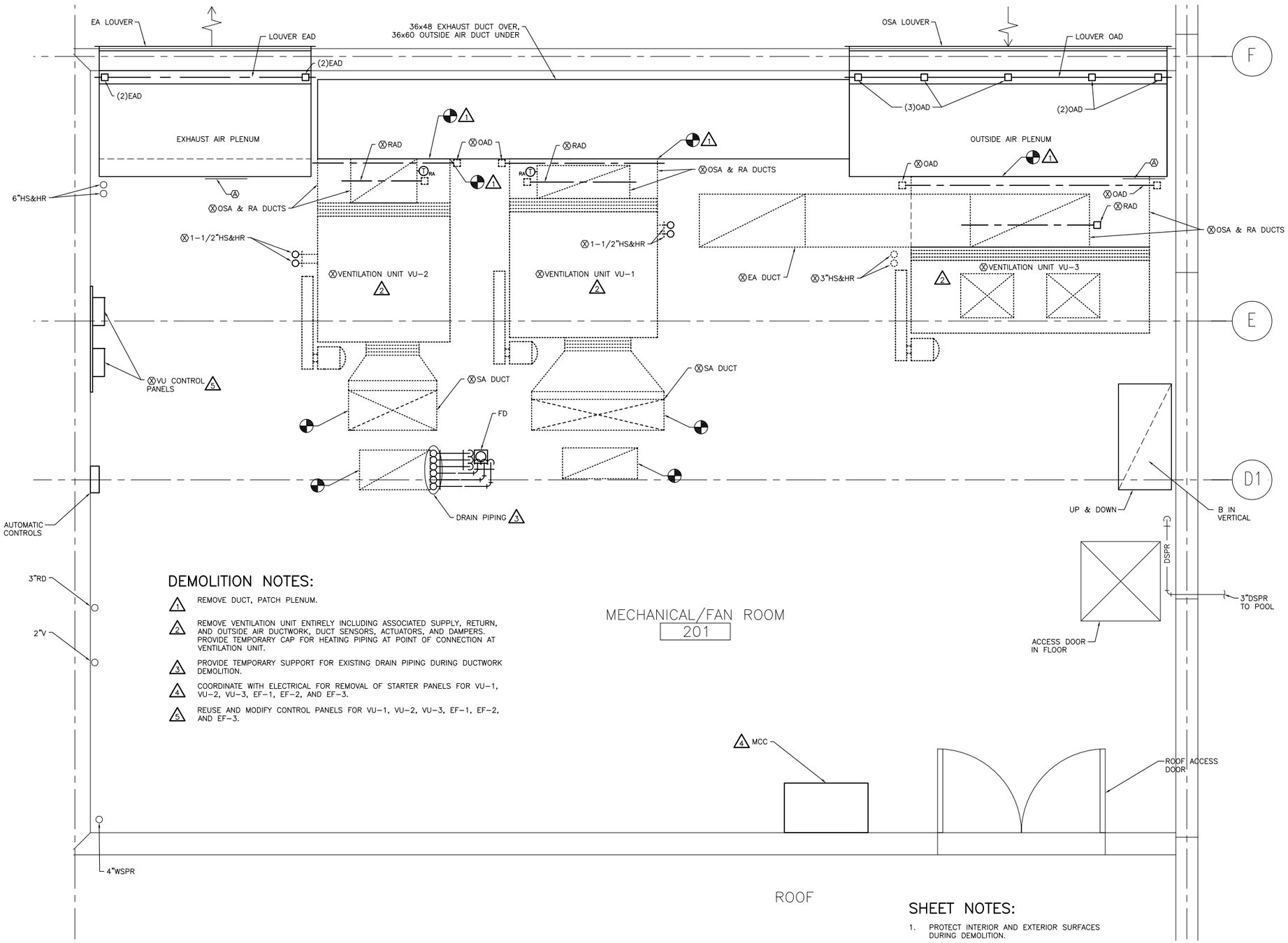
HAINES SCHOOL
FANS REPLACEMENT
HAINES, ALASKA

SHEET TITLE:
DETAILS

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.
M500

JOB NO. M-473.1

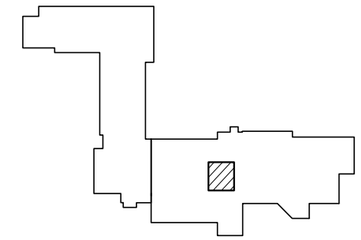


DEMOLITION NOTES:

1. REMOVE DUCT, PATCH PLENUM.
2. REMOVE VENTILATION UNIT ENTIRELY INCLUDING ASSOCIATED SUPPLY, RETURN, AND OUTSIDE AIR DUCTWORK, DUCT SENSORS, ACTUATORS, AND DAMPERS. PROVIDE TEMPORARY CAP FOR HEATING PIPING AT POINT OF CONNECTION AT VENTILATION UNIT.
3. PROVIDE TEMPORARY SUPPORT FOR EXISTING DRAIN PIPING DURING DUCTWORK DEMOLITION.
4. COORDINATE WITH ELECTRICAL FOR REMOVAL OF STARTER PANELS FOR VU-1, VU-2, VU-3, EF-1, EF-2, AND EF-3.
5. REUSE AND MODIFY CONTROL PANELS FOR VU-1, VU-2, VU-3, EF-1, EF-2, AND EF-3.

SHEET NOTES:

1. PROTECT INTERIOR AND EXTERIOR SURFACES DURING DEMOLITION.



KEY PLAN
HAINES SCHOOL

1 ENLARGED FAN ROOM PLAN – LOWER – DEMOLITION

SCALE: 0 1' 2' 4'

PROJECT NORTH

STATE OF ALASKA 49th DOUGLAS H. MURRAY ME 7870 REGISTERED PROFESSIONAL ENGINEER

ISSUE DATE: 10/31/2013

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HAINES SCHOOL FANS REPLACEMENT

HAINES, ALASKA

SHEET TITLE:

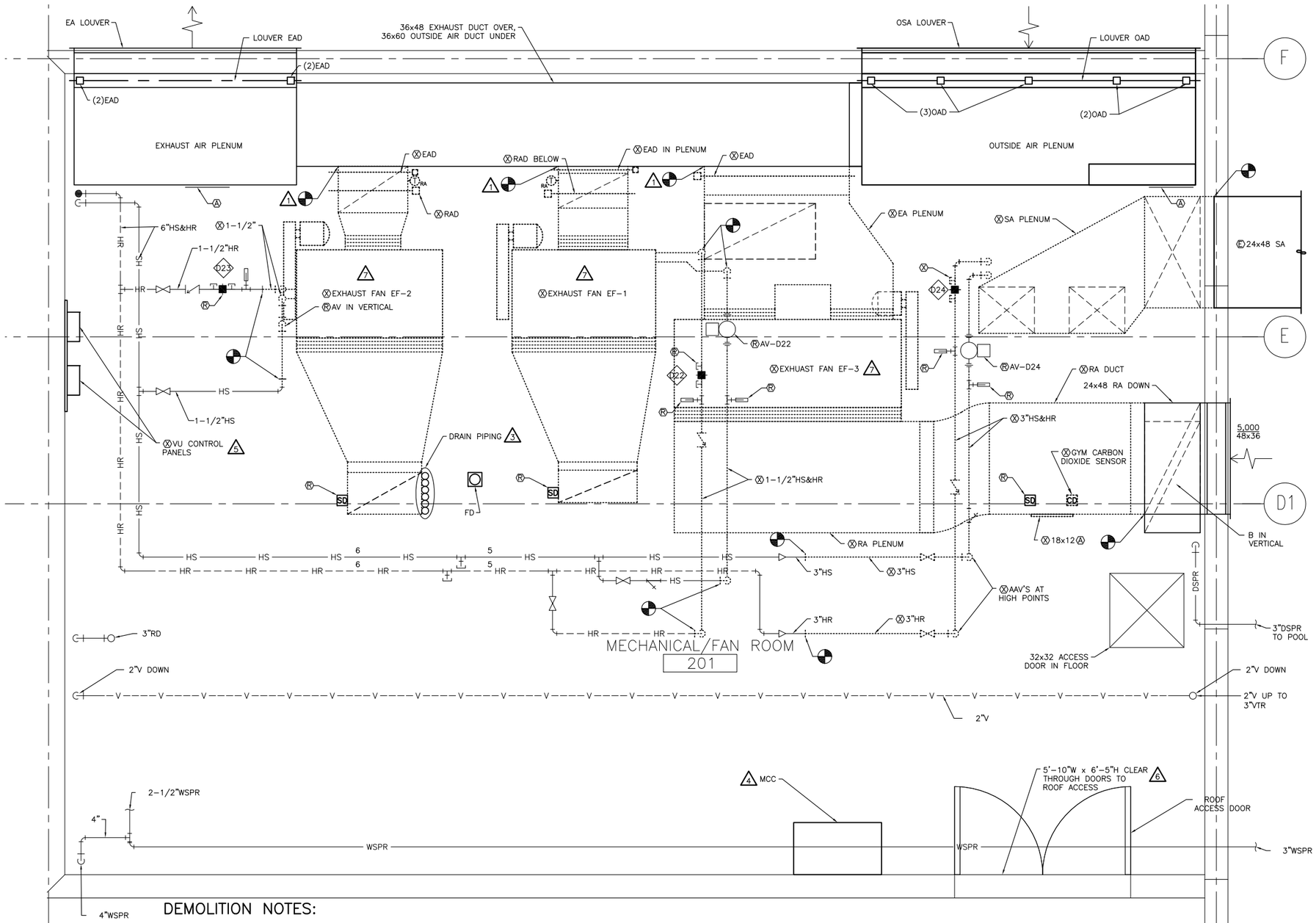
ENLARGED FAN ROOM PLAN – LOWER – DEMOLITION

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

SHEET NO.

MD200

JOB NO. M-473.1



KEY PLAN
HAINES SCHOOL

DEMOLITION NOTES:

1. REMOVE DUCT, PATCH PLENUM.
2. REMOVE VENTILATION UNIT ENTIRELY INCLUDING ASSOCIATED SUPPLY, RETURN, AND OUTSIDE AIR DUCTWORK, DUCT SENSORS, ACTUATORS, AND DAMPERS. PROVIDE TEMPORARY CAP FOR HEATING PIPING AT POINT OF CONNECTION AT VENTILATION UNIT.
3. PROVIDE TEMPORARY SUPPORT FOR EXISTING DRAIN PIPING DURING DUCTWORK DEMOLITION.
4. COORDINATE WITH ELECTRICAL FOR REMOVAL OF STARTER PANELS FOR VU-1, VU-2, VU-3, EF-1, EF-2, AND EF-3.
5. REUSE AND MODIFY CONTROL PANELS FOR VU-1, VU-2, VU-3, EF-1, EF-2, AND EF-3.
6. PROTECT ROOF SURFACES DURING DEMOLITION.
7. REMOVE EXHAUST FAN UNIT ENTIRELY INCLUDING ASSOCIATED RA AND EA DUCTWORK, ACTUATORS, AND DAMPERS.

SHEET NOTES:

1. SEE PIPING DIAGRAMS FOR COMPLETE PIPING CONFIGURATION, SIZES, VALVES, AND ALL RELATED APPURTENANCES.
2. NOTE SPRINKLER PIPING AND HEADS NOT SHOWN, COORDINATE ONSITE. PROTECT SYSTEM DURING DEMOLITION.

1 ENLARGED FAN ROOM PLAN – UPPER – DEMOLITION

SCALE: 0 1' 2' 4'

PROJECT NORTH

STATE OF ALASKA 49th DOUGLAS H. MURRAY ME 7870 REGISTERED PROFESSIONAL ENGINEER
ISSUE DATE: 10/31/2013

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HAINES SCHOOL FANS REPLACEMENT

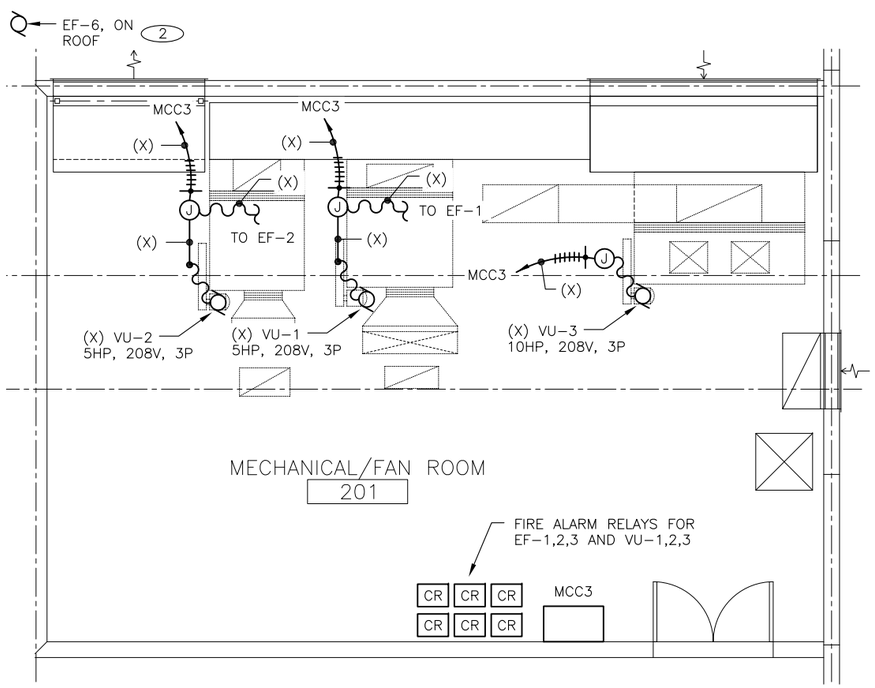
HAINES, ALASKA

SHEET TITLE:
ENLARGED FAN ROOM PLAN – UPPER – DEMOLITION

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: KB
DESIGNED: DM
CHECKED: DM

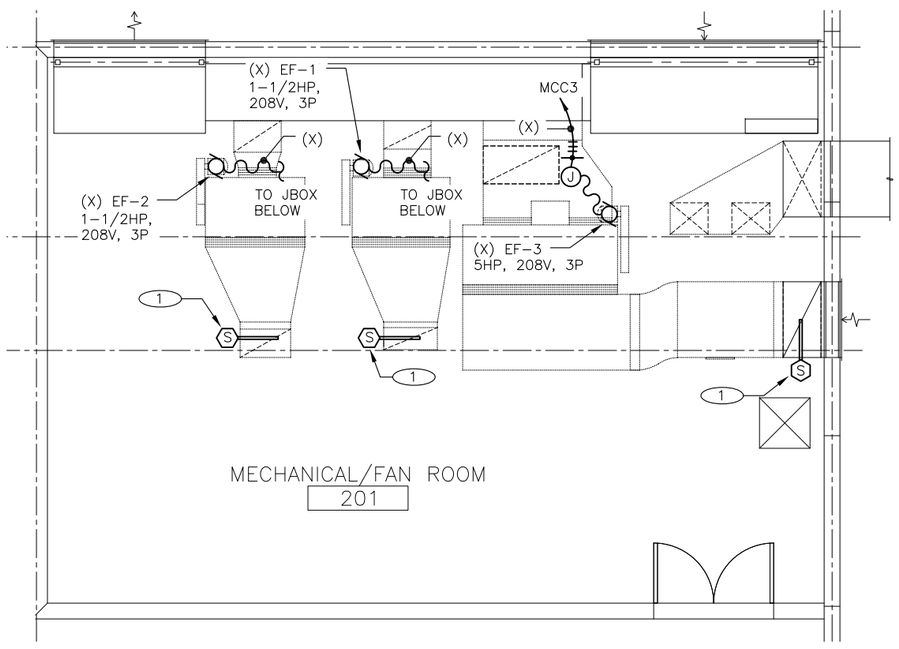
SHEET NO.
MD201

JOB NO. M-473.1



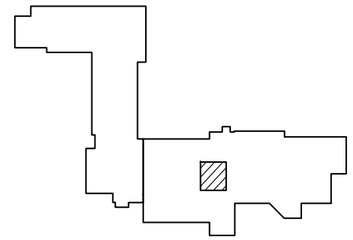
1 FAN ROOM DEMOLITION PLAN – LOWER

SCALE: 0 2' 4' 8'



2 FAN ROOM DEMOLITION PLAN – UPPER

SCALE: 0 2' 4' 8'



KEY PLAN
HAINES SCHOOL

NOTES:

1. REMOVE AND SALVAGE SMOKE DETECTOR FOR REINSTALLATION. PROVIDE NEW SAMPLING TUBE AS REQUIRED.
2. REMOVE AND REPLACE ELECTRICAL TO EF-6 AS SCHEDULED. REFER TO DRAWING M203 FOR EXACT LOCATION.

LEGEND

SYMBOL	DESCRIPTION
	MOTOR CONNECTION
J	JUNCTION BOX
	HOT CONDUCTOR
	NEUTRAL CONDUCTOR
	GROUND CONDUCTOR
	HOMERUN TO INDICATED DESTINATION
	FLEXIBLE CONDUIT CONNECTION

REFERENCE SYMBOLS

SYMBOL	DESCRIPTION
(E)	EXISTING
(X)	REMOVE

ABBREVIATIONS

A	AMPERE
C	CONDUIT
CR	CONTROL RELAY
G	GROUND
HP	HORSEPOWER
KW	KILOWATTS
KVA	KILOVOLT–AMPERES
MCC	MOTOR CONTROL CENTER
N	NEUTRAL (GROUNDED CONDUCTOR)
P	PHASE
V	VOLTS
VA	VOLT–AMPERES

MECHANICAL EQUIPMENT SCHEDULE

TAG	DESCRIPTION	HP	KW	AMPS	VOLTS	PHASE	TOTAL VA	FEEDER	DISCONNECT		STARTER SIZE	NOTES
									SWITCH	FUSE		
AHU–1	SUPPLY FAN	5			208	3	6.3	3/4"C, 3#8, 1#10G		25	1	.
	RETURN FAN	5			208	3	6.3	3/4"C, 3#8, 1#10G		25	1	.
AHU–2	SUPPLY FAN	5			208	3	6.3	3/4"C, 3#8, 1#10G		25	1	.
	RETURN FAN	3			208	3	4.0	3/4"C, 3#12, 1#12G		17.5	1	.
AHU–3	SUPPLY FAN	15			208	3	17.4	1–1/2"C, 3#2, 1#8G		60	3	.
	RETURN FAN	7–1/2			208	3	9.1	3/4"C, 3#6, 1#10G		40	1	.
EF–6	EXHAUST FAN	1/3			120	1	0.9	1/2"C, 2#12, 1#12G	30/2	10	1	.

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10/31/2013

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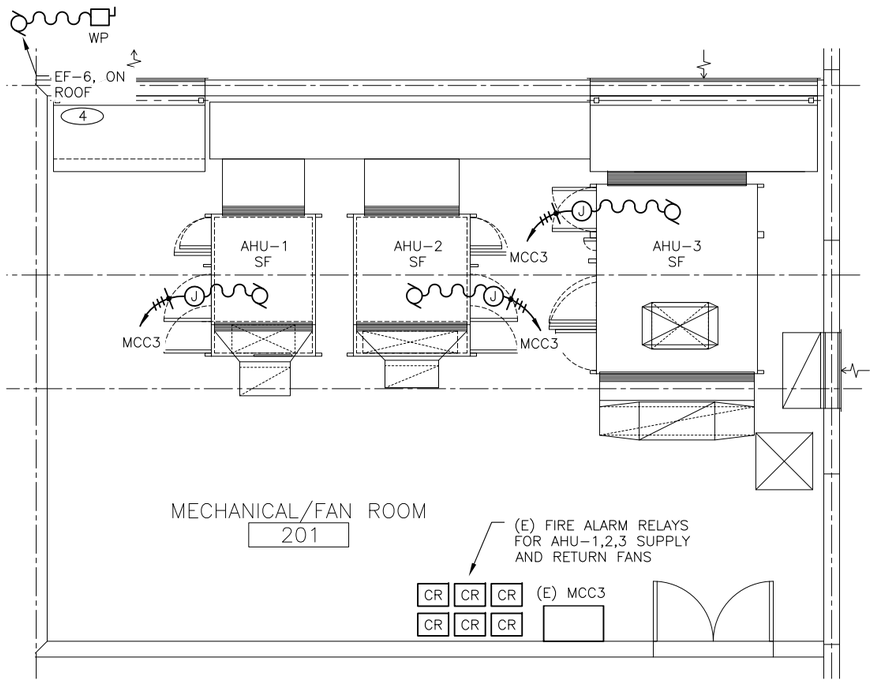
HAINES SCHOOL
FANS REPLACEMENT
HAINES, ALASKA

SHEET TITLE:
LEGEND, SCHEDULE, AND DEMOLITION PLANS

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: BJB
DESIGNED: BJB
CHECKED:

SHEET NO.
E200

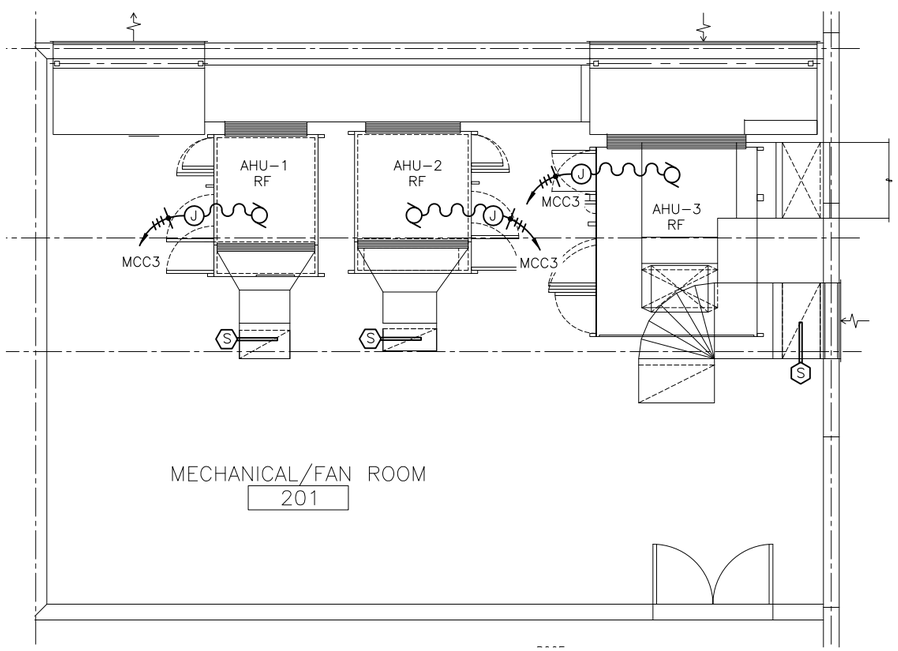
JOB NO. M–473.1



1 FAN ROOM PLAN – LOWER

SCALE: 0 2' 4' 8'

PROJECT NORTH



2 FAN ROOM PLAN – UPPER

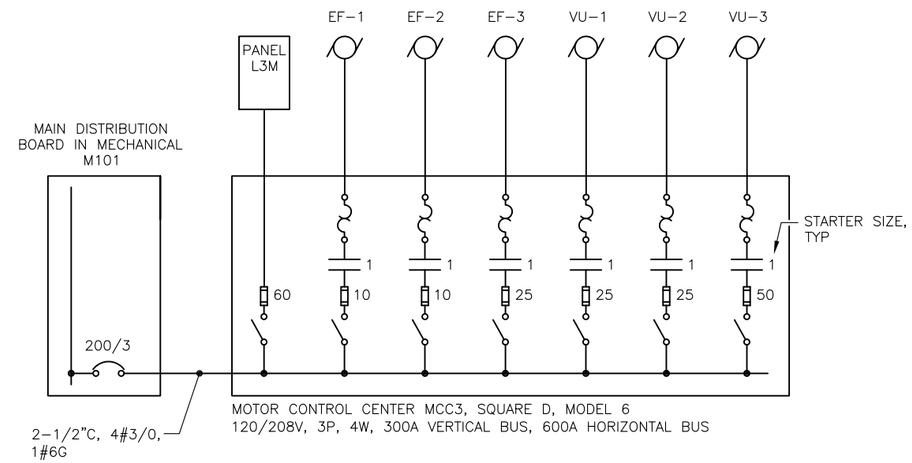
SCALE: 0 2' 4' 8'

PROJECT NORTH

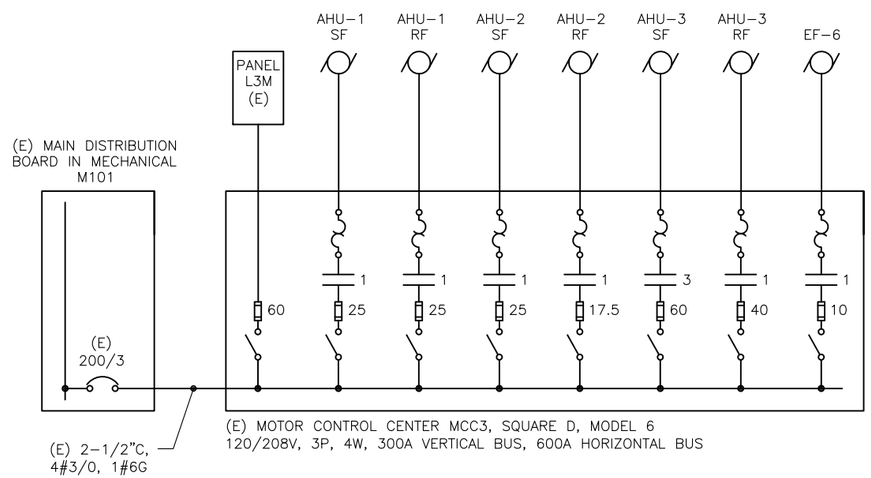
NOTES:

1. CONNECT AIR HANDLING UNIT MOTOR CONTROLS THROUGH EXISTING FIRE ALARM RELAYS FOR SHUT DOWN UPON DETECTION OF SMOKE.
2. PROVIDE NEW STARTER FOR AHU–3 SUPPLY FAN.
3. REPLACE FUSES AND OVERLOAD RELAYS TO COORDINATE WITH NEW MOTOR CHARACTERISTICS.

(4) REFER TO DRAWING M203 FOR EXACT LOCATION.



3 EXISTING SINGLE LINE DIAGRAM



4 NEW SINGLE LINE DIAGRAM

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10/31/2013

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HAINES SCHOOL FANS REPLACEMENT

HAINES, ALASKA

SHEET TITLE:
ENLARGED FAN ROOM PLANS

SCALE: AS SHOWN:
DATE: 10/31/2013
DRAWN: BJB
DESIGNED: BJB
CHECKED:

SHEET NO.
E201

JOB NO. M–473.1