INVITATION TO BID

Haines Borough Vocational Education Building Upgrade

Issue Date: March 12, 2015

Bid Deadline: 2:00pm, Friday, April 3, 2015

NOTICE INVITING BIDS AND BIDDER INSTRUCTIONS

Haines Borough Vocational Education
Building Upgrade

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NOTICE INVITING BIDS AND BIDDER INSTRUCTIONS

Haines Borough Vocational Education Building Upgrade

Issue Date: March 12, 2015

The Haines Borough is soliciting sealed bids from qualified and licensed contractors to perform the work for the **Haines Borough Vocational Education Building Upgrade** project.

RECEIPT OF BIDS / BID DEADLINE: Bids will be accepted until 2:00 p.m., Local Time, Friday, April 3, 2015, 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.

The Haines Borough reserves the right to reject any or all bids, to waive any irregularities in a bid, and to make award to the lowest responsive, responsible bidder as it may best serve the interest of the Borough. Award selection is based on competitive sealed bids; local hire is not a consideration. Notice given that the project requires compliance with AS 36.15.010 "Use of Local Forest Products Required in Projects Financed By Public Money."

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: Krista Kielsmeier, Deputy Clerk
103 Third Ave / P.O. Box 1209, Haines, AK 99827
Phone: 907-766-2231 ext.36
Email: kkielsmeier@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 mechanical system upgrades to the Vocational Education Building at Haines High School. The project is located in Haines, Alaska.

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

Request for Bids Issued	March 12, 2015
Request for Bids Publishing Dates	March 12, 19 and 26, 2015 (in Chilkat Valley News)
Receive and Open Bids	April 3, 2015
Borough Assembly Authorization	April 14, 2015
Notice of Intent to Award	April 14, 2015
*Notice to Proceed	April 24, 2015 (approximate)
Project Completion	Substantial Completion: August 21, 2015
	Final Completion: September 18, 2015

***4 AAC 31.080(c):**

(c) The (Haines Borough) shall provide for the administrative review of a complaint filed by an aggrieved offeror that allows the offeror to file a bid protest, within 10 days after notice is provided of intent to award the contract, requesting a hearing for a determination and award of the contract in accordance with the law. The (Borough) shall provide notice to all interested parties of the filing of the bid protest.

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 Borough Vocational Educational Building Upgrade*."

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 Borough Vocational Education Building Upgrade

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 Vocational Education
Building Upgrade

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 Borough Vocational Education
Building Upgrade

Located in Haines, Alaska, have not, either directly or indirectly, entered into any agreement, participated 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 _____, 2015.

Notary Public_____

My Commission Expires:_____

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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 _____**, 2015**.

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 Borough Vocational Education Building Upgrade

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 Vocational Education
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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 Borough Vocational Education Building Upgrade

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 _____, 2015.

_____
Principal

(SEAL) BY:_____

_____
Surety

(SEAL) BY:_____

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

Haines Borough Vocational Education
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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 Borough Vocational Education Building Upgrade

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 _____, 2015.

_____
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 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Cutting and patching.
   2. Progress cleaning.
   3. Protection of installed construction.

B. Related Requirements:
   1. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

3.4 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 014119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

B. Related Requirements:
1. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 028213 – HAZARDOUS MATERIALS ABATEMENT

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including General and Supplementary Conditions.

B. Contract drawings.

1.2 SUMMARY

A. Bulk sampling has identified the following asbestos containing materials (ACM) in the Haines Vocational Education Building that will impact this project:

1. Duct tape on the fan loft and on the original ventilation system in all shops.

B. Inspection has identified the following additional hazardous materials in the building:

1. Fluorescent ballasts potentially containing PCBs; and
2. Fluorescent bulbs containing traces of mercury.

C. The intent of the abatement portion of the overall project is to remove all duct tape on the ventilation system in the fan loft and the shops and to remove all fluorescent ballasts and bulbs. Much of the ducting is being removed as part of the project; abatement subcontractor may wrap and cut ductwork for removal in all areas scheduled for duct removal.

D. The abatement project includes all material, labor, equipment and other related costs for:

1. coordinating with prime contractor to determine the timing for abatement.
2. mobilizing (including moving all plant and equipment onto the site; providing necessary project utilities or improving existing utilities as necessary, arranging for approved storage areas, issuing and posting all notices, and submitting all submittals),
3. installing all necessary critical barriers to establish non-permanent asbestos control areas to isolate the various abatement areas,
4. completing all abatement elements as described in Paragraph C. above,
5. cleaning all surfaces and spaces within the confines of the asbestos control areas,
6. providing air monitoring, including appropriate elements summarized in Asbestos Air Monitoring in DEFINITIONS below, and in accordance with PART 3 EXECUTION of this section,
7. providing on-site lab analysis for required air monitoring,
8. disposing of ACM and related demolition debris in accordance with these contract documents,
9. removing the non-permanent asbestos control areas,
10. general cleanup and demobilization.

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1.3 COORDINATION AND TIMING OF ABATEMENT ACTIVITIES

A. The building will be unoccupied.
B. The OWNER will provide access to temporary power and to hot and cold water for direct project use. The abatement Subcontractor is responsible for all costs and effort required to develop those utilities for his use.
C. Electrical and mechanical systems not directly modified by this project shall remain functional, and shall be protected from contamination during the abatement work.
D. The OWNER shall be allowed access to electrical and mechanical systems as necessary throughout the abatement project to ensure their operational continuity.
E. Security to the site shall be maintained for the duration of the abatement project. It will be the responsibility of the abatement Subcontractor to coordinate with the CONTRACTOR and other trades to sequence the work.

1.4 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Code of Federal Regulations (CFR) Publications:

29 CFR 1910.1001	Asbestos (for general industry standards)
29 CFR 1910.134	Respiratory Protection
29 CFR 1910.145	Specifications for Accident Prevention Signs and Tags
29 CFR 1910.1200	Hazard Communications
29 CFR 1926.1101	Asbestos (for construction and demolition standards)
40 CFR 61 Sub-part A	General Provisions
40 CFR 61 Sub-part M	National Emission Standard for Asbestos
40 CFR 241	Guidelines for Land Disposal of Solid Wastes

   2. Alaska Department of Labor Construction Code:

      Subchapter 05.045 (as amended November 27, 1991)-Construction Code (Asbestos)

      Subchapter 15.0101-Hazard Communication
   3. Additional References:

      US EPA Publication 560/5-85-024: Guidance for Controlling Asbestos Containing Materials in Buildings

1.5 DEFINITIONS

A. ACM: See Asbestos Containing Material (ACM).

B. Abandonment: Leaving in place existing asbestos materials. An example is leaving pipes inside walls when new piping is to be routed differently. Complete documentation must be made of the exact location and condition of the asbestos before abandonment, including the type and method of use of any encapsulant.

C. Action Level: See Exposure Standards.

D. Aggressive Conditions: Required technique to prepare an area that has passed visual inspection for clearance sampling. Before starting the sampling pumps, the exhaust from forced air equipment (such as a 1 horsepower leaf blower) shall be directed against all walls, ceilings, floors, ledges and other surfaces in the room. This effort shall take at least 5 minutes per 1,000 square feet of floor. Next, a 20-inch fan shall be placed in the center of the space (one such fan shall be employed for every 10,000 cubic feet of room volume), directed towards the ceiling, and set to run on slow speed. Once the fans are set up and operational, the sampling pumps shall be started and run for the required time. Once sampling is complete all 20-inch fans shall be secured.

E. Amended Water: Water containing a wetting agent specifically designated by the manufacturer for the wetting of asbestos.

F. Approved Laboratory: An independent laboratory properly staffed and equipped for the collection and analysis of asbestos bulk and/or air samples, and who maintains demonstrable satisfactory performance from all technicians involved in the performance of these analyses. For air samples, participation and a documented record of satisfactory performance in either the NIOSH Proficiency Analytical Testing (PAT) program, equivalent American Industrial Hygiene Association (AIHA) program, or an equivalent inter-laboratory testing protocol in accordance with 29 CFR 1926.1101, Appendix A is required. The lab must be capable of performing both phase contract illumination microscopy, and transmission electron microscopy, and be capable of the required short turn around times. For bulk analysis, participation in and maintenance of a satisfactory record with the bulk asbestos analysis program with the Research Triangle Park, NC 27709-2194, (919) 541- 6000, is required. If any participation in any equivalent program is proposed to meet this requirement, the details of the program, documentation of satisfactory performance, and name, address and telephone number of the operator of the program must be submitted as part of the asbestos work plan for approval.

G. Area Monitoring: See Asbestos Air Monitoring.

H. Asbestos: A class of six naturally occurring fibrous hydrous mineral silicates. Minerals included in this group are chrysotile, crocidolite, amosite and the fibrous forms of anthophyllite, tremolite and actinolite.

I. Asbestos Air Monitoring: An approved air monitoring plan is required if air monitoring is part of the abatement work. To be approved such a plan must include the following elements:

1. Area Monitoring: Sampling for airborne concentrations of asbestos fibers within the

existing or planned asbestos control area that is representative of the fiber levels that may reach the worker's breathing zone. Area pumps drawing 10 liters per minute through the filter cassette are used for area monitoring and should pull at least 1,200 liters of air for each sample.

2. Environmental Monitoring: Sampling for airborne concentrations of asbestos fibers outside the asbestos control area to assure that no asbestos fibers are escaping the enclosure, and that personnel outside the control area are not being exposed. Where a sealed area is not used, such as during exterior siding removal, this will refer to sampling conducted at the perimeter of the control area to assure that a sufficient buffer zone around the work in progress has been established, and that personnel outside this zone are not being exposed. Area pumps drawing 10 liters per minute through the filter cassette are used for environmental monitoring and should pull at least 1,200 liters of air for each sample.
3. Baseline (Background) Monitoring: Sampling conducted to determine the initial level of airborne asbestos fibers present prior to the start of asbestos work. Area pumps drawing ≥ 1 but < 10 liters per minute through the filter cassette are used for this monitoring and should pull at least 1,200 liters of air for each sample. This sampling can be subdivided into three parts:

    a. Natural Background Sampling: Sampling conducted outside the structure where the work will be accomplished to determine the naturally occurring fiber levels present in that locale. When results indicate that this level may reach or exceed 0.01 f/cc, a minimum of 5 consecutive days of sampling will be used to establish an arithmetic average. This average will be used as the background level.
    b. Environmental Background Sampling: Sampling conducted to determine the background fiber levels within a structure, but outside the planned asbestos work area. This sampling is accomplished to ascertain the normal background fiber level within these areas of the structure. Special care must be taken during this sampling to minimize sample contamination by non-asbestos fibers, such as from cloth, paper and carpet.
    c. Work Area Background Sampling: Sampling conducted in the area where asbestos work is planned, normally used to determine the level of personal and other protective measures required by personnel preparing the area for asbestos work and to establish the level of contamination present prior to the beginning of asbestos operations.
4. Initial Exposure Assessment Monitoring: Sampling conducted by a “competent person” immediately before or at the initiation of the operation to ascertain the expected exposures during that operation. Initial Exposure Assessment Monitoring must be completed in time to allow compliance with requirements which are triggered by exposure data or the lack of a "negative exposure assessment”, and to provide information necessary to assure that all control systems planned are appropriate for the operation and will work properly. Until Initial Exposure Assessment Monitoring confirms that employees on the job will not be exposed in excess of the PEL, or a “negative exposure assessment” for non-friable asbestos has been accepted, it shall be assumed that employees are exposed in excess of the TWA and excursion limit.
5. Negative Exposure Assessment: For any one specific asbestos job involving non-friable material which will be performed by trained employees, it may be demonstrated that employee exposures will be below the PEL by data which conform to the following

criteria:

a. Objective data demonstrating that the product or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the TWA and excursion limit under those work conditions having the greatest potential for releasing asbestos.

b. Where the employer has monitored prior asbestos jobs for the PEL and the excursion limit within 12 months of the current or projected job, the monitoring and analyses were performed in compliance with the asbestos standard in effect; and the data were obtained during work operations conducted workplace conditions "closely resembling" the processes, type of material, control methods, work practices, and environmental conditions in the current operations, the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job, and these data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that employee exposures will not exceed the TWA and excursion limit.

c. The results of initial exposure monitoring of the current job made from breathing zone air samples that are representative of the 8-hour TWA and 30 minute short-term exposures of each employee covering operations that are most likely during the performance of the entire asbestos job to result in exposures over the PEL.

6. Clearance Monitoring: Sampling occurring at the completion of the asbestos work or at the completion of a specific phase of asbestos work, prior to removing the enclosure. It is accomplished to prove that the clean-up activities have been effective, and that remaining fiber levels both inside and outside the enclosure comply with airborne fiber concentrations defined in "Clearance Levels" below. Clearance sampling is normally accomplished in the same locations and by the same methods as the baseline monitoring, and is done in an aggressive manner (see EPA 560/5-85-024 for description of methods). Transmission Electron Microscopy (TEM) analysis is required for clearance monitoring inside schools and sometimes for inside public buildings to assure that the area is truly safe for reoccupancy. For public buildings the requirement for TEM analysis can be waived in favor of Phase Contrast Illumination Microscopy (PCM) at the OWNER's option. See PART 3-EXECUTION, MONITORING for additional information.

7. Personal Monitoring: Sampling for asbestos fiber concentrations at the breathing zone of a worker, used to document individual exposures, and, in conjunction with the work area sampling, to determine the required degree of personal and respiratory protection. A minimum of two samples shall be collected per eight-hour shift at a flow rate of 0.5 to 2.5 liters per minute. At least 25% of the workers doing a particular job shall be sampled each eight-hour shift. See Exposure Standards for more information.

J. Asbestos Containing Material (ACM): Material composed of asbestos of any type, and in any amount equal to or greater than 1 percent by weight, either alone or mixed with other fibrous or non-fibrous materials.

K. Asbestos Control Area: An area where operations involving asbestos are performed which is isolated by physical barriers designed to prevent the spread of asbestos dust, fibers, and debris, and to prevent or deter the entry or unauthorized and unprotected personnel. For areas where isolation is not feasible, it will be an area that is physically demarcated, e.g., bounded by a

physical barrier such as a rope, barricade, etc., separating the known "clean" zone from the asbestos work area and buffer zone.

L. Asbestos Fibers: This expression refers to a particular form of asbestos, fibrous tremolite, anthophyllite, or actinolite having a length to diameter aspect ratio of 3:1 or greater, and an overall length of 5.0 micrometers or longer. Where specialized analytical techniques, such as electron microscopy, are utilized for analysis, this shall refer to the number of fibers considered to equate to a specific weight of asbestos.

M. Asbestos Survey: A detailed survey accomplished by specially trained, experienced technicians of a specific area to determine the presence, absence, condition, and amount of asbestos and asbestos contamination present in that area.

N. Asbestos Workers' Personal Hygiene Area: A dedicated area containing shower(s), change room and, if required, toilet facilities where personnel working with asbestos (where a control area is not established) can change into protective clothing, and can disrobe, shower, and change into clean clothing without danger of transferring contamination to themselves or others.

O. Baseline Monitoring: See Asbestos Air Monitoring.

P. Bulk Sampling and Analysis: Representative samples taken from materials suspected to contain asbestos, analyzed by an approved laboratory using polarized light microscopy (PLM). When specialized methodology, such as electron microscopy is required, collection and analysis shall be in accordance with the recommendations of the laboratory providing the analysis, and the result expressed as both mass per unit volume and percent by weight shall be given.

Q. Clean Room: An uncontaminated room having facilities for storage of employees' street clothing, uncontaminated materials and equipment.

R. Clearance Levels: The maximum fiber levels present after completion of the asbestos work, or a given phase of work, sampled during initial or final clearance monitoring. This level shall be the lower of the baseline work area monitoring value for the location, or less than **0.01 fibers/cc**, whichever is lower. In the special case where the naturally occurring outdoor background levels outside the structure are greater than or equal to 0.01 f/cc, averaged arithmetically over a minimum 5-day period, the clearance level shall be the interior work area background level prior to the start of CONTRACTOR work, or less than or equal to the average natural background level, wherever is lower.

S. Clearance Monitoring: See Asbestos Air Monitoring.

T. Competent Person: An individual experienced in the abatement and control of asbestos who has received specialized additional training in the supervision and management of asbestos abatement projects. This individual is the full-time on-site manager responsible for ensuring that all safety, health and environmental protection requirements are met, that approved operational methods are followed, and that all personnel on the site comply with these requirements. Specialized training must include an EPA recognized course in the management of asbestos abatement projects. The Competent Person shall report to the Industrial Hygienist.

U. Containment: See Enclosure.

V. Decontamination Area: An enclosed area adjacent and connected to a sealed asbestos control area and consisting of an equipment room, shower area, and clean room used for the decontamination of workers, materials and equipment. This also forms the only authorized entry and exit for the control area, except as required in Equipment Decontamination Area below.

W. Encapsulant: A liquid material which can be applied to ACM which reduces the potential for release of asbestos fibers from a material, either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).

X. Encapsulate: The process whereby an encapsulant is applied to ACM to seal in or bind together the individual asbestos fibers, thereby reducing the potential for the release of these fibers.

Y. Enclosure: Construction of a sealed, permanent structure around asbestos. Complete documentation must be made of the exact location and condition of the asbestos before the enclosure is finished, including the type and method of use of any encapsulant.

Z. Equipment Decontamination Area: When used, a separate area designed similarly to the personnel decontamination area, but on a large scale. Used to decontaminate large items, or for the purpose of a separate exit for asbestos waste removal where the normal means of egress is not effective (such as the removal of long pieces of pipe from the basement of a structure).

AA. Equipment Room (Change Room): A room located within the decontamination area that is supplied with impermeable bags or receptacles for the disposal or storage of contaminated protective clothing and equipment, and lockers for the storage and contaminated tools and work shoes.

BB. Exposure Standards
1. Workers:
    a. Action Level: An action level concept shall be used by the abatement Subcontractor to ensure that no personnel are exposed to airborne concentrations of asbestos, actinolite, anthophyllite, or tremolite fibers, or a combination of these mineral fibers, equaling or exceeding **0.1 fibers per cubic centimeter** (0.1 f/cc) expressed as an 8-hour time weighted average (TWA) without placement on a medical monitoring program for asbestos. Personnel exposed at or above this level must be provided proper training in the removal of asbestos containing materials, and must be provided proper personal protective equipment.
    b. Excursion Limit (EL): An airborne concentration of asbestos of **1.0 fiber per cubic centimeter** of air (1 f/cc) as averaged over a sampling period of 30 minutes.
    c. Permissible Exposure Level (PEL): The abatement Subcontractor shall ensure that no employee is exposed to an airborne concentration of asbestos, actinolite, anthophyllite, or tremolite fibers, or a combination of these mineral fibers, exceeding **0.1 fibers per cubic centimeter** (0.1 f/cc) expressed as an 8-hour time weighted average (TWA) as defined by the NIOSH sampling and analytical method 7400. (Reference 29 CFR 1926.1101, Appendix A.)
2. Non-Workers:

a. Personnel who are not asbestos workers as defined by OSHA and this specification shall not be exposed to levels of asbestos fibers exceeding the EPA clearance level criteria of **0.01 f/cc**.

CC. Fibers: All fibers, regardless of composition, as determined by analysis in accordance with the method described in 29 CFR 1926.1101, Appendix A. When specialized methodology, such as electron microscopy is required, collection and analysis shall be in accordance with the recommendations of the laboratory providing the analysis, and the equivalent fiber level, expressed in both mass per unit volume and fibers per cubic centimeter shall be given.

DD. Glovebag Technique: A method with limited applications for removing small amounts of friable asbestos-containing material from HVAC ducts, short piping runs, valves, joints, elbows, and other non planar surfaces not isolated inside an enclosure. The glovebag assembly is a manufactured or fabricated device consisting of a glovebag (typically constructed of 6-mil transparent polyethylene or polyvinyl chloride plastic), two inward projecting long sleeve gloves, an internal tool pouch, and an attached, labeled receptacle for asbestos waste. The glovebag is constructed and installed in such a manner that it surrounds the object or material to be removed and contains all asbestos fibers released during the process. All workers who are permitted to use the glovebag technique must be highly trained, experienced and skilled in this method.

EE. HEPA Filter Equipment: High Efficiency Particulate Air (HEPA) filtered vacuuming, local exhaust, or respiratory protective equipment equipped with specialized filters capable of collecting and retaining asbestos fibers. Filters must be of 99.97 percent or greater efficiency at collection of 0.3-micron diameter particles. Filters must be factory tested and certified as meeting this filtration requirement.

FF. Industrial Hygienist: An individual certified by the American Board of Industrial Hygiene, and having significant prior experience in managing and evaluating the health and safety aspects on asbestos projects of similar nature and scope to ensure capability of performing asbestos work in a satisfactory manner. Prior project similarities shall be in areas related to material composition, project size, number of employees, and in the engineering, work practice, environmental, and personal protection control required. An equivalent individual, such as a Licensed Professional Safety Engineer, Certified Safety Professional, and other qualified person with a minimum of 5 years of experience in industrial hygiene, including extensive experience in the management and evaluation of health and safety aspects of asbestos abatement, may substitute for the Certified Industrial Hygienist, subject to approval by the ENGINEER. The Industrial Hygienist shall be responsible for all monitoring, training and asbestos work, for ensuring that all safety and health requirements prescribed by State and Federal regulations, as well as these specifications, are compiled with, and for ensuring that the competent person performs all assigned duties in accordance with this specification and applicable Federal and State regulations.

GG. Initial Exposure Assessment Monitoring: See Asbestos Air Monitoring.

HH. Lockdown Sealant: A spray-on liquid-type sealant applied to surfaces from which ACM has been removed. It is applied after final cleaning and visual inspection has occurred, but prior to initial clearance sampling. Its purpose is to control and minimize the amount of airborne asbestos fiber generation that might result from any residual ACM debris on the substrate. All

lockdown sealant shall be acrylic copolymer blend that forms a durable non-combustible barrier that when cured becomes an excellent primer for spray back insulation and water based architectural coatings.

II. Lower Limit of Detection (LLD): The smallest quantifiable amount of a substance, or number of fibers, present in a given sample that can be determined accurately by the sampling and analysis methods in use. A LLD is normally specified to represent a 95% confidence level. All samples taken for baseline, background, environmental or clearance sampling shall have an LLD of 0.01 f/cc or less. Samples taken for bulk analysis shall have an LLD of less than 0.1 percent by weight of the sample of homogeneous samples.

JJ. Negative Exposure Assessment: See Asbestos Air Monitoring.

KK. Negative Pressure: A minimum of **minus 0.02 inches of water pressure** (negative pressure) differential between the asbestos control area and all adjacent areas, at a minimum flow rate of **four air changes per hour** at all points within the asbestos control area. See PART 3-EXECUTION; SAFETY AND HEALTH COMPLIANCE; Vacuums and local exhaust systems for additional information.

LL. Permissible Exposure Level (PEL): See Exposure Standards.

MM. Personal Monitoring: See Asbestos Air Monitoring.

NN. Phase Contrast Illumination Microscopy (PCM): An analytical method for counting fibers in air sampling filters.

OO. Polarized Light Microscopy (PLM): An analytical method for determining asbestos content in bulk samples.

PP. Time Weighted Average (TWA): The TWA is an average of the airborne concentration of asbestos fibers, expressed as the number of fibers per cubic centimeter (f/cc) of air, measured and calculated for a minimum of 8 hours, and taken into account the relative proportions of time exposed when averaging different exposure levels.

QQ. Transmission Electron Microscopy (TEM): A procedure whereby an electron beam is scanned through a specially prepared air-sampling filter. The beam diffraction pattern is then analyzed by computer, which differentiates between the patterns of asbestos and the non-asbestos materials, and quantifies the mass of the asbestos present on the filter. This mass can then be referenced to an equivalent number of fibers per cubic centimeter. By far the most sensitive and specific test for airborne asbestos, it is expensive and results cannot normally be provided for several days. Used for detection of extremely low levels, or when suspected non-asbestos fibers are believed to be interfering with the accuracy or readability of normal sampling methods. All clearance samples for projects inside school buildings must use TEM in accordance with methods set forth in 40 CFR 760, Subpart E.

1.6 PRE-WORK SUBMITTALS

A. The Pre-Work Submittal shall be submitted digitally as a complete package and modified as necessary to obtain approval by the ENGINEER five working days prior to any work on the

project. The abatement Subcontractor shall perform his work in compliance with the approved Pre-Work Submittal which shall include:

1. Asbestos Work Plan: A plain language plan describing work procedures to be used during each and all operations involving asbestos. Annotated building plans or site plans no larger than 11 inches by 17 inches shall be included to detail locations for asbestos control areas, monitoring locations, access and disposal routes, and other activities where needed. The plan shall include as a minimum the following elements:

    a. Location and construction of each asbestos control area.
    b. Sequencing of asbestos work to include separate sequences if the work is to be accomplished in separate sections or phases.
    c. A detailed air monitoring plan that complies with 05.045 Alaska Department of Labor Construction Code (Asbestos), 29 CFR 1926.1101, current US EPA guidance, and applicable requirements of "Asbestos Air Monitoring", "Exposure Standards", and "Personal Monitoring" in DEFINITIONS above.
    d. Transport and disposal plans.
    e. A contingency plan for potential emergencies/accidents/incidents covering, but not limited to:

        - Medical emergencies/accidents inside the control area.
        - Violation of the control area.
        - Spills inside the control area.
        - Spills outside the control area.
        - Fire inside and outside the control area.
        - Loss of power.
        - Loss of negative pressure in the controlled area.
        - Discovery that fiber levels inside or outside the control area have exceeded prescribed limits.
        - Spills during transport or disposal.

    f. A notification listing of personnel and organizations to be contacted by the abatement Subcontractor in the event of an incident, emergency or contingency.
    g. The 24-hour contact point for the abatement Subcontractor and the designated "competent person" to contact in case of an on-site problem. Response time to the site shall not exceed 1 hour from the time of the notification.

2. Notifications: Copies of EPA and OSHA notifications submitted prior to work.
3. Competent Person: Submit the name(s) proposed, address (es), telephone number(s) and complete documentation the individual's qualifications proving the person's qualifications meet the requirements described in DEFINITIONS above.
4. Industrial Hygienist: Submit the name, address and telephone number of the Industrial Hygienist selected to prepare the asbestos work plan, and direct monitoring and training. Include documentation proving the person's qualification meet the requirements described in DEFINITIONS above.

5. Training: Submit certificates signed by each employee and the Industrial Hygienist that each employee has received the training required by 29 CFR 1910.1001, 29 CFR 1926.1101, and appropriate State of Alaska Regulations and this specification. Include proof that each employee is certified as an asbestos worker in the State of Alaska in accordance with current state regulations.
6. Testing Laboratory: If Asbestos Air Monitoring is included in the Contract, submit the name, address, telephone number and qualifications of the independent testing laboratory selected to perform the monitoring, testing and reporting of airborne asbestos fibers. Include documentation certifying that all technicians performing the analysis have been judged proficient by successful participation within the last year in the NIOSH PAT program or the equivalent AIHA program, or an equivalent inter-laboratory testing program.
7. Protective Equipment and Protective Method Plans: Details of planned personnel protective equipment requirements and protective methods, including respirators as will be required for each specific type of operation or condition. Include supporting justification when alternate (e.g., less than the maximum specified) protection is proposed.

B. Any changes to procedures, methods, conditions, etc., identified in the approved Pre-Work Submittal must be submitted in writing for review and approval by the ENGINEER prior to the inception of the change. The changes must be reviewed and approved by the Certified Industrial Hygienist prior to being submitted to the ENGINEER for review. Where changes must be implemented immediately for the protection of workers, personnel outside the work area, the structure or the environment, and the change established an environment more stringent than that previously existing, the changes may be implemented by the competent person or other individuals with appropriate authority, and the ENGINEER notified immediately. These changes will then be submitted in writing within 24 hours for final review and approval.

1.7 POST-WORK SUBMITTALS

A. The Post-Work Submittal shall be submitted digitally and approved by the ENGINEER as complete before final payment is approved. The Post-Work Submittal shall include:
1. Work Log: A detailed log of all operations involving the asbestos portion of the work, to include but not be limited to:

a. The names, entry and exit dates and times, duties performed, and protective equipment worn by each individual during their time within the asbestos control area, covering all personnel, (including inspectors, monitoring personnel and visitors) entering each asbestos control area. This information is normally provided in the form of fully legible copies of the entry/exit control log for the control area. Each day's listing should also include a summary of the work performed (quantity, type, location, etc.).
b. A listing of all personnel performing asbestos related work outside the control area, showing duties performed, date, time, duration, and location of the work and protective equipment worn while performing these duties. Each day's listing should also include a summary of the work performed (quantity, type, location, etc.).
c. Copies of the complete and reviewed sampling results as an attachment.

d. A summary of each problem, incident, contingency, and emergency that occurred, and the actions taken to resolve the situation.

e. A copy of all shipping manifests that document disposal of all ACM at an approved solid waste facility.

PART 2- PRODUCTS-NOT USED

PART 3- EXECUTION

3.1 PROTECTION OF ADJACENT AREAS

A. Perform all asbestos work in such a way as to not contaminate 1) adjacent areas, or 2) interior spaces of components within the abatement area (such as cabinets, ducts, or electrical components). Where such areas or spaces are contaminated, they shall be cleaned and/or restored to their original condition as directed by the ENGINEER at the abatement Subcontractor's expense.

3.2 NOTIFICATIONS AND PERMITS

A. The abatement Subcontractor shall notify the regional office of the United States Environmental Protection Agency (US EPA) in accordance with 40 CFR 61 Subpart M.

B. The abatement Subcontractor shall also notify the Alaska Department of Labor, Occupational Safety and Health Division (AK OSHD) in accordance with current State of Alaska asbestos regulations.

C. The abatement Subcontractor shall notify the ENGINEER 48 hours prior to commencement of any abatement work, and immediately upon completion or termination of the work.

D. The abatement Subcontractor shall carry out disposal in accordance with state and federal requirements, and shall secure necessary permits in conjunction with asbestos removal and transport, and provide timely notification of such actions as may be required by Federal, State, regional and local authorities.

3.3 COMPETENT PERSON

A. All asbestos work, including setup and teardown of the asbestos enclosure(s) and control area(s), and all asbestos disposal operations shall be under the direct and continuous on-site supervision of the Competent Person (who is identified in the Pre-Work Submittal and whose qualifications and duties are defined in DEFINITIONS above). The Industrial Hygienist shall oversee all activities of the competent person.

3.4 INDUSTRIAL HYGIENIST

A. The abatement Subcontractor shall conduct all monitoring, training and asbestos work under the direction of the Industrial Hygienist (who is identified in the Pre-Work Submittal and whose qualifications and duties are defined in DEFINITIONS above).

B. While performing asbestos work, the abatement Subcontractor may be subject to on-site inspection by the OWNER, the ENGINEER (or his designated representative), fire, safety, and health personnel, and Federal and State inspectors. If the work is in violation of specification requirements, or applicable Federal or State regulations, the ENGINEER may issue a stop-work order to be in effect immediately, and which will remain in place until the violation(s) are resolved and, if required by the ENGINEER, a new or amended asbestos work plan is submitted. Restart will not be accomplished without approval of the ENGINEER. Standby time and expenses required to resolve the violation(s) and provide new or amended submittals shall be at the abatement Subcontractor's expense.

3.5 SAFETY AND HEALTH COMPLIANCE

A. The abatement Subcontractor shall comply with all laws, ordinances, rules and regulations of Federal, State, regional and local authorities regarding demolition, handling, storing, transporting and disposing of asbestos and asbestos containing materials. He shall also comply with the applicable requirements of the current issues of 29 CFR 1910.1001, 29 CFR 1926.1101, and 40 CFR 61 Subparts A and M. Asbestos removal is also required to comply with the provisions of the State of Alaska, Solid Waste Management Codes, title 18 of the Alaska Administrative Code, and the State of Alaska OSHA Standards.

3.6 ASBESTOS WORK PROCEDURES

A. The work specified in these contract documents shall be carried out in accordance with all applicable local, state, and federal regulations, and the following special requirements:

1. OSHA Class I asbestos WORK: Class I WORK shall comply with the appropriate sections of OSHA 1926.1101(g)(4) "Class I Requirements" and OSHA 1926.1101(g)(5). Certified asbestos abatement workers are a requirement for Class I asbestos WORK.
2. OSHA Class II asbestos WORK: Class II WORK shall comply with the appropriate sections of OSHA 1926.1101(g)(7) "Work Practices and Engineering Controls for Class II WORK" and OSHA 1926.1101(g)(8). Certified asbestos abatement workers are a requirement for Class II asbestos WORK.
3. Asbestos Handling Procedures: The CONTRACTOR shall sufficiently wet ACM with a fine spray of amended water during removal, cutting or other handling to reduce the emission of airborne fibers. All removed and waste materials shall be placed in plastic disposal bags or other approved containers. Under no circumstances shall asbestos waste or debris be allowed to accumulate in the WORK area.
4. Disposal of Asbestos: Procedures for hauling and disposal shall comply with 40 CFR 61, Subpart M, 40 CFR 241 and 257, and state, regional, and local standards. Abated material and associated debris shall be packaged in accordance with applicable regulations and disposed of at an approved facility. All ACM shall be transported in an enclosed vehicle.

3.7 MONITORING

A. The abatement Subcontractor shall provide third-party on-site air monitoring for the duration of the Project in accordance with the approved Pre-WORK Submittal.

B. At a minimum the CONTRACTOR shall provide "Area Monitoring", "Environmental Monitoring", "Baseline (Background) Monitoring", "Initial Exposure Assessment Monitoring", "Personal Monitoring" and "Clearance Monitoring" all as specified in Paragraph 1.5 "DEFINITIONS", above.

C. The CONTRACTING OFFICER reserves the right to perform confirmation air monitoring including all elements summarized in Asbestos Air Monitoring in DEFINITIONS, above.

D. Clearance Procedures

1. After abatement activities are complete but prior to the application of lockdown sealant and the performance of clearance monitoring, the abatement Subcontractor and the ENGINEER or his representative shall perform a detailed visual inspection of the work area for any visible asbestos residual. If any is found, a complete re-cleaning of the area shall be performed, and the area re-inspected. Once the visual inspection is satisfactorily completed the lockdown shall be applied..
2. After the site has passed the visual inspection and has received spray application of

lockdown sealant but prior to the removal of the enclosure, clearance monitoring of the work area, conducted under **aggressive conditions** (as defined in DEFINITIONS above), shall be accomplished to confirm the effectiveness of the clean-up operations. Such sampling shall not be performed until all areas and materials within the work area are fully dry.

3. Clearance sampling for this project shall be done using TEM analysis. Once clearance criteria have been achieved, clearance shall be considered final and removal of any protective enclosure shall be accomplished.
4. The owner's representative will be traveling from outside Haines to perform the final inspection for each phase. The visual inspection and subsequent aggressive clearance sampling shall be conducted within the time frame of a single day trip to Haines. The Abatement Subcontractor shall be responsible for all costs relating to all clearance monitoring (including costs accrued by the Owner's representative relating to any extension of a particular inspection trip, any follow-up trip required to finalize that particular inspection) after the first failed clearance sampling, and for any additional trips added to the project to improve the Contractor's schedule. The Abatement Subcontractor is responsible for coordinating inspection trips with the owner's representative.
5. The abatement Subcontractor shall be responsible for all costs relating to all clearance monitoring after the first failed clearance sampling.

END OF SECTION 028213

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems. Project is to consist of installation of a double check backflow preventer and replacement of all sprinkler heads.

1.2 RELATED REQUIREMENTS

A. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

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 B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2010.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.

D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.

E. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 2009 (ANSI/ASME B16.5).

F. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers; 2007.

G. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers; 2004.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

I. ASTM A135/A135M - Standard Specification for Electric-Resistance Welded Steel Pipe; 2009.

J. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2008.

K. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).

L. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).

M. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.

N. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

O. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

P. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of components. Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

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

1. Extra sprinklers and wrenches, see Section 211300 - Fire Suppression Sprinklers.

F. Submittal Format: All data shall be submitted at one time in neatly bound loose-leaf three ring binders with pockets and tabulated in order of Specification. All data shall be typed, minimum 10 point font, not 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, data, 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 the 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 diner 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 the each submittal page.

G. As-Built Drawings: As-builts shall accurately show all changes for Contract Document for piping, ductwork, and equipment. As-Built drawings shall be updated daily and available for inspection on-site by the ARCHITECT.

H. Operation 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 with front and back of binder identification of project, discipline, and date.

1.5 COOPERATIVE WORK

A. The Work hereunder shall be coordinated between various mechanical sections including Division 21, 22, 23 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 ARCHITECT and shall be made to the satisfaction of the ARCHITECT.

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.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience and approved by manufacturer if applicable.

C. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

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.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Welding Materials and Procedures: Conform to ASME Code.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10 for 2-1/2 inch and larger or ASTM A53 Schedule 40, black, galvanized. Threaded or rolled groove joints.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 BACKFLOW PREVENTER

A. Manufacturers:

1. Ames.
2. Febco.
3. Watts.

B. Double Check Valves Assemblies: Bronze or steel body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent, test cocks, valves each side, listed for fire protection systems.

2.4 VALVE TAMPER SWITCH

A. Manufacturers:

1. Potter
2. ADTC.
3. Grinnell.

B. All-metal construction with switch housing and holder secured to valve with anchor bolts. Arranged to sense if valve is closed. Electrical connection furnished under Electrical Divisions.

2.5 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

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

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.6 GATE VALVES

A. Up to and including 2 inches:
1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

C. Over 4 inches:
1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.7 BUTTERFLY VALVES

A. Bronze Body:
1. Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC.

B. Cast or Ductile Iron Body
1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

D. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

E. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

END OF SECTION 210500

SECTION 211300 - FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flush entire system, provide replacement sprinkler heads and testing of existing system.

1.2 RELATED REQUIREMENTS

B. Section 210500 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on sprinklers including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings: Not required.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from contract drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
   3. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.

E. Equipment and Components: Provide products that bear UL label or marking.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
   1. Tyco Fire Products: www.tyco-fire.com.
   2. Viking Corporation: www.vikinggroupinc.com.

2.2 SPRINKLER SYSTEM

A. Sprinkler System: Provide replacement sprinkler heads and testing.

B. Occupancy: Ordinary Hazard, Class 2, comply with NFPA 13.

C. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.3 SPRINKLERS

A. Suspended Ceiling Type: Recessed pendant type with matching push on escutcheon plate.
   1. Response Type: Standard.
   2. Coverage Type: Extended.
   3. Finish: Chrome plated.
   4. Escutcheon Plate Finish: Chrome plated.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Pendant type with guard.
   1. Response Type: Standard.
   2. Coverage Type: Extended.
   3. Finish: Chrome plated.
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Guards: Finish to match sprinkler finish. Required on all heads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard. Coordinate location of piping, heads, and equipment with other disciplines prior to installation.

B. Install equipment in accordance with manufacturer's instructions.

C. Provide approved backflow preventer assembly at sprinkler system water source connection.

D. Flush entire piping system of foreign matter.

E. Install guards on all sprinklers.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 211300

SECTION 220510 - GENERAL MECHANICAL-PLUMBING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Mechanical Work is governed by the entire Specifications and not just Division 22. 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.

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, 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 22 sections. 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.

8. Preliminary Electronic Submittal data shall be formatted for ease of reviewing with each specification section as a separate pdf and the entire submittal bound with separate tabs for each section. Electronic submittals that are not organized neatly will be returned without reviewing.

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 show all underground piping whether changed or not, dimensioned from building lines. As-built drawings shall be updated daily and available for inspection on-site by the ENGINEER.

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 ENGINEER for approval 30 days prior to the request for Commissioning or Substantial Completion inspection, whichever comes first. Partial or separate data will be returned for completion.

F. 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.

G. 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.

H. 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 ARCHITECT and shall be made to the satisfaction of the ARCHITECT.

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. Coordinate closely with all other Contractors.

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 Plumbers and Pipe Fitters shall have a minimum documented installation experience in commercial or industrial facilities of 3 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.

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

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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 220510

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 RELATED REQUIREMENTS

A. Section 221005 - Plumbing 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 C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2012.

F. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2007.

G. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 2010.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

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. See Section 013000 - 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 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 3 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: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.

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. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 650 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

D. 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.

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

F. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

G. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

2.3 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com.
   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. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. 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.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with full PVC jacket and fitting covers.

PART 4 - SCHEDULES

A. Domestic Hot and Cold Water Supply and Hot Water recirculation: Mineral fiber pipe insulation, 1 inch thick. 1/2-inch thick may be used on plumbing piping branches 3/4-inch and smaller diameter when located inside walls.

B. Tempered Hot Water to Emergency Showers Downstream of Tempering Valve: Not insulated.

END OF SECTION 220719

SECTION 221005 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Domestic water.

1.2 RELATED REQUIREMENTS

A. Section 220719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).

C. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2011.

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2007.

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

F. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2010.

G. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.

H. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

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

J. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2012.

K. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2009.

L. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

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

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

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.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.1 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.2 SANITARY SEWER AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

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.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

B. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
   4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   7. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
   8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.5 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.conbraco.com.
   3. Nibco, Inc: www.nibco.com.

4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends. Solder ends only on smaller than 1-inch,

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

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

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Install valves with stems upright or horizontal, not inverted.

I. Install water piping to ASME B31.9.

J. 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 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.4 TOLERANCES

A. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

END OF SECTION 221005

SECTION 221006 - PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backflow preventers.

B. Floor Drains.

C. Cleanouts.

D. Oil Waste Interceptor

1.2 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2009 (ANSI/ASSE 1012).

B. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 2009.

C. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2011 (ANSI/ASSE 1019).

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

D. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.2 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, Inc: www.zurn.com.

B. Double Check Valve Assemblies:
1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.3 DRAINS

A. A. Manufacturers:
1. Josam Company
2. Mifab
3. Zurn
4. Jay R Smith

B. Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable 5-inch nickel-bronze strainer. 2-inch size. With priming line connection

2.4 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company
2. Josam Company
3. Zurn Industries, Inc
4. Mifab
5. .

B. Cleanouts at Interior Finished Floor Areas (FCO):
1. Galvanized cast iron body with anchor flange, reversible clamping collar, threaded top assembly. Round scored cover with gasket in service areas. Round cover used in tiled areas. Round depressed cover with gasket to accept floor finish where required in finished floor areas.

C. Cleanouts at Interior Finished Wall Areas (WCO):
1. Line type with galvanized cast iron body and round gasketed cover, and round stainless steel access cover secured with machine screw.

D. Cleanouts at Interior Unfinished Accessible Areas (CO): Line type with galvanized cast iron body and tapered thread plug with gasket. Provide bolted stack cleanouts on vertical rainwater leaders.

2.5 HOSE BIBBS

A. A. Manufacturers:
1. Jay R. Smith Manufacturing Company
2. Watts Regulator Company
3. Zurn Industries, Inc
4. Mifab

B. Interior Concealed Hose Bibbs: (HB-1)
1. Bronze or brass, wall mounted, faucet with hose thread spout, integral stops. Chrome plated lockable box cover, and vacuum breaker in conformance with ASSE 1011. Cold water only. Install HB-1 at approximately 16-inches above finished floor.

2.6 SUMPS AND INTERCEPTORS

A. Manufacturers:
1. Zurn Industries, Inc: www.zurn.com. Z-1189 Size 100 Design Manufacturer.
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
3. Mifab: www.mifab.com
4. Substitutions: See Section 016000 - Product Requirements.

B. Oil and Sediment Interceptors:
1. Construction:
   a. Material: Epoxy coated fabricated steel.
   b. Rough-in: Recessed in floor.

c. Accessories: Braonze cleanout plug and visible double wall trap seal, removable sediment bucket, horizontal baffle, internal vent connection. Provide extensions necessary for recessed location – field verify dimension of extension. Anchor flange as needed for installation.
d. Cover: Cast-iron, epoxy coated, heavy duty grate recessed for floor finish, suitable for vehicle traffic. Two grates as needed.
e. Capacity: 100 lbs of sludge, approximate dimensions of 29 inches long by 24 inches wide by 33 inches deep. 4-inch outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install oil interceptor per manufacturers instructions. During demolition of the floor verify height of connecting waste piping and provide necessary extension to oil water separator as required. Provide anchor flanges to recessed unit in concrete floor. Coordinate concrete finish around interceptor for smooth finish.

END OF SECTION 221006

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Eye and face wash fountains.

1.2 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

B. Section 223000 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2009.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in OWNER's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Faucet Washers: One set of each type and size.
   3. Extra Lavatory Supply Fittings: One set of each type and size.
   4. Extra Toilet Seats: One of each type and size.
   5. Flush Valve Service Kits: One for each type and size.

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 REGULATORY REQUIREMENTS

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 - PRODUCTS

2.1 EMERGENCY EYE AND FACE WASH

A. Emergency Wash Manufacturers:
1. Haws Corporation: www.hawsco.com.
2. Therm-Omega-Tech, Inc: www.thermomegatech.com.
3. Elkay; www.elkay-usa.com
4. Speakman; www.speakman.comm

B. Emergency Shower and Eye/face Wash: ANSI Z358.1; free standing, self-cleaning, non-clogging eye and face wash with quick opening, overhead shower, full-flow valves, stainless steel bowl. receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings. Stainless steel push handle activator. Integral inline strainer. Scald protection vavle. Full bowl cover. ADA compliant. Provide identification plaques of appliance. Equal to Speakman 600 Series.

2.2 EMERGENCY EYE/FACE WASH

A. Emergency Wash Manufacturers:
1. Haws Corporation: www.hawsco.com.
2. Therm-Omega-Tech, Inc: www.thermomegatech.com.
3. Elkay; www.elkay-usa.com
4. Speakman; www.speakman.comm

B. Emergency Eye/face Wash: ANSI Z358.1; wall mounted, aerated eye sprays and face wash with quick opening flip top caps, full-flow valves, stainless steel eye and face wash receptor. Stainless steel push handle activator. Integral inline strainer. Scald protection vavle. Full bowl cover. ADA compliant. Provide identification plaques of appliance. Equal to Speakman SE-1050

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install components level and plumb.

B. Install and secure fixtures in place with wall supports and bolts.

C. Route eyewash drain to floor drain and terminate with indirect drain pointed towards floor drain. Locate so not to be a tripping hazard. Paint drain yellow.

3.4 ADJUSTING

A. Test emergency shower and demonstrate. Provide written documentation for correct operation and demonstration.

3.5 CLEANING

A. Clean plumbing fixtures and equipment.

3.6 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 224000

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.

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, 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 15000 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.
   8. Preliminary Electronic Submittal data shall be formatted for ease of reviewing with each specification section as a separate pdf and the entire submittal bound with separate tabs for each section. Electronic submittals that are not organized neatly will be returned without reviewing.

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 show all underground piping whether changed or not, dimensioned from building lines. As-built drawings shall be updated daily and available for inspection on-site by the ARCHITECT.

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 ARCHITECT 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 boilers, air handlers, fans, water heaters, expansion tanks, thermostatic mixing valves, pumps, unit heaters, cabinet unit heaters, air conditioning units, 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 15075 - 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 provided 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 15075 - Mechanical Identification.

F. 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.

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

H. 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.

I. 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 ARCHITECT and shall be made to the satisfaction of the ARCHITECT.

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. In many portions of the building, piping mains, piping branches, and sprinkler piping, as well as some duct branches will need to be installed in the joist space to allow for installation of duct mains. Coordinate closely with all other Contractors.

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 3 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 3 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 ARCHITECT 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 ARCHITECT.

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. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

C. Static pressure gages.

D. Filter gages.

1.2 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

B. Section 230923 - Direct-Digital Control System for HVAC.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

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

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

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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

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 PRESSURE GAGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Moeller Instrument Co., Inc: www.moellerinstrument.com.
   3. Omega Engineering, Inc: www.omega.com.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi and KPa.

2.2 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   4. Substitutions: See Section 016000 - Product Requirements.

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: www.dwyer-inst.com.
   2. Omega Engineering, Inc: www.omega.com.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

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 THERMOMETERS, DIGITAL TYPE

A. Manufacturers:
   1. Weiss
   2. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   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.

2.7 TEST PLUGS

A. Manufacturers:
   1. Pete's Plugs.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

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. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

E. Locate duct mounted thermometers minimum 5 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

F. 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 gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J. Locate test plugs adjacent to pressure gages and pressure gage taps.

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. See Section 013000 - Administrative Requirements, for submittal procedures.

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

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

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

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

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Heat Transfer Equipment: Nameplates.

E. Major Control Components: Nameplates.

F. Piping: Pipe markers.

G. Pumps: Nameplates.

H. Small-sized Equipment: Tags.

I. Thermostats: Nameplates.

J. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
   2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   3. Seton Identification Products: www.seton.com.
   4. Letter Color: White.
   5. Letter Height: 1/4 inch.
   6. Background Color: Black.
   7. Plastic: Conform to ASTM D709.

2.3 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
   2. Brady Corporation: www.bradycorp.com.
   3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   4. Seton Identification Products: www.seton.com.

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

2.4 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com.
   2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   3. MIFAB, Inc.: www.mifab.com.
   4. Seton Identification Products: www.seton.com.

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

C. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

PART 3 - EXECUTION

3.1 PREPARATION

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

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

D. 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.

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.

B. Testing, adjustment, and balancing of hydronic systems.

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 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to ARCHITECT.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the ARCHITECT and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

c. Identification and types of measurement instruments to be used and their most recent calibration date.
d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
e. Final test report forms to be used.
f. Expected problems and solutions, etc.
g. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
h. Details of how TOTAL flow will be determined; for example:
    1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
    2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
j. Confirmation of understanding of the outside air ventilation criteria under all conditions.
k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
l. Method of checking building static and exhaust fan and/or relief damper capacity.
m. Proposed selection points for sound measurements and sound measurement methods.
n. Time schedule for TAB work to be done in phases (by floor, etc.).
o. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
p. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to Commissioning Authority.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise 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) and SI (metric) 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 Engineer registered in State of Alaska with minimum of 5 years documented experience in testing and balancing.

E. TAB Supervisor 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. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and 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. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. 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. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. 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.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the OWNER.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

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

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

C. Measure air quantities at air 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. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. Coordinate and work with controls contractor onsite to identify multiple outside air volume positions of the outside air damper for sequence of exhaust fans make-up air.

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.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCOPE

A. Test, adjust, and balance the following:
   1. Source Side Pumps
   2. Load Side Pumps
   3. HVAC Pumps
   4. Water to Water Heat Pump
   5. Water to Air Heat Pumps
   6. Air Coils
   7. Terminal Heat Transfer Units
   8. Air Handling Units
   9. Fans
   10. Air Filters
   11. Air Terminal Units
   12. Air Inlets and Outlets

3.8 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. Pumps:
1. Identification/number
2. Manufacturer
3. Size/model
4. Impeller
5. Service
6. Design flow rate, pressure drop, BHP
7. Actual flow rate, pressure drop, BHP
8. Discharge pressure
9. Suction pressure
10. Total operating head pressure
11. Shut off, discharge and suction pressures
12. Shut off, total head pressure

D. Water to Air Heat Pumps:
1. Identification/number
2. Location
3. Manufacturer
4. Model number
5. Serial number
6. Water Flow Rate
7. Air Flow Rate
8. Entering DB air temperature, design and actual
9. Leaving DB air temperature, design and actual
10. Number of compressors

E. 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

F. 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

G. 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
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

H. 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. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

I. 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

J. Air Monitoring Stations:
1. Identification/location
2. System
3. Size
4. Area
5. Design velocity
6. Design air flow
7. Test velocity
8. Test air flow

K. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

L. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

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 230553 - 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; 2011.

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; 2012.

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 013000 - 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.

D. Installer: Qualified contractor, indicate minimum three years documented experience and references.

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, labelled 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: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.

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: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.

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.

2.4 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
1. Lagging Adhesive:

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.

3.3 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings: Mineral Fiber Blanket Insulation 1-1/2 inches thick.

B. Exhaust air ducts connected to wall mounted fans outside of Mechanical rooms: Mineral Fiber Blanket Insulation 1-1/2 inches thick. Insulate 10 linear feet of duct from edge of cap where there is not an exhaust air damper. Otherwise insulate to damper.

C. Outside Air Intake Ducts: Rigid Mineral Fiber Duct Board Insulation, 2 inches thick. Cover with canvas. Insulate duct from edge of louver to fan inlet connection.

D. Relief Air Elbow Assembly at Exterior: Rigid Mineral Fiber Duct Board Insulation, 2 inches thick. Cover with canvas. Insulate duct from edge of louver to top of elbow.

E. Supply Ducts: Not insulated.

F. Return and Relief Ducts in Mechanical Rooms: Not insulated.

G. Air Separators and Expansion Tanks: Mineral Fiber Blanket Insulation 1-1/2 inches thick.

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 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

B. Section 230713 – Duct Insulation: Insulation of HVAC Equipment.

C. Section 232113 - 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; 2011.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2012.

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; 2012.

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. See Section 013000 - 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.

D. Installer: Qualified contractor, indicate minimum three years documented experience and references.

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, labelled 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

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.

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. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum service temperature: 650 degrees F.
   3. Maximum moisture absorption: 0.2 percent by volume.

D. 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.

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

F. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

2.3 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com.
   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. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

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

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

3.3 SCHEDULE

A. Heating Water Supply and Return: Mineral fiber pipe insulation:
   1. Pipe Size Range: Up to and including 1" pipe diameter; thickness of 1 inch.
   2. Pipe Size Range: 1-1/4” to 2-1/2” 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 the Haines Vocational Education Upgrade project building automation system & automatic controls. Work includes removal of a partial pneumatic and electronic DDC system and installation of a Direct Digital Control (DDC) Building Automation System (BAS) and local controls as indicated with connection to the existing High School DDC. Associated sequence of operations and schematic control diagrams detail the scope of WORK for this project.

1.2 QUALITY ASSURANCE

A. The direct digital control system addition for this project shall be a ATS Alerton environmental Controls system. 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. Exceptions to the specification may qualify the bid as unacceptable.

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. The DDC system shall provide stand-alone DDC control for all designated equipment described in the sequence of operation and shown on the control schematics to provide a complete facility management system.
3. The work includes working with the adjustment contractor, VFD supplier and start-up representative, and mechanical contractor for adjustment and setting of the VFD systems.
4. The work also includes connection to an uninterruptible power system (UPS) battery back-up system for GCM and Microzone controllers. UPS for distributed controllers such as for dampers and valve actuators are not required. Coordinate with Electrical.
5. 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.
6. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.
7. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, balancing, inspection, and commissioning.
8. Provide necessary temporary equipment and connections required for the various Work phases in order for occupied areas to remain functional.
9. Provide a comprehensive operator and technician training program as described herein.
10. 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 for standardization.

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.
   3. Upon completion of the work, provide a complete set of drawings on disk media. Drawings shall be provided as AutoCAD compatible files.

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.

1.8 WARRANTY

A. A warranty period of one year shall commence upon final 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.

B. Warranty Trips: Control Contractor to visit site and perform inspection of systems twice in the first year warranty period; first trip at half way through or at beginning of heating system and second trip at end of warranty period. Modify settings and update trending programs as requested by Owner during trip. Submit field reports to OWNER and ARCHITECT with documented observations at end of each trip and prior to end of warranty period. Provide 2 hours training to maintenance personnel during each trip, document in field report.

1.9 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 8 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.

1.10 VFD CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

B. Start-up provided by VFD System Supplier.

1.11 VFD QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. VFD Industrial Control Panel Manufacturer: Company specializing in manufacturing products and UL listed Industrial Control Panels specified in this section with minimum three years documented experience.

C. Installer: Company specializing in performing WORK of this section with minimum three years documented experience.

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.

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).

C. Server computer: (1) Required. Minimum requirements as follows:
1. Configuration: Provide Laptop work station.
2. PC Processor 2 GHz dual-core (or better) processor.
3. 80 GB hard drive.
4. Minimum memory: 2GB RAM.
5. Cache memory: 512 Mbytes.
6. High-performance graphics adapter.
7. Keyboard: Low profile, detachable, having Qwerty layout plus 10 key numeric pad.
8. CD/DVD writer. Minimum of two USB ports.
9. Mouse: Software supported mouse with support software including self building menus and display of system operations and functions.
10. Minimum of a 17 inch diagonal flat screen monitor.
11. Communication: wireless network card, and network card for hard connection.
12. Operating system: Windows 7 or Windows 8.1.
13. The contractor shall coordinate with Owner to connect the computer to the networks and to implement on the Owners networks prior to Substantial Completion.
14. Provide with DDC operational software and diagnostic software for field troubleshooting equipment, trending, and editing software.
15. Computer shall be provided and usable for interface with BAS system and shall have all necessary software and graphics capabilities loaded and operational.

D. Portable operator's terminal: (1) Required. Minimum requirements as follows:
1. Configuration: Provide Laptop work station.
2. PC Processor 2 GHz dual-core (or better) processor.
3. 80 GB hard drive.
4. Minimum memory: 2GB RAM.
5. Cache memory: 512 Mbytes.
6. High-performance graphics adapter.

7. CD/DVD writer. Minimum of two USB ports.
8. Mouse: Software supported mouse with support software including self building menus and display of system operations and functions.
9. Communication: wireless network card, and network card for hard connection.
10. Operating system: Windows 7 or Windows 8.1.
11. The contractor shall coordinate with Owner to connect the computer to the networks and to implement on the Owners networks prior to Substantial Completion.
12. Provide with DDC operational software and diagnostic software for field troubleshooting equipment, trending, and editing software.
13. Computer shall be provided and usable for interface with BAS system and shall have all necessary software and graphics capabilities loaded and operational.

E. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog Value, Analog Input, Analog Output, Binary Value, Binary Input, Binary Output, Calendar, Device, Event Enrollment, File, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

F. Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network. The Operator Workstation shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.

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. Upon entering the graphics program floor plans shall be shown with all terminal equipment locations, ALL room temperatures, and any alarm features at the actual physical locations and not in a tabulated format. The floor plan layout shall be shown accurately and as shown on the contract documents with the actual room numbers listed. Mechanical equipment systems shall have their own screens with all control points, adjustable set points, and alarms shown.
   2. The user will be able to zoom in to the building from the site plan and then zoom in to a particular area for closer inspection and then further zoom in on this area and so on until the detailed color graphic display of a desired portion of the facility is represented. The operator shall be able in this manner to "penetrate" to any desired system information without being required to enter any commands via the keyboard. A minimum of 70 dynamic points shall be displayable on any one screen.
   3. As a minimum, a graphic screen shall be designed showing the entire facility, each major piece of mechanical equipment within each building, all of which will display the data for each area dynamically.
   4. Equipment Diagrams: 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. Energy Calculations. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.
6. 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. Controls shall be microprocessor based, Air Handler Digital Controllers (AHDC's). AHDC's shall be provided for Air Handling Units, Boiler, and Pump control, and other applications as shown on the drawings. Subcontractor shall use existing spare points in microzone if possible. 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 Subcontrol 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. 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 Subcontactor, for the purpose of troubleshooting the 120 VAC circuit to the Subcontactor. 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 defineable 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 sensors.

B. Space Temperature:
   1. Accessible adjustment (55-85F range) with thermometer indicator on cover. Minimum 0.1% accuracy. Removable covers. 3F throttling range. BAS monitoring and remote temperature override capability on ALL thermostats. Locking guards on all thermostats located in Hallways, Entry, and Shop areas.
   2. Local control thermostats: Thermistor or RTD with 50-80ºF range, accuracy of +/-0.4ºF over full range, and maximum drift of 0.1ºF/year. Removable covers with tamper proof fasteners. Provide sensors with temperature indication and adjustable setpoint integral with cover. Locking guards on all thermostats located in Commons, Hallways, Vestibules, and Public Restrooms.

C. Duct Air Temperature, Probe Type: For supply air and return air 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.
   1. Provide averaging bulb thermostats for mixed air with element installed to cover twice the cross-section of the duct.
   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. Thermistor or RTD with minimum 30-230 F range, accuracy of +/-1.0 F over full range, and maximum drift of 1F per year. Siebe TS-8000 series, Mamac TE 205 series or equal. 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. Mamac PR-274/275 or equal.
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.

2.8 AIRFLOW MEASUREMENT (AMS)

A. Manufacturers:
   1. Ebtron

B. Airflow measuring systems:
   1. OSA: Multiple probe type. Remote air measuring stations with digital flow readout in CFM (w/ contacts for DDC remote monitoring). Coordinate requirements for DDC connection.

2.9 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.

2.10 CONTROL VALVES

A. Automatic Valves: For water or steam, as applicable, suitable for system conditions. 2-inch and smaller: Brass body, threaded, installed with union on each connection. 2-1/2 inch and larger: Iron body, flanged. Seats and discs or plugs of nonferrous metals. Modulating or positive acting as required. See Contract Documents for operation and capacity.

B. Positive-acting: Flat, single discs with renewable composition faces.

C. Modulating: Single or balanced, parabolic or V-notched inner valve plug. Steam valves single seat type for tight shutoff.

D. General: For hot water as applicable.
   1. Non-terminal unit control valves (1/2” through 3”) sizes shall have cast bronze bodies with static pressure rating conforming to ANSI B16.15- 1971 250 PSIG rating. Maximum water pressure shall be 400 PSIG with 40 to 150ºF water, decreasing to 321 PSIG at the maximum water temperature of 281ºF.
   2. All valves shall have stainless-steel stems, brass or stainless-steel throttling plugs, bronze valve seats, and spring-loaded Teflon -cone packing. Two-way valve plugs for non-steam applications shall have composition disks.
   3. All valves shall be fully modulating unless otherwise indicated. control Subcontractor is responsible for the selection of the proper control valves for the project including sizing, pressure rating, flow coefficient, flow characteristic, close-off rating, and actuator selection.

4. All two-way valves shall have contoured or characterized throttling plugs with linear (for steam applications) or equal- percentage flow characteristics.
5. All three-way and four-way valves shall have brass or stainless steel linear throttling plugs with stainless steel stems.

2.11 VALVE ACTUATORS

A. General:
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.

B. Modulating Electronic Actuators:
1. Modulating actuators for control valves over 1-1/4" to convert electronic 1-10 VDC, or 4-20 mA analog signal to a linear, positive positioning stroke. Direct mount type with appropriate valve and damper linkage kits as needed. Modulating actuators for control valves up to 1-1/4" to be hydraulic type with spring return. Proportional control by variable Vdc input signal.

C. Two-Position Electronic Actuators:
1. Two-position actuators for larger valves shall be gear train type or direct mount type as required. Provide integral, adjustable end switches as required for the application.
2. Two-position actuators for small valves shall be direct mount type or hydraulic type as required. Provide integral, adjustable end switches as required for the application.

2.12 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.

2.13 VARIABLE FREQUENCY DRIVES (VFD) FOR PUMPS P-2 AND VU-1SF

A. Manufacturers:
1. Allen Bradley
2. ABB

B. Type: UL Listed. Microprocessor based variable frequency drive. All VFD's shall be of same manufacturer.

C. Output Power: Output voltage adjustable from 0 to rated voltage. Output frequency range adjustable from 0 to 400 Hz. Pulse width modulated (PWM) waveform.

D. Operator Interface: Integral LCD digital display. LCD shall be remote mounted on panel door. The keypad shall include programming keys, drive operating keys, and numeric keys for direct entry. LCD shall display the following:
1. Drive operating conditions
2. Fault/alarm indications
3. Output Frequency
4. Motor Speed
5. Motor Current
6. Calculated Motor Torque
7. Calculated Motor Power
8. DC Bus Voltage
9. Output Voltage
10. Heatsink Temperature
11. Analog input values and analog output values.
12. Keypad reference values
13. Elapsed Time Meter
14. Digital input status
15. Digital output status

E. Inputs/Outputs: (1) Programmable 0-10 VDC analog output. (2) 0-10 VDC or 4-20 mA analog inputs. (5) digital inputs. (2) relay outputs. Relays shall be programmable to different conditions including Fault, Alarm, At Speed, Drive Ready.

F. Auto/Manual Mode (H-O-A switch): In Auto mode, the drive receives its frequency command from the programmed source. When in Hand mode, control of the frequency command is transferred to the Operator Interface.

G. Communications: The drive must be capable of communicating with PLC and DDC's through an RS-484 port.

H. Drive Faults:
1. Loss of Reference Fault
2. Overcurrent
3. Overvoltage
4. Undervoltage
5. Overtemperature
6. Ground Fault

I. VFD installed in Panel with the following features:
1. UL listed and labeled industrial control panel as a complete assembly.
2. Enclosure: Nema 1 enclosure. Ventilated with fan as needed.
3. Mechanically interlocked VFD/Bypass contactor.
4. Integral fused disconnect with padlockable handle. Use Class J fuses sized per motor.
5. Utilize 5% line reactor for harmonics reduction.
6. VFD-Bypass selector switch.
7. H-O-A switch for the VFD.
8. Start/Stop push buttons for Bypass mode operation.

9. Motor overload protection for VFD. Motor overload protection for Bypass.
10. Green VFD Running indication lights. Green Bypass Running indication lights. White Ready light for power available.
11. 4-20 mA or 0-10 VDC input for speed control.

J. Provide for interface with automatic controls. Provide dry contact outputs as required:

2.14 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 under the Electrical Division for new panel locations. The power will be available in J-boxes located in the Mechanical Rooms. Provide the electrical connection between all automatic control equipment and the control power J-boxes. In locations where existing panels are being replaced with new panels, Control Contractor to disconnect 120volt control power and reconnect power to new panel in same location.

2.15 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.

2.16 GLOBAL DIGITAL CONTROLLER (GDC)

A. 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. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches.

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

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

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

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

G. Provide thermostat sensors with remote adjustment for all occupied areas. Suitable for shop areas.

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

I. 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 16, State and Local Codes and Ordinances.

2. Unenclosed low voltage wiring shall be plenum rated cabling type and shall be acceptable for installation only in concealed, accessible areas such as above suspended ceilings. All other wiring/cabling shall be installed in conduit.

3. 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.

4. Provide wire with copper stranded conductors. Provide color or number coded jackets.

5. Provide 20 gauge minimum foil-shielded cable rated 100 VDC at 80 C. for input/output wiring.

6. Provide communications network wiring meeting the gauge, impedance, capacitance, resistance and shielding requirements specified by the manufacturer of the connected devices.

7. Install wiring in a neat an orderly manner generally running piping and wiring along building lines.

8. Seal conduit penetrations at rated walls with fire-stopping installed in accordance with fire-stopping manufacturers UL listed installation requirements.

9. Wire all electrical controls and switches furnished under this section of the Specifications.

10. Support and conceal wiring in finished areas.

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. Coordinate requirements and work with the VFD supplier and contractor.

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

C. Control Contractor is to provide a monitoring connection to the packaged Boiler/Burner outdoor air reset control and enabling for the heating system. Responsibility for correct operation of boilers, burners, pumps, and heating plant operation included hereunder. Coordinate with Mechanical Contractor on requirements.

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 VFD system, and help coordinate the adjustment the system to ensure proper operation.

3.6 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.
2. Warranty Trip: Verify sequences during both warranty trips and document in field reports.

3.7 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, a dedicated voice grade telephone extension for remote telecommunications during this period.

3.8 START-UP AND TRAINING - VFD

A. VFD's: System supplier start-up shall be provided for each drive. System supplier shall be available on-site over a two day period during each equipment start-up. System supplier performing start-up shall be qualified for WORK by manufacturer's representative. Coordinate with CONTRACTOR completion for date of start-up for each piece of equipment. System supplier shall provide 2 hours of training per drive. Provide minimum 15 working days notice to OWNER prior to training.

B. BAS Contractor shall be on-site during testing and start-up of VFD's.

3.9 SEQUENCE OF OPERATIONS

A. BOILER (B-1) ENABLE: DDC system shall enable boiler continuously when boiler control switches are in AUTO mode. DDC system shall monitor heating supply header temperature and report reset temperature in heating supply main where shown. Alarm sent to BAS when burner fails to operate or any safety functions shutdown a respective burner.

1. Separate Packaged Reset Schedule Provided under Boiler Section: Boilers shall operate to maintain heating supply temperature in heating distribution main according to the following schedule: 190F HS temperature at 20F OSA temperature modulating to 150F HS temperature at 60F OSA temperature. Alternate can be DDC type boiler set back system upon approval of Engineer and Owner with local/remote switch to go between local controls and DDC.

2. All WORK required for a complete operating boiler control system included hereunder, including entire line voltage electrical installation,, low voltage electrical installation, and integration with burner controls. Coordinate provision of sensors, wiring, and connection points with electrical division and burner controls for a complete system. Coordinate provision with Mechanical Contractor during Bidding.

3. Provide heating supply and return sensor for BAS monitoring of building hot water return temperature. Display on Graphics.

B. BOILER HEATING RETURN TEMPERATURE CONTROL: Immersion thermostat in heating return piping for boiler shall modulate open P-2 bypass valve to maintain a minimum 135F return water temperature.

C. BOILER PRIMARY HEATING PUMP (P-1): A manual starter with on-off switch provides direct power for the burner motor through their safeties.

D. BUILDING SECONDARY HEATING PUMP (P-2): A variable frequency drive (VFD) provides direct power for the pump motor. When the VFD is in the AUTO position, the BAS shall operate and modulate the speed of the pump to maintain the hydronic static pressure sensor pressure differential setpoint. Sensor located between the heating mains where shown. Pressure differential required at pressure sensing location determined by the Adjustment and Control Contractors. Initially set pressure differential at 6 psi. When the VFD is in HAND position, a digital speed control integral with the VFD panel provides manual speed control. When VFD is in BYPASS mode, the pump operates at full speed (60 HZ). Activate an alarm when a VFD generated status alarm occurs due to low current. Include VFD speed and VFD fault alarm inputs to the BAS. Display actual speed, alarms, and status on Graphics.

1. Pressure Differential Sensor located where shown.
2. DDC Display: Indicate heating water main temperature setpoint, reset schedule, pump speed, operation status, and alarms.
3. Bypass Valve: Automatic valve shall modulate open when pressure is above setpoint of 15 gpm to maintain a minim flow though pump. Flow to be set and measured during TAB work.

E. HEATING PLANT SCHEMATIC: In addition to individual equipment control schematics on graphics, an overall Heating Plant Control Schematic shall be included on graphics to provide a quick overview of heating plant system operation.

F. GENERAL FAN UNIT NOTES: The following controls apply to the various ventilation systems outlined in this section, as indicated within each fan system description or listed below as typical for all fan units.

1. Smoke Sensors: Furnished and installed under the ELECTRICAL division.
2. Filter Alarm: Differential pressure sensor across filter to send filter alarm to BAS whenever the differential pressure exceeds an adjustable 0.50 inches water column for pre-filters. Analog input signal with set point adjustable at the BAS. Alarm is to be sent to the BAS for confirmation.
3. Low-limit control: Averaging bulb thermostat at the discharge of the heating coil to stop the fan below an adjustable 40°F upon a time delay of 45 seconds. Mixing dampers repositioned to full recirculation position and automatic valve positioned to full open heating. Fan automatically reset on temperature rise above set point. Alarm is to be sent to the BAS for confirmation.
4. Fan operation status Differential pressure sensor installed across supply fans units to send signal to BAS when in operation. Alarm is to be sent to the BAS for confirmation when fan does not operate when commanded on. Current sensor not acceptable.
5. In HAND position all AHU fan shall operate in occupied mode and at the command of the smoke sensor.
6. All Exhaust Fans operation status: Current sensor to send fan operation signal to BAS. Alarm is to be sent to the BAS for confirmation when fan does not operate when commanded on.

7. Exhaust Fan Automatic Damper: Where exhaust fan has an automatic damper, an end switch shall be utilized so that fan unit will not start until damper is mostly open. This control shall work in either Auto or Hand position through use of relay. A programmed delay start is not acceptable.
8. AHU coil minimum flow: When OSA drops below 32F, AHU AV-2 minimum flow rate shall be set at 10% open when fan unit is off to reduce chance of freeze-up.

G. AIR HANDLING UNIT (AHU-1): A variable frequency drive (VFD) located on the mounting board, provides direct power for the respective fan motor. When the VFD is in the AUTO position, the BAS shall operate each fan unit at the speed required to meet design CFM (as verified with TAB Contractor). When the VFD is in HAND position, a digital speed control integral with the VFD panel provides manual speed control. When VFD is in BYPASS mode, the fan operates at full speed (60 HZ). Activate an alarm when a VFD generated status alarm occurs due to low current or other alarm. Include VFD speed and VFD fault alarm inputs to the BAS. Display speed, alarms, and status on Graphics. In the AUTO, HAND, or BYPASS positions, the fan units operate according safety functions such as the low-limit thermostat and the smoke sensor.

1. Schedule of Operation:

   a. Normal Occupied Schedule: See General Fan Notes (Schedule) above for hours of operation. During normal operation, AHU-1 fan to provide minimum outdoor air as scheduled below.
   b. Unoccupied Mode: AHU-1 shall remain OFF in Unoccupied mode.
   c. Night Setback Mode: AHU-1 does not have a Night Setback mode.

2. During the Occupied schedule, Minimum outside air damper (OAD-1) to open to minimum position to provide the required minimum outside air. Minimum OSA volume is as follows and is to be manually verified during initial adjustment of mechanical systems. Air monitoring station installed in OSA duct to monitor OSA air volume. Damper to continue to open when additional exhaust fans and dust collector are operating as follows:

   a. AHU-1 Occupied Minimum OSA: 800 CFM
   b. AHU-1 Occupied Minimum OSA with Dust Collector On: Add 2500 CFM OSA.
   c. AHU-1 Occupied Minimum OSA with either welding exhaust fan On: Add 1500 OSA CFM.
   d. AHU-1 Occupied Minimum OSA with Vehicle exhaust fan On: Add 1000? CFM

3. Dampers (OAD-A, OAD-B, RAD-1, RAD-2, EAD-1, EAD-2D): Supply air sequence control to modulate the modulating outside air damper (OAD-B), the recirculating air dampers (RAD-1 and RAD-2), and exhaust air damper (EAD-1, EAD-2) to maintain the adjustable supply air setpoint provided minimum outdoor air volume is attained and the carbon dioxide control sequence is satisfied. Dampers to modulate cooperatively, with the modulating 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. Exhaust air damper (EAD-1, EAD-2) shall modulate independently with separate control signal as needed to maintain building pressure.

4. Supply air temperature: Supply air discharge sensor to control the heating coil automatic valve and mixing dampers in order to supply an adjustable air discharge temperature set by the supply air reset schedule; 62°F supply air at 62°F outside air temperature modulating to 66°F supply air at 20F outside air temperature and below. Heating coil automatic valve to close to heating on an outside air temperature above an adjustable 62°F OSA.

7. Building pressure sensor. Outdoor pressure reference sensor located on exterior of Service 105 north wall. Duct pressure sensor located in each shop. Provide input to BAS system.
8. SF VFD Speed: When the VFD is in the AUTO position, the BAS shall operate fan unit at the speed required (constant speed) to meet design CFM (as verified with TAB Contractor). Air measuring station on fan inlet to display CFM on BAS and on AHU cabinet display.
9. Provide Low-Limit Control, Filter Alarms, Air Measuring Station(s) for SA, RA, and OSA, Fan Operation Status, and AHU Minimum Coil Flow: See above for descriptions.

H. EXHAUST FAN (EF-1): Manual starter with ON_OFF switch shall control operation of EF-1 through hazardous gas control panel.

I. EXHAUST FAN (EF-2, EF-3): Manual starter with ON_OFF switch shall control operation of EF-2 Welding.

J. EXHAUST FAN (EF-4): Manual starter with ON_OFF switch shall control operation of EF-4 Vehicle Exhaust.

K. EXHAUST FAN (EF-5): A manual starter with an ON-OFF switch is located adjacent to the unit.

L. COMBUSTION AIR SUPPLY FAN (SF-1): A room thermostat, operates the fan and actives the supply air fan when the room temperature is at or above 90°F. Combustion air damper CAD-1 is to open whenever SF-1 operates with adjustable delay of operation until CAD-1 is open. Thermostat sensor value displayed on floor plan graphic with Alarm sent to BAS when temperature reaches above adjustable 90°F. Local Control is NOT acceptable.

M. COMBUSTION AIR CAD-1: Combustion air damper actuator to open whenever burner operates. Provide relays and connections as required.

N. UNIT HEATER ZONE CONTROL: room thermostat to modulate respective radiant zone valve and operate unti heater blower to maintain setpoint, initially set at 65F. Room thermostats and automatic valves to be provided hereunder.

O. DUST COLLECTOR: Provide operation status for existing dust collector starter for modulating of VU-1 OSA.

END OF SECTION 230926

SECTION 231113 - FACILITY FUEL-OIL PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and pipe fittings.

B. Valves.

C. Accessories.

1.2 REFERENCE STANDARDS

A. ASME (BPV) - Boiler and Pressure Vessel Code; The American Society of Mechanical Engineers; 2007.

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

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.

D. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2010 (ANSI/ASME B31.1).

E. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers; 2004.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.

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

J. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2008.

K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2010.

L. NFPA 30 - Flammable and Combustible Liquids Code; National Fire Protection Association; 2012.

M. NFPA 31 - Standard for the Installation of Oil Burning Equipment; National Fire Protection Association; 2011.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of piping system, and system components.

1.4 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 3 years of experience and approved by manufacturer.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable regulations for installation of fuel oil system.

B. Conform to ASME B31.1 for installation of fuel oil piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

PART 2 - PRODUCTS

2.1 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53/A53M or ASME B36.10M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought carbon steel or alloy steel welding type.
   2. Joints: NFPA 30, threaded or welded to ASME B31.1.

2.2 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: Malleable iron, adjustable swivel, split ring.

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

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

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

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

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

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under:
   1. Ferrous pipe: 150 psi malleable iron threaded unions.
   2. Copper tube: 150 psi bronze unions with brazed joints.

B. Pipe Size Over 2 Inches:
   1. Ferrous pipe: 150 psi forged steel slip-on flanges; 1/16 inch thick preformed neoprene gaskets.
   2. Copper tube: 150 psi slip-on bronze flanges; 1/16 inch thick preformed neoprene gaskets.

2.4 BALL VALVES

A. Manufacturers:
   1. Conbraco Industries: www.conbraco.com.
   2. Nibco, Inc: www.nibco.com.
   3. Milwaukee Valve Company: www.milwaukeevalve.com.
   4. Substitutions: See Section 016000 - Product Requirements.

B. MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder.

2.5 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. Green Country Filtration: greencountryfiltration.com.

3. WEAMCO: www.weamco.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk.
2. Flexicraft Industries: www.flexicraft.com.
3. Penflex: www.penflex.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Bronze inner hose and braided exterior sleeve, suitable for minimum 200 psi CWP and 250 degrees F.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 PIPING INSTALLATION

A. Install in accordance with manufacturer's instructions and AP1 RP 1615.

B. Route piping in orderly manner and maintain gradient.

C. Group piping whenever practical at common elevations.

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

E. Provide clearance for installation of insulation and access to valves and fittings.

F. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting

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

END OF SECTION 231113

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Pipe and pipe fittings for:
   1. Heating water piping system.
   2. Glycol water piping system.
   3. Equipment drains and overflows.

C. Pipe hangers and supports.

D. Unions, flanges, mechanical couplings, and dielectric connections.

E. Valves:
   1. Ball valves.
   2. Check valves.

F. Flow controls.

1.2 RELATED REQUIREMENTS

A. Section 220719 - Plumbing Piping Insulation.

B. Section 230516 - Expansion Fittings and Loops for HVAC Piping.

C. Section 230553 - Identification for HVAC Piping and Equipment.

D. Section 230719 - HVAC Piping Insulation.

E. Section 232114 - 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; 2012 (ANSI B16.18).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2010).

D. ASME B31.9 - Building Services Piping; 2011 (ANSI/ASME B31.9).

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

F. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2006.

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

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

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

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005 (Reapproved 2011).

K. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2010.

L. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007.

M. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; 2011 and errata.

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

O. AWWA C606 - Grooved and Shouldered Joints; 2011 (ANSI/AWWA C606).

P. AWWA C606 - Standard Specification for Grooved and Shouldered Joints; American Water Works Association; 2006.

Q. 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. See Section 013000 - Administrative Requirements, for submittal procedures.

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

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

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

E. 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. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
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:
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 GLYCOL HEATING WATER PIPING

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
      b. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy.
   2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
   3. Press Fit Joints: Mechanically pressure applied joints equal to PRO-PRESS.

2.3 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: Malleable iron, adjustable swivel, split ring.

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

D. Hangers for Hot Pipe Sizes 2 to 4 Inches: 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. Vertical Support: Steel riser clamp.

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

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

K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

L. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.4 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

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.

2.5 GLOBE OR ANGLE VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.conbraco.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, screwed bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.6 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.conbraco.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.
   5. Victaulic Company: www.victaulic.com.

B. Up To and Including 2 Inches:
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches:
   1. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.7 SPRING LOADED CHECK VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Hammond Valve: www.hammondvalve.com.
   3. Crane Co.: www.cranevalve.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.8 FLOW SETTERS

A. Manufacturers:
1. ITT Bell & Gossett.
2. Griswold Controls.
3. Taco, Inc.

B. Angle or straight pattern, inside screw globe or ball valve for 125 psig working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lock-shield key cap and set screw memory bonnet for balancing service. ½ inch or ¾ inch may be sweat type ends. Valve bodies to have differential read-out port and caps. Provide three probe adapters for meter reading. Provide two spare read-out port caps.

2.9 STRAINERS

A. Manufacturers:
1. Hoffman.
2. Spiray/Sarco
3. Mueller.

B. Size 2 inch and Under: Screwed brass or iron body for 125 psig working pressure, Y pattern with 1/32 inch removable stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch: Flanged iron body for 125 psig working pressure, Y pattern with 3/64 inch removable stainless steel perforated screen.

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.

F. After completion, fill, clean, and treat systems. Refer to Section 232500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, glycol, 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. Refer to Section 220516.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 230516.

J. 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 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 230719.

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

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

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

P. Install valves with stems upright, not inverted.

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

B. Hanger Spacing for Steel Piping.
   1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
   2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 1/2 inch.
   4. 2 inches: Maximum span, 10 feet; minimum rod size, 1/2 inch.
   5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 1/2 inch.
   6. 3 inches: 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. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Flow indicators, controls, meters.

F. Relief valves.

G. Glycol system.

1.2 RELATED REQUIREMENTS

A. Section 221006 - Plumbing Piping Specialties: Backflow Preventers.

B. Section 232113 - Hydronic Piping.

C. Section 232500 - HVAC Water Treatment: Pipe Cleaning.

1.3 REFERENCE STANDARDS

A. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2010.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

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

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

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

F. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Propylene glycol Solution: Two containers, 10 gallon size.

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 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 EXPANSION TANKS

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Taco, Inc: www.taco-hvac.com.

B. ET-1 (Heating Water): Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible EPDM diaphragm or bladder sealed into tank, and steel support stand. Suitable for glycol systems.

C. Size: See Schedules.

2.2 AIR VENTS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com.
   2. ITT Bell & Gossett: www.bellgossett.com.
   3. Taco, Inc: www.taco-hvac.com.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.3 AIR SEPARATORS COMBINATION AIR/DIRT SEPARATOR

A. Manufacturers:
1. Spirotherm - Spirovent High Velocity Drain.

B. Air Separators, Dirt/Water type: Steel construction for 150 psig maximum operating pressure. Integrated brass venting mechanism on top. Removable lower head with flanges to clean inside body. Threaded blowdown connection port at bottom.

C. High Velocity Type: Suitable for 10 feet per second inlet velocity.

D. Air and dirt eliminator: Copper bundle designed to suppress turbulence and provide high efficiency. Shall be capable of removing 100% of free and entrained air, and 99.6% of the dissolved air. Dirt separation shall be at least 80% of all particles 30 micron and larger within 100 passes.

2.4 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Green Country Filtration: greencountryfiltration.com.
3. WEAMCO: www.weamco.com.

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.

2.5 RELIEF VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Armstrong International, Inc: www.armstronginternational.com.
3. ITT Bell & Gossett: www.bellgossett.com.
4. Conbraco Industries, Inc: www.conbraco.com.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

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.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

H. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

I. Pipe relief valve outlet to nearest floor drain.

J. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION 232114

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. In-line circulators.

1.2 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 230716 - HVAC Equipment Insulation.

C. Section 230719 - HVAC Piping Insulation.

D. Section 232113 - Hydronic Piping.

E. Section 232114 - Hydronic Specialties.

F. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).

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

C. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

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

E. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Pumps: One pump for P-1 & P-2.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Pumps Inc.

B. ITT Bell & Gossett.

C. Taco Pumps Series 1600.

D. Grundfos.

2.2 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Minimum Quality Standard: UL 778.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.3 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 175 psi maximum working pressure.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Permanently-lubricated ball bearings.

E. Shaft: Alloy steel with bronze sleeve, integral thrust collar.

F. Seal: Mechanical seal , 275 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling.

H. Performance: Scheduled.

I. Electrical Characteristics:
   1. Refer to Section 262717.
   2. Motor: 1750 rpm unless indicated otherwise; refer to Section 220513.
   3. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings.

END OF SECTION 232123

-SECTION 232500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chemical feeder equipment.

B. Chemical treatment.

1.2 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

B. Section 232114 - Hydronic Specialties.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

D. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

E. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

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

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 PROPYLENE GLYCOL ANTI-FREEZE

A. Manufacturers:
1. Dow Chemical: Dowfrost.
2. Lyondell Chemical.

B. Provide and fill glycol heating piping (GS and GS) system with propylene glycol for a 40% anti-freeze mixture, minimum of 30 gallons (Total system capacity of approximately 90 gallons). Store quantity not used in initial fill and steady state operation in storage containers in location directed by Project Manager.

C. Test Kit. Provide testing kit with floating ball hydrometer, in waterproof case with minimum of five years of materials for semiannual testing.

2.2 ANTI-FREEZE MAKEUP SYSTEM (GFT-1) FOR HEAT RECOVERY COIL SYSTEM

A. Manufacturers:
1. Wessels Company GMP-18
2. J. L. Wingert Company.
3. Neptune Chemical Pump Company.

B. Description: Automatic glycol feed package consisting of a prefabricated polyethylene tank, polyethylene cover, 110 volt pressurization pump with integral pressure control, pressure assembly. Pressurization assembly shall consist of a pressurization pump with pressure controls, a pre-pressurized storage tank, a pressure reducing valve, and pressure gage to continuously monitor the PRV outlet controls. Field adjustable pressure. 18 gallon capacity. Preset at 12 psig.

PART 3 - EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during filling

C. Verify that electric power is available and of the correct characteristics.

3.2 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during filling

C. Verify that electric power is available and of the correct characteristics.

3.3 CLEANING SEQUENCE

A. Hot Water Heating Systems:
   1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
   3. Circulate for 6 hours at design temperatures, then drain.
   4. Refill with clean water and repeat until system cleaner is removed.

B. Use neutralizer agents on recommendation of TSP system cleaner supplier and approval of ENGINEER.

C. Remove, clean, and replace strainer screens.

D. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.4 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 232500

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

1.2 RELATED REQUIREMENTS

A. Section 233300 - Air Duct Accessories.

B. Section 233700 - Air Outlets and Inlets.

C. Section 230593 - 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; 2012.

D. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2012.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

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; 2012.

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; 2012.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

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

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. 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. Minimum of 24 gage.

B. Supply Air: 2 inch w.g. pressure class, galvanized steel.

C. Return and Relief: 1 inch w.g. pressure class, galvanized steel.

D. General Exhaust: 1 inch w.g. pressure class, galvanized steel.

E. Outside Air Intake: 1 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 of 24 gage.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used, 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. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

H. 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.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

C. Welding Ductwork: Clamp together galvanized sheet metal with rolled collar for clamping edge. Equal to Nordfab with Q-F clamp together design.

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and construct for operating pressures indicated.

B. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

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

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

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

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

H. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

END OF SECTION 233100

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Fire dampers.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connections.

F. Volume control dampers.

G. Welding Booth Station

H. Automatic Dampers.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 233100 - HVAC Ducts and Casings.

C. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

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

C. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

D. Project Record Drawings: Record actual locations of access doors and test holes.

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

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.2 FIRE DAMPERS

A. Manufacturers:
1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel

jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

E. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.3 DUCT ACCESS DOORS

A. Manufacturers:
1. Acudor Products Inc: www.acudor.com.
2. Elgen Manufacturing: www.elgenmfg.com.
3. Nailor Industries Inc: www.nailor.com.
4. Ruskin Company: www.ruskin.com.
5. SEMCO Incorporated: www.semcoinc.com.
6. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, 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 hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
1. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Carlisle HVAC Products: www.carlislehvac.com.
2. Elgen Manufacturing: www.elgenmfg.com.
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.

2.6 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: www.louvers-dampers.com.
   2. Nailor Industries Inc: www.nailor.com.
   3. Ruskin Company: www.ruskin.com.

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

C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
   1. Fabricate for duct sizes up to 6 x 30 inch.
   2. Blade: 24 gage, minimum.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, minimum.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.
   4. Products:
      a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com.

2.7 WELDING BOOTH STATION

A. Manufacturers:
   1. Avani Environmental: www.avanienvironmental.com.
   2. Substitutions: See Division 1.

B. Manufactured welding booth with extraction port, duct supports, explosion proof lights, adjustable slots for backdraft & hood, clean our drawer, and optional fume arm. Adjustable feet supports. Fume arm ceiling supports & brackets. Hood service panel. Two piece assembly; backdraft assembly and hood draft assembly. Lifting lugs. Equal to Avani WB-5000 series.

C. Nominal Dimensions: 60 inches wide, 54 inches deep, and 56 inches tall. Provide 36 inches tall support structure.

D. Optional Equipment: Provide options below.
   1. Welding nuts for J-hooks. Adjustable rear shelf.

2.8 DAMPERS

A. Description: Galvanized steel with vinyl bulb edging and edge seals in galvanized frame, with galvanized steel axles in self-lubricating nylon bearings. RA and EA in parallel blade arrangement with damper blades positioned across short air opening dimension. OSA dampers in opposed blade arrangement. Insulated blades and construction for cold weather applications. Damper Leakage: Maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

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 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

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

E. Provide fire dampers, at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install fire dampers in accordance with NFPA 92A. Provide labeled access door for service.

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.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall exhausters.

B. Cabinet exhaust fans.

C. Ceiling exhaust fans.

1.2 RELATED REQUIREMENTS

A. Section 233300 - Air Duct Accessories: Backdraft dampers.

B. Section 262717 - Equipment Wiring: 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.; 1990.

F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

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. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Manufacturer's Instructions: Indicate installation instructions.

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

E. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: One set 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. Nedermann.

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 WALL AND CABINET EXHAUSTERS (EF-1, EF-5)

A. Performance Ratings:
   1. Motor: Refer to Section 220513.

B. Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 1/2 inch mesh, 0.062 inch thick aluminum wire bird screen. Wall fans with mounting bracket.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor, and wall mounted multiple speed switch.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

E. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.4 WELDING EXHAUST FANS (EF-2, EF-3)

A. Fan Unit: Direct driven with heavy duty steel housing; dynamically balanced welded blades; resiliently mounted motor. Spark B construction. Corrosion resistant.

B. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor, and wall mounted multiple speed switch.

2.5 CEILING EXHAUST FANS (TEF-1, TEF-2)

A. Performance Ratings:
   1. Electrical Characteristics:
      a. Refer to Section 262717.
   2. Motor: Refer to Section 220513.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

D. Grille: Molded white plastic.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 230548.

C. Provide sheaves required for final air balance.

D. Install backdraft dampers on inlet to wall exhausters.

E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

F. Provide duct extension between ceiling grille and TEF's.

END OF SECTION 233423

SECTION 233516 - ENGINE EXHAUST SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exhaust fans.

B. Ductwork and duct fittings.

C. Inlet fittings.

D. Accessories.

E. Carbon monoxide detectors.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220513 - Common Motor Requirements for Plumbing Equipment: Fan motors.

C. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Vibration isolators.

D. Section 230513 - Common Motor Requirements for HVAC Equipment: Fan motors.

E. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Vibration isolators.

F. Section 262717 - Equipment Wiring: 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.; 1990.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

G. AWS D9.1M/D9.1 - Sheet Metal Welding Code; American Welding Society; 2006.

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

I. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2004.

J. SMACNA (ROUND) - Round Industrial Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 1999.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers literature and data sheets indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.

C. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, and locations and sizes of field connections.

D. Manufacturer's Installation Instructions: Include assembly and installation instructions.

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

F. Maintenance Materials: Furnish the following for OWNER's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Exhaust Hose: One, 10 foot length.

1.5 QUALITY ASSURANCE

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

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

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

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

1.6 FIELD CONDITIONS

A. Permanent exhaust system may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Car-Mon Products: www.car-mon.com.

B. Nedermann: www.nedermann.com.

C. Flexaust: www.flexaust.com.

D. Substitutions: See Section 016000 - Product Requirements.

2.2 CENTRIFUGAL FANS (EF-7)

A. Manufacturers:
   1. Greenheck.
   2. Nedermann.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Base performance on sea level conditions.

C. Performance:
   1. Refer to Fan Schedule.

D. Wheel and Inlet: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

E. Housing: Heavy gage steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.

F. Motors and Drives:
   1. Motors: As indicated, in compliance with Section 220513.
   2. Electrical Characteristics: Refer to Section 262717.
   3. Bearings: Heavy duty pillow block type, self aligning, grease-lubricated ball bearings or roller bearings.
   4. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.
   5. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch, matched belts, and rated minimum 1.5 times nameplate rating of motor.
   6. Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 12 gage, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated.

2.3 DUCTWORK AND DUCT ACCESSORIES

A. Materials:
   1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
   2. Coated Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 zinc coating and 4 mil polyvinyl chloride coating inside and out.

B. Ductwork:
   1. Fabricate and support in accordance with:
      a. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible.
      b. SMACNA (ROUND) - Round Industrial Duct Construction Standard and SMACNA (RIDC) - Rectangular Industrial Duct Construction Standard.
   2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
   3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   4. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard.
   5. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
   6. Joints: Minimum 4 inch cemented slip type, brazed or electric welded to AWS D9.1M/D9.1. Prime coat welded joints.
   7. Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
   8. Use double nuts and lock washers on threaded rod supports.

C. Flexible Connectors: UL listed, fire-retardant polyethylene impregnated fabric, minimum density 20 oz per sq yd, approximately 2 inches wide, crimped into metal edging strip.

D. Manufactured Engine Exhaust Ductwork: Clamp together galvanized sheet metal with rolled collar for clamping edge. Equal to Nordfab with Q-F clamp together design.

2.4 EXHAUST SYSTEM ACCESSORIES

A. Tail Pipe Adapters: Rubber formed to tapered cone with spring clip attachment, adapter size 6 inch, for connection to 2-1/2 inch diameter hose.

B. Flexible Exhaust Hose: Heat resistant neoprene coated fabric spring steel wire reinforced, rated for duty to 260 degrees F and 20 inches WG positive or negative.

C. Overhead Suspension System: System to support overhead hose consisting of 5/16 inch diameter nylon cable, 2 inch diameter cadmium plated cast steel swivel pulleys, 6 inch cadmium plated cast steel cleats.

D. Exhaust Hose Reel VER: Spring operated, manually controlled reel consisting of metal cylinder with internal aluminum flexible pipe, zinc plated steel stand, two steel springs, brake mechanism, hose stop, hose guide and 16 feet of 2-1/2 inch diameter hose. Two required.

2.5 VEHICLE EXHAUST GAS DETECTOR

A. Manufactures:
   1. Armstrong AMC-1AVCs

B. Description: Electrochemical combination gas monitoring package with micro-controller design. Carbon monoxide and Nitrous dioxide detectors and control panel for operation of exhaust fan. Control panel to have LED lights for each sensor and for operation of fan, audible alarms. Panel face to have manual operation switch for EF-1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturers instructions.

B. Install fans with resilient mounting and flexible electrical leads. Refer to Section 220548 and Section 262717.

C. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

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

E. Provide channel framing for mounting vehicle exhaust hose reels to exposed ceiling structure.

END OF SECTION 233516

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

1.2 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

B. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.

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

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carnes Company HVAC.

B. Ruskin.

C. Price Industries.

D. Titus.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square and rectangular, multi-louvered, square and rectangular, adjustable pattern, and multi-louvered diffuser to discharge air in 4-way pattern. Design manufacturer Titus TDCA.

B. Connections: square. See schedule.

C. Frame: Hard ceiling type.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by ARCHITECT from manufacturer's standard range.

F. Accessories: Provide removable core, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

2.3 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, long blade in front, double deflection. Equal to Titus 350RL.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: White.

2.4 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face. Equal to Titus 350RL.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: White.

2.5 LOUVERS

A. Type: 6 inch deep with blades on 45 degree slope, heavy channel frame, 1/2 inch square mesh screen over exhaust and 3/4 inch square mesh screen over intake. Drainage blade type for rain applications. Kynar finish with 10 year warranty. Equal to Ruskin 6375DX.

B. Fabrication: 16 gage thick galvanized steel welded assembly, with factory prime coat finish.

C. Color: Forest Green.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E.

END OF SECTION 233700

SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manufactured breechings.

B. Manufactured double wall chimneys for fuel fired equipment.

1.2 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

B. 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; 2012.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

D. NFPA 31 - Standard for the Installation of Oil Burning Equipment; National Fire Protection Association; 2011.

E. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association; 2011.

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

G. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

H. UL 378 - Standard for Draft Equipment; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.1 DEFINITIONS

A. Breeching: Vent Connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

D. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.2 DESIGN REQUIREMENTS

A. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, calculations for specific installation, electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

D. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Designer Qualifications: Design stacks under direct supervision of a Professional Structural Engineer experienced in design of the type of work specified and licensed in Alaska.

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

C. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of documented experience and approved by manufacturer.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for installation of oil burning appliances and equipment.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Schebler.

B. Metal-Fab, Inc.

C. Selkirk Corporation.

D. Substitutions: See Section 016000 - Product Requirements.

2.2 FIELD FABRICATED BREECHINGS

E. Breechings Less Than 24 inches in Diameter: Fabricate from hot-dipped galvanized steel sheet, ASTM A653/A653M FS, with G90/Z275 coating; make longitudinal seams using pipe lock or flat lock groove seam and make end joints beaded and crimped.

F. Minimum Metal Thicknesses:
   1. Sizes up to 12 inches: 18 gage.

G. Provide adjustable self-actuating barometric draft dampers, where indicated, full size of breeching.

H. Provide cleanout doors of same gage as breeching, at bottom of stack.

I. Fabricate breeching fittings to match adjoining breechings. Fabricate elbows with center-line radius equal to breeching width. Limit angular tapers to 20 degrees maximum.

2.3 MANUFACTURED BREECHINGS

A. Provide factory-built, modular connector and manifold system, tested to UL 103 with positive pressure rating.

B. Assembly to be UL listed for use with building equipment in compliance with NFPA 211.

C. Fabricate with 1 inch minimum air space between walls and construct inner liner of 304 stainless steel and outer jacket of 304 stainless steel.
   1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.

D. Design, fabricate, and install gas-tight preventing products of combustion leaking into the building.
   1. Securely connect inner joints and seal with factory supplied overlapping V-bands and appropriate sealant in accordance with manufacturer's instructions.
   2. System design to compensate for all flue gas induced thermal expansion.

2.4 DOUBLE WALL METAL STACKS

A. Provide double wall metal stacks, tested to UL 103 and UL listed with positive pressure rating, for use with building heating equipment, in compliance with NFPA 211.

B. Fabricate with 1 inch minimum air space between walls and construct inner liner of 304 stainless steel and outer jacket of 304 stainless steel.
   1. Protect aluminized steel surfaces exposed to the elements with a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the application.
   2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide approximately 6 feet of double chimney in Boiler, connecting to exiting double wall chimney at ceiling. Provide tee with natural draft damper. Provide offset for new boiler top outlet location.

B. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breechings, chimneys, and stacks at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.

D. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

E. Level and plumb chimney and stacks.

F. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

END OF SECTION 235100

SECTION 235223 - CAST-IRON BOILERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Boilers.

B. Controls and boiler trim.

1.2 RELATED REQUIREMENTS

A. Section 232114 - Hydronic Specialties.

B. Section 235100 - Breechings, Chimneys, and Stacks.

C. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASME (BPV IV) - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; The American Society of Mechanical Engineers; 2007.

B. 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; 2010.

C. NFPA 31 - Standard for the Installation of Oil Burning Equipment; National Fire Protection Association; 2011.

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

E. UL 726 - Oil-Fired Boiler Assemblies; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating general layout, dimensions, and size and location of water, fuel, and vent connections, seismic straps, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Submit manufacturers complete installation instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in OWNER's name and registered with manufacturer.

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 REGULATORY REQUIREMENTS

A. Conform to applicable code for internal wiring of factory wired equipment.

B. Conform to ASME (BPV IV) and (BPV VIII, 1) for boiler construction.

C. Units: AGA certified.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Weil-McLain/SPX Corporation; Model 680 (Design Manufacturer)

B. Burnham

C. Substitutions: See Section 016000 - Product Requirements.

2.2 MANUFACTURED UNITS

A. Hot Water Boilers: Suitable for forced draft with insulated jacket, sectional cast iron heat exchanger, natural gas burning system, refractory, controls, and boiler trim.

B. Provide water wall design consisting of water backed combustion area with water circulating around firebox. Refractory chamber or separate base not required.

C. Electrical Characteristics:
1. Refer to Section 262717.

D. Efficiency:
1. Annual Fuel Utilization Efficiency: 0.80.

2.3 FABRICATION

A. Assembly: Cast iron sections with 30 psig water ASME Boilers and Pressure Vessels Code rating, assembled with push nipples or gaskets and draw rods. Factory assembled.

B. Access: To flue passages for cleaning and flame observation ports.

C. Structural Base: Aluminized steel lined with high temperature mineral fiber insulating panels.

D. Jacket: Glass fiber insulated steel jacket, finished with factory applied baked enamel.

E. Combustion Connection: Top Outlet.

F. Seismic Restraints: Manufacturer's recommended steel straps welded to sections at factory.

2.4 HOT WATER BOILER TRIM

A. ASME rated pressure relief valve, 30 psig.

B. Combination water pressure and temperature gage.

C. Low water cut-off to prevent burner operation when boiler water falls below safe level.

D. Operating temperature controller with outdoor reset to maintain boiler water temperature.

E. Electronic operating temperature controller:
1. NEMA 250 Type 1 enclosure with full cover for wall mounting.
2. Ambient temperature range -30 to 150 degrees F.
3. Adjustable reset ratio of outside air temperature change to discharge control point change 1:2 to 100:1.
4. Integral set point adjustment 80 to 230 degrees F.
5. Electronic primary and outdoor sensors.

F. High limit thermostat with automatic reset for burner to prevent boiler water temperature from exceeding safe system temperature.

G. High limit temperature controller with manual reset for burner to prevent boiler water temperature from exceeding safe system temperature.

H. Boiler air vent.

2.5 FUEL BURNING SYSTEM

A. Manufacturer:
1. Beckett
2. Carlin

B. Burner Operation: On-off with low fire position for ignition. Natural draft operation.

C. Oil Burner: High pressure atomizing type for No. 2 fuel oil with combustion air blower, fuel pump, hinged flame inspection port, cadmium sulphide flame sensor, electrodes, ignition transformer, and oil nozzle.

D. Oil Burner Safety Controls: Energize burner motor and electric ignition, limit time for establishment of main flame, monitor flame continuously during burner operation and stop burner on flame failure with manual reset necessary, solenoid oil delay valve opens after burner motor energized and closes when de-energized.

E. Controls: Pre-wired, factory assembled electronic controls in control cabinet with flame scanner or detector, programming control, relays, and switches. Provide pre-purge and post-purge ignition and shut-down of burner in event of ignition pilot and main flame failure with manual reset.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler in galvanized sheet metal pan with welded 3 inch high base and on top of cinder blocks approximately 2 inches high.

C. Provide connection to fuel oil supply in accordance with requirements of NFPA 31.

D. Provide piping connections and accessories as indicated; refer to Section 232114.

E. Pipe relief valves to nearest floor drain.

F. Provide for connection to electrical service. Refer to Section 262717.

G. Provide packaged outdoor air reset temperature controller for boiler temperature operation. Coordinate power requirements with electrical division, otherwise provide all low voltage components hereunder.

3.2 SYSTEM STARTUP

A. Provide the services of manufacturer's certified field representative for starting and testing unit. Provide standardized testing report of combustion adjustment and analysis.

3.3 CLOSEOUT ACTIVITIES

A. Train operating personnel in operation and maintenance of units.

B. Provide the services of the manufacturer's field representative to conduct training.

END OF SECTION 235223

SECTION 237313 - AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Factory fabricated assembly of modular sections consisting of housed centrifugal 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.

1.2 RELATED REQUIREMENTS

A. Section 230719 - HVAC Piping Insulation.

B. Section 233300 - Air Duct Accessories: Flexible duct connections.

C. Section 233416 - Centrifugal HVAC Fans.

D. Section 233300 - Air Duct Accessories: Flexible duct connections.

E. Section 262717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 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 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute; 2001 (R2005) .

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

E. 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).

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

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

H. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.

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

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

K. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2011.

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

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

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

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

P. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

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

1.4 SUBMITTALS

A. See Section 013000 - 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.

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 016000 - Product Requirements, for additional provisions.
   2. Extra Fan Belts: Two sets for each unit.
   3. Extra Filters: Eight sets pre-filters for each unit. Four sets final filters for each unit.

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 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

2.1 MANUFACTURERS

A. Daikin.

B. Trane.

C. York

2.2 GENERAL DESCRIPTION

A. Components:
1. Casing construction.
2. Fan section.
3. Filter section.
4. Damper section.
5. Heating coil section with face & bypass damper.

B. Configuration: Fabricate with fan plus accessories, including:
1. Heating coil.
2. Filter section; Pre and Final.
3. Heat Recovery Glycol Coil; Maximum coil velocity 400 fpm.
4. Face and bypass damper section.

C. Fabrication: Conform to AMCA 99 and AHRI 430.

D. Performance: Sea level conditions:
1. Air Flow: 6,000 max and 3,500 min cfm.
2. External Static Pressure: 1.5 inch wg external static pressure.
3. Motor: 7.5 hp, 208 volt, three phase, 60 Hz. Suitable for variable speed.
4. Maximum outlet fan velocity: 1700 fpm.

2.4 CASING CONSTRUCTION

E. 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.

F. Casing:
   1. Construct of one piece, insulated, double wall panels. Baked enamel.
   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:

G. Access Doors: 18 x 22 inch of galvanized steel for flush mounting, with gasket, latch, and handle assemblies and 12 x 12 inch inspection window of 1/4 inch thick acrylic sheet. Provide welded channel frame to set door out from casing to permit external insulation.
   1. Construction, thermal and air pressure performance same as casing.
   2. Provide surface mounted handles on hinged, swing doors.

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

I. 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.

J. 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.

2.3 FAN SECTION

A. Type: Airfoil plenum, centrifugal type fan, Class 2. Refer to Section 233416.

2.4 FANS

A. Type: Air foil, double width, double inlet, centrifugal plug type fan. Refer to Section 233416.

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. Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing.

F. 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. Mount base on vibration isolators; refer to Section 230548.

G. Flexible Duct Connections: For separating fan and coil, and adjacent sections; refer to Section 233300.

H. Fan Accessories: Discharge dampers and Damper operator. Refer to Section 233416.

I. Flexible Duct Connections: For separating fan and coil, and adjacent sections; refer to Section 233300.

2.5 BEARINGS AND DRIVES

A. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated roller bearings with ABMA 11 L-50 life at 500,000 hours.

B. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

C. 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.

D. Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; 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.

2.6 COILS

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside 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.

C. Fabrication:
1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
2. Fins: Aluminum.
3. Casing: Die formed channel frame of galvanized steel.

D. Water Heating Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.

2. 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: 48 inch wide, 27 inch high. Coordinate with fan unit.
2. Rows: 2.
3. Capacity: 235,000 Btuh.
4. Entering Air Temperature: -5 degrees F.
5. Leaving Air Temperature: 60 degrees F.
6. Air Static Pressure Drop: 0.10 inch wg.
7. Water Flow Rate: 15.7 gpm.
8. Entering Water Temperature: 190 degrees F.
9. Leaving Water Temperature: 160 degrees F.
10. Water Pressure Drop: Max 2.0 ft head.

2.7 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.

2.8 FILTERS

A. Filter Box: Section with filter guides, access doors from both sides, for side loading with gaskets and blank-off plates.

B. Filter Media: UL 900 listed, Class I or Class II, approved by local authorities.

C. Flat: MERV 8 Pre filter and MERV 13 Final filter; 2 inches deep washable permanent panel filters. Refer to Section 234000.

D. Filter Gages:
1. 3-1/2 inch diameter diaphragm actuated dial in metal case with static pressure tips.

2.9 DAMPERS

A. Mixing Boxes: Section with factory mounted outside and return air dampers of galvanized steel with vinyl bulb edging and edge seals in galvanized frame, with galvanized steel axles in self-lubricating nylon bearings, in parallel blade arrangement with damper blades positioned across short air opening dimension. Provide removable, full width rack for supporting freeze protection thermostat, with removable end panel to permit rack removal.

B. Damper Leakage: Maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.

PART 3 - EXECUTION

3.1 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 isolated fans with resilient mountings and flexible electrical leads.

F. Bolt fan to concrete floor, minimum of four locations per manufacturer's requirements.

G. Provide sheaves required for final air balance.

H. Make connections to coils with unions or flanges.

I. 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 float operated automatic air vents at high points complete with stop valve.
   5. Ensure water coils are drainable and provide drain connection at low points.

3.2 SCHEDULES

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

1)	1st Octave	80
2)	2nd Octave	80
3)	3rd Octave	80
4)	4th Octave	79
5)	5th Octave	78
6)	6th Octave	73
7)	7th Octave	72
8)	8th Octave	68

      b. Casing Radiated

1)	1st Octave	72
2)	2nd Octave	73
3)	3rd Octave	69
4)	4th Octave	62

5)	5th Octave	58
6)	6th Octave	51
7)	7th Octave	39
8)	8th Octave	33

END OF SECTION 237313

SECTION 238101 - TERMINAL HEAT TRANSFER UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Unit heaters.

B. Cabinet unit heaters.

1.2 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

B. Section 23 2114 - Hydronic Specialties.

C. Section 23 0926 - Sequence of Operations for HVAC Controls.

D. Section 26 2726 – Wiring Devices: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.3 SUBMITTALS

A. See Section 01 2500 – Substitution Procedures, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Manufacturer's Instructions: Indicate installation instructions and recommendations.

D. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

E. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in OWNER's name and registered with manufacturer.

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

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

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

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. Manufacturers:

1. Rittling
2. Sterling Hydronics/Mestek Technology, Inc
3. Trane Inc
4. Vulcan.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Casing: 20 gage thick steel with threaded pipe connections for hanger rods.

D. Finish: Factory applied baked enamel of color as selected by ARCHITECT.

E. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings.

F. Air Outlet: 4-way Adjustable pattern diffuser with vertical and horizontal discharge..

G. Motor: Permanently lubricated sleeve bearings on horizontal models.

H. Control: Local disconnect switch.

I. Capacity: As scheduled.

2.4 CABINET UNIT HEATERS

A. Manufacturers:

1. Rittling
2. Sterling Hydronics/Mestek Technology, Inc
3. Trane Inc
4. Vulcan.

B. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 100 psi and 220 degrees F.

C. Cabinet:

1. Ceiling type: Steel with exposed corners and edges rounded, glass fiber insulation, and

integral air outlet and inlet ducts. Easily removable panels. To be set on the floor with connecting ductwork.

D. Finish: Factory applied baked enamel of color as selected by ARCHITECT on visible surfaces of enclosure or cabinet.

E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

F. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

G. Control: Multiple speed switch, factory wired, located in cabinet.

H. Filter: Easily removed 1 inch thick washable type, located to filter air before coil.

I. Capacity: As Scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

E. Cabinet Unit Heaters: Install as indicated. Coordinate to assure correct placement for ducted inlet and outlet connections.

F. Hydronic Units: Provide with shut-off valve on supply and return and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For cabinet unit heaters and unit heaters, provide float operated automatic air vents with stop valve.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Clean filters.

END OF SECTION 238101

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

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

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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/THWN-2.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC and Type SO with ground wire.

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. Feeders: Stranded Copper.

B. Branch Circuits: Stranded Copper.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 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. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

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.

B. Make splices, terminations, and taps that are compatible with conductor material.

1. Use oxide inhibitor in each splice, termination, and tap for exterior conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 QUALITY ASSURANCE

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Stranded.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

A. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

B. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

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

1. Material: Plain steel.
2. Channel Width: 1-5/8 inches (41.25 mm).
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
5. Channel Dimensions: Selected for applicable load criteria.

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

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

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. 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 where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. 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 unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

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

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. 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).

D. 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 Existing Concrete: Expansion anchor fasteners.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
4. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.
6. 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.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

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. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

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

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

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

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

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:

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

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, unless otherwise indicated, and sized according to NFPA 70.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Screw-cover type, unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.3 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. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

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

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Device Box Dimensions**:** 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

H. Gangable boxes are allowed.

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

J. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door.
3. Metal barriers to separate wiring of different systems and voltage.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

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

1. Exposed Conduit: GRC or IMC.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

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

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC or IMC.
6. Boxes and Enclosures: NEMA 250, Type 1.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

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 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 or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

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

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Install conduits parallel or perpendicular to building lines.

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

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

I. 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 (35mm) 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.

J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

L. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

N. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

O. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

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

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for conductors.
2. Equipment identification labels, including arc-flash warning labels.
3. Miscellaneous identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 LABELS

A. Self-Adhesive Labels:

1. Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable diameter, such that the clear shield overlaps the entire printed legend.

2. Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

a. Nominal Size: 3.5-by-5-inch (76-by-127-mm).

2.3 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.4 Signs

A. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. inches (129 sq. cm), minimum 1/16-inch- (1.6-mm-).
b. For signs larger than 20 sq. inches (129 sq. cm), 1/8 inch (3.2 mm) thick.
c. Engraved legend with black letters on white face.
d. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Verify identity of each item before installing identification products.

C. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

3.3 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied **or** field applied for sizes larger than No. 8 AWG.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

B. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. .Enclosed switches.
d. Enclosed circuit breakers.
e. Enclosed controllers.
f. Push-button stations.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Indoor occupancy and vacancy sensors.
2. Switchbox-mounted occupancy sensors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCYAND VACANCY SENSORS

A. General Requirements for Sensors:

1. Ceiling-mounted, solid-state indoor occupancy sensors.
2. Dual technology.
3. Integrated power pack.
4. Hardwired connection to switch.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Operation:

   a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Power: Line voltage.
8. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

9. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
10. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

B. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
4. Switch Rating: Not less than 800-VA LED load at 120 V.

B. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m)].
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP**.**

4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
8. Color: White.
9. Faceplate: Color matched to switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within one month from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions.

1. For occupancy sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. SPD: Surge protective device.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Key interlock scheme drawing and sequence of operations.

1.5 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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 NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Height: 80 inches (2.03 m) maximum.
3. Front: Secured to box with concealed trim clamps. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Finishes:

    a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.

F. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.

    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

C. Mains: Lugs only.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: lugs only.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

1. Copper equipment and isolated ground buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
4. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching lighting loads.
f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:

1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 80 inches (2029 mm) above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

I. Install overcurrent protective devices and controllers not already factory installed.

1. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections.

K. Install filler plates in unused spaces.

L. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.3 IDENTIFICATION

A. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262416

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.

e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.

2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. Include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.

1.7 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.8 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.11 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Configuration: Nonreversing.
2. Surface mounting.
3. Red pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Configuration: Nonreversing.
2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
3. Surface mounting.
4. Red pilot light.

D. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Configuration: Nonreversing.
2. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
4. Control Circuits: 120-V ac.
5. Solid-State Overload Relay:

a. Switch or dial selectable for motor running overload protection.
b. Sensors in each phase.
c. Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

6. N.C. isolated overload alarm contact.
7. External overload reset push button.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

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: Standard-duty, oiltight type.

a. Push Buttons: Unguarded types; maintained or momentary as indicated.
b. Pilot Lights: LED types; colors as indicated.
c. Selector Switches: Rotary type.

B. Reversible N.C./N.O. auxiliary contact(s).

C. Spare control wiring terminal blocks, quantity as indicated; wired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

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

C. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, and overload-relay pickup and trip ranges.

3.7 PROTECTION

A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

END OF SECTION 262913

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior and building mounted exterior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.

5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule: For luminaires and lamps**.**

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

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. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

C. CRI and CCT as indicated on the Luminaire Schedule,

D. Rated lamp life of 50,000 hours.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: 120 V ac.

H. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

I. Housings:

1. Extruded-aluminum housing and heat sink.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Construction Manager, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.

G. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES

HAINES SCHOOL DISTRICT

HAINES ALASKA

CONSTRUCTION DOCUMENTS SUBMITTAL MARCH, 2015

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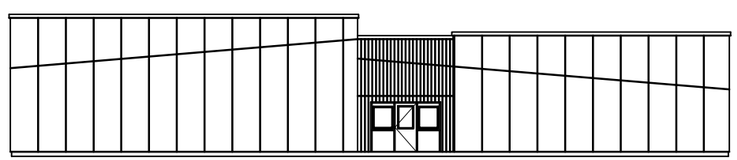
DRAWING INDEX



SYMBOLS

CW	COLD WATER	
HW	HOT WATER	
V	VENT	
W	WASTE	
	ACCESS DOOR	
CO	CLEANOUT	
DV	DRAIN VALVE	
	UNION	
	PITCHED DOWN	
	REDUCER	
	CAPPED OR PLUGGED	
	GATE VALVE OR BALL VALVE	
5	FLOW SETTER W/NO.	
FCO	FLOOR CLEANOUT	
	CHECK VALVE	
	GLOBE VALVE OR ISOLATING BALL VALVE	
2	CONSTRUCTION NOTE	
	THERMOSTAT OR THERMOSTATIC SENSOR – IMMERSION, ROOM	
	THERMOMETER	
$	CONTROL SWITCH	
ø	DIAMETER	
℄	CENTER LINE	
P	PRESSURE SENSOR	
OR	MANUAL BUTTERFLY DAMPER	
100 9x9 8"ø SG–1 3–WAY BLOW	AIR VOLUME DIFFUSER/GRILLE SIZE DIFFUSER INLET SIZE GRILLE TYPE BLOW PATTERN	
	CEILING RETURN/EXHAUST GRILLE	
	CEILING SUPPLY DIFFUSER	
	SQUARE TO ROUND DUCT TRANSITION	
	SUPPLY DUCT UP, DOWN	
	WALL GRILLE	
	PIPING UP AND DOWN	
1 M503	SECTION CUT NUMBER	
1 M602	DETAIL NUMBER	
(B)	BELOW GRADE	
(E)	EXISTING	
(X)	REMOVE	
	POINT OF CONNECTION OR REMOVAL	

AFF	ABOVE FINISHED FLOOR
AMS	AIRFLOW MEASURING STATION
B	BUTTERFLY DAMPER
BAS	BUILDING AUTOMATION SYSTEM
BOD	BOTTOM OF DUCT
C	COMMON
CFM	CUBIC FEET PER MINUTE
CL	CENTERLINE
CO	CLEANOUT
DF	DRINKING FOUNTAIN
DG	DOOR GRILLE
DU	DIELECTRIC UNION
DV	DRAIN VALVE
DWH	WATER HEATER
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EEW	EMERGENCY EYE WASH
EF	EXHAUST FAN
EG	EXHAUST GRILLE
ESH	EMERGENCY SHOWER
ESP	EXTERNAL STATIC PRESSURE
EWT	ENTERING WATER TEMPERATURE
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FG–1	FLOOR GRILLE
FP	FINNED PIPE
FRD	FIRE RATED DAMPER
GPM	GALLONS PER MINUTE
HB	HOSE BIBB
HWT	HOT WATER TANK
IAW	IN ARCHITECTURAL WORK
IEW	IN ELECTRICAL WORK
ICW	IN CIVIL WORK
INV. EL.	INVERT ELEVATION
IPS	IRON PIPE SIZE
L	LAVATORY
LAT	LEAVING AIR TEMPERATURE
MBD	MULTI BLADE DAMPER
MBH	1,000 BTU PER HOUR
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NIM	NOT IN MECHANICAL
NF	NON FREEZE
NO	NORMALLY OPEN
OC	ON CENTER
OSA	OUTSIDE AIR
PSI	POUNDS PER SQUARE INCH
RA	RETURN AIR
RF	RETURN FAN
RG	RETURN GRILLE
SA	SUPPLY AIR
SAT	SUPPLY AIR THERMOSTAT
SD	SMOKE DAMPER
SG	SUPPLY GRILLE
TAB	TESTING, ADJUSTING, AND BALANCING
TP	TRAP PRIMER
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
VER	VEHICLE EXHAUST REEL
VTR	VENT THROUGH ROOF
WC	WATER CLOSET
WCO	WALL CLEAN OUT
WF	WASH FOUNTAIN
WH	WALL HYDRANT

MECHANICAL SHEET LIST

CODE NOTES:

1. ALL WORK HEREUNDER SHALL BE STRICTLY IN CONFORMANCE WITH APPLICABLE CODES AND REGULATIONS. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2009 INTERNATIONAL CODES, 2009 UNIFORM PLUMBING CODE, NFPA, IN SO FAR AS MINIMUM REQUIREMENTS, BUT THE DRAWINGS AND SPECIFICATIONS SHALL GOVERN IN CASES WHERE THE MINIMUM REQUIREMENTS ARE EXCEEDED.

SHEET NOTES:

1. SEE MECHANICAL DESIGN DEVELOPMENT NARRATIVE FOR ADDITIONAL INFORMATION ON EQUIPMENT AND METHODS REQUIRED FOR RENOVATION WORK.

VENTILATION UNIT SCHEDULE

EQUIPMENT	AREA SERVED	CFM	Δ P, INCHES OF WATER	MIN. HP	VOLTS / PHASE	FEATURES AND ACCESSORIES
VU–1	VOCATIONAL SHOP	6,000 MAX 3,500 MIN.	1.5" ESP	7.5	208V / 3ø	CENTRAL STATION AIR HANDLING UNIT; VFD SPEED CONTROL, MERV 8 PREFILTER, MERV 13 FILTER. POLYPROPYLENE GLYCOL HEATING COIL.

FAN SCHEDULE

EQUIPMENT	AREA SERVED	CFM	TSP, INCHES OF WATER	DESIGN MANUFACTURER AND MODEL	MIN. HP	VOLTS / PHASE	FEATURES AND ACCESSORIES
EF–1	GENERAL DUTY	1600	0.5	GREENHECK, SWB–113	1/2	120V/1ø	BACKWARDS INCLINED, CENTRIFUGAL UTILITY FAN. BACK HORIZONTAL, CCW ROTATION. CORROSION RESISTANT, SPARK B CONSTRUCTION. CO–NO2 SENSING CONTROL BOX.
EF–2	WELDING EXHAUST	1500	4.5	GREENHECK, 11–IPA	2.0	208V/3ø	BACKWARDS INCLINED, CENTRIFUGAL UTILITY FAN. BACK HORIZONTAL, CCW ROTATION. CORROSION RESISTANT, SPARK B CONSTRUCTION.
EF–3	WELDING EXHAUST	1500	4.5	GREENHECK, 11–IPA	2.0	208V/3ø	BACKWARDS INCLINED, CENTRIFUGAL UTILITY FAN. BACK HORIZONTAL, CCW ROTATION. CORROSION RESISTANT, SPARK B CONSTRUCTION.
EF–4	VEHICLE EXHAUST	800	6.0	NEDERMAN, N–40	3.0	208V/3ø	IN LINE VEHICLE EXHAUST FAN.
EF–5	LASER CUTTER	400	2.5	CW–101HP–VG	1/2	120V/1ø	IN LINE VEHICLE EXHAUST FAN.
TEF–1 TEF–2	TOILET ROOM EXHAUST	95	0.25	PANASONIC, FV–11VF2	33 WATTS	120V/1ø	INLINE, CEILING MOUNTED, CABINET EXHAUST FAN WITH INTEGRAL EXHAUST GRILLE. PROVIDE EXHAUST CALL CAP WITH BACKDRAFT DAMPER. PROVIDE MANUAL ON/OFF SWITCH ON WALL NEXT TO LIGHT SWITCH.
SF–1	BOILER ROOM	350	0.25	GREENHECK, SBS–1H20	1/4HP	120V/1ø	EXPLOSION PROOF, WALL MOUNTED EXHAUST FAN WITH INTEGRAL BACKDRAFT DAMPERS & WEATHER HOOD WITH BIRD SCREEN.

HEATING UNIT SCHEDULE

EQUIPMENT	DESIGN MANUFACTURER	MODEL	CONTROLS/OPTIONS
UNIT HEATER, UH (4)	RITTLING	RH	MINIMUM 70 MBH @ LOW SPEED WITH 20°F TEMPERATURE DROP FOR WATER, 60°F EAT, 200°F EWT. HORIZONTAL BLOW. 4–WAY ADJUSTABLE VANES. UNIT PROVIDED WITH DISCONNECT. ELECTRICAL REQUIREMENT: 1/15HP, 120V, 1–PHASE.
CABINET UNIT HEATER, CUH (1)	RITTLING	RFRC–410	18.8 MBH @ LOW SPEED WITH 20°F TEMPERATURE DROP FOR WATER, 60°F EAT, 200°F EWT. UNIT PROVIDED WITH DISCONNECT. ELECTRICAL REQUIREMENT FOR FAN: 1/40HP, 120V, 1–PHASE, INLET GRILLE AND OUTLET CONNECTIONS.

HEATING COIL SCHEDULE

COIL	UNIT SERVED	SIZE (LxW)	CAPACITY (MBH)	WATER TEMPERATURES ENTERING	WATER TEMPERATURES LEAVING	AIR TEMPERATURES ENTERING	AIR TEMPERATURES LEAVING	DESIGN MANUFACTURER	FEATURES & ACCESSORIES
HC–1	VU–1	50x30	405	180°F	150°F	–5°F	60°F	US COIL	1 ROW, 8 FINS PER INCH.

PUMP SCHEDULE

EQUIPMENT	FUNCTION	GPM	HEAD, FT	DESIGN MANUFACTURER AND MODEL	MINIMUM HORSEPOWER ELECTRICAL CHARACTERISTICS	FEATURES
P–1	HEATING SYSTEM	40	15	TACO 1600 B&G SERIES 60	3/4 HP, 208V / THREE–PHASE	IN–LINE, TRIMMED IMPELLER, PUMP, PIPE MOUNTED. COMPLETE SPARE PUMP PROVIDED AND STORED IN MECHANICAL ROOM.
P–2	HEATING SYSTEM	50	25	TACO 1600 B&G SERIES 60	1.0 HP, 208V / THREE–PHASE	IN–LINE, TRIMMED IMPELLER, PUMP, PIPE MOUNTED. VFD. COMPLETE SPARE PUMP PROVIDED AND STORED IN MECHANICAL ROOM.

HEATING EQUIPMENT SCHEDULE

EQUIPMENT	DESIGN MANUFACTURER	MODEL	FEATURES/CONTROLS/OPTIONS
BOILER (1)	WEIL–McLAIN	680	CAST–IRON SECTIONAL, NET IBR 551 MBH. COMPLETE PACKAGE INCLUDING LOW WATER CUTOFF, OPERATING THERMOSTAT CONTROL SET AT 200°F WITH 10°F DIFFERENTIAL, HIGH LIMIT WITH AUTO RESET THERMOSTAT, EXTRA HIGH LIMIT WITH MANUAL RESET THERMOSTAT, PRESSURE RELIEF VALVE, FLUE COLLAR WITH BREECHING DAMPER. SPARE PRESSURE RELIEF VALVE AND THERMOSTATS STORED IN MECHANICAL ROOM IN ORIGINAL PACKAGING. ALL CONTROLS TO BE IMMERSION TYPE WITH WELLS, STRAP–ON TYPE NOT ALLOWED. DATA REQUIRED.
BURNER (1)	BECKET CF800–W	4.50 GPH	115V, SINGLE–PHASE, FOR FORCED DRAFT FIRE. COMPLETE SET OF SPARE PARTS STORED IN MECHANICAL ROOM IN ORIGINAL PACKAGING CONSISTING OF FAN MOTOR, OIL PUMP, COUPLING, HONEYWELL 8184 PROGRAMMER, TRANSFORMER, FLAME DETECTOR, SOLENOID VALVE, PRE–PURGE, COMPLETE SET OF ELECTRODES, AND LIST OF SPARE PARTS. DATA REQUIRED.
CHIMNEY	SCHEBLER	P1	DOUBLE WALL, INSULATED CHIMNEY RATED FOR POSITIVE PRESSURE. EXTERIOR CHIMNEY OF STAINLESS STEEL OUTER WALL CONSTRUCTION. INTERIOR CHIMNEY MAY BE ALUMINUM OUTER WALL CONSTRUCTION. CLEANOUT INSTALLED AT BOTTOM OF STACK WITH SUPPORT FLANGES AT PENETRATIONS. STAINLESS STEEL RAIN CAP ON TOP. 1 INCH INSULATION. DATA REQUIRED.
EXPANSION TANK, ET–1	AMTROL	MODEL AX–100	26 GALLON MINIMUM ACCEPTANCE VOLUME. 55 GALLON MINIMUM TOTAL TANK VOLUME. ASME LABELED. DATA REQUIRED.
WATER FEEDER	WATTS, BELL & GOSSETT	U5LP, B–38	3/4 INCH WITH SELF CLEANING STRAINER, ADJUSTABLE PRESSURE REDUCING VALVE SET AT 12 PSI. INSTALLED WITH PRESSURE GAGES EACH SIDE AND BYPASS AS SHOWN.
BACKFLOW PREVENTER	WATTS	909	REDUCED PRESSURE DOUBLE CHECK ASSEMBLY WITH SHUT OFF VALVES EACH SIDE AND FUNNEL DRAIN UNDER VENT PIPED TO FLOOR DRAIN.
AIR SEPARATOR	SPIROTHERM	VHT300	FOR 3" PIPE SIZE. WITH REMOVABLE STRAINER. AIR VENT ON TOP. CONNECTION TO EXPANSION TANK AND COLD WATER SUPPLY ON TOP. WITH 1" VALVED BLOWDOWN.
TEMPERING VALVES	POWERS 430 SERIES LEONARD	433	ROUGH CHROME TEMPERATURE MIXING VALVES. TEMPERATURE LIMITING AND PRESSURE BALANCING WITH COMBINATION STRAINER CHECK STOPS. 3/4" INLET AND OUTLET SIZE. SET AT DISCHARGE TEMPERATURE OF 115°F AND RECORDED FOR O&M. DATA REQUIRED.
GLYCOL FEED UNIT	WESSELS	GMP–18	PREFABRICATED AUTOMATIC PACKAGE. MAINTAIN A FILL PRESSURE OF 15PSI WITH PRESSURIZATION PUMP WITH PRESSURE CONTROLS, PRE–PRESSURIZED STORAGE TANK, PRV, PRESSURE GAGE. 18 GALLON STORAGE 110V, 60HZ.

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
SYMBOLS & SCHEDULES

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SHEET NO.
M001
JOB NO. M–463

FLOWSETTER AND AUTOMATIC VALVE SCHEDULE

NUMBER	UNIT SERVED	AREA SERVED	LOCATION	DESIGN GPM	FLOWSETTER SIZE (INCHES)	AUTOMATIC VALVE PRESSURE DROP (PSI)	AUTOMATIC VALVE TYPE	AUTOMATIC VALVE OPERATION	CONTROL TYPE	NORMAL POSITION
1	HEATING PLANT	HEATING SYSTEM BYPASS	BOILER ROOM	15	1-1/2	2-4	2-WAY	MODULATING	–	CLOSED
2	HEATING COIL	VENTILATION UNIT	MEZZANINE	30	2	2-4	2-WAY	MODULATING		OPEN
3	CUH	ENTRANCE	MEZZANINE	2.0	1/2	1-2	2-WAY	POSITIVE	ON-OFF	OPEN
4	UH	HEATING SYSTEM	AUTOSHOP	7.7	1	1-2	2-WAY	POSITIVE	ON-OFF	OPEN
5	UH	HEATING SYSTEM	AUTOSHOP	7.7	1	1-2	2-WAY	POSITIVE	ON-OFF	OPEN
6	UH	HEATING SYSTEM	WOODSHOP	7.7	1	1-2	2-WAY	POSITIVE	ON-OFF	OPEN
7	UH	HEATING SYSTEM	WOODSHOP	7.7	1	1-2	2-WAY	POSITIVE	ON-OFF	OPEN
8	HEATING PLANT	HEATING SYSTEM	BOILER ROOM	50	2-1/2	–	–	–	–	–
9	P-1	HEATING SYSTEM	BOILER ROOM	40	2	–	–	–	–	–
10	P-2	HEATING SYSTEM	BOILER ROOM	50	2-1/2	–	–	–	–	–

DIFFUSER AND GRILLE SCHEDULE

SUPPLY CEILING DIFFUSER/WALL GRILLE						RETURN OR EXHAUST GRILLE					
ROOM	MARK	NUMBER	SUPPLY CFM	FACE SIZE	NECK SIZE	MARK	NUMBER	RETURN CFM	EXHAUST CFM	FACE SIZE	NECK SIZE
AUTOSHOP	SG-1	1	2,300	36X18	–	RG-1	1	2,300	–	16x36	–
AUTOSHOP EF-1	–	–	–	–	–	EG-1	1	–	1600	16x24	–
						EG-1	1	–	2300	18x36	–
WOODSHOP	SG-1	1	3,370	36X24	–	RG-1	1	3,370	–	24x36	–
						EG-1	1	–	3370	18x18	–
OFFICE	SG-2	1	120	6X6	6"ø	–	–	–	–	–	–
AUTOSHOP STORAGE	SG-2	1	120	6X6	6"ø	–	–	–	–	–	–

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HAINES SCHOOL DISTRICT

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MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
SCHEDULES

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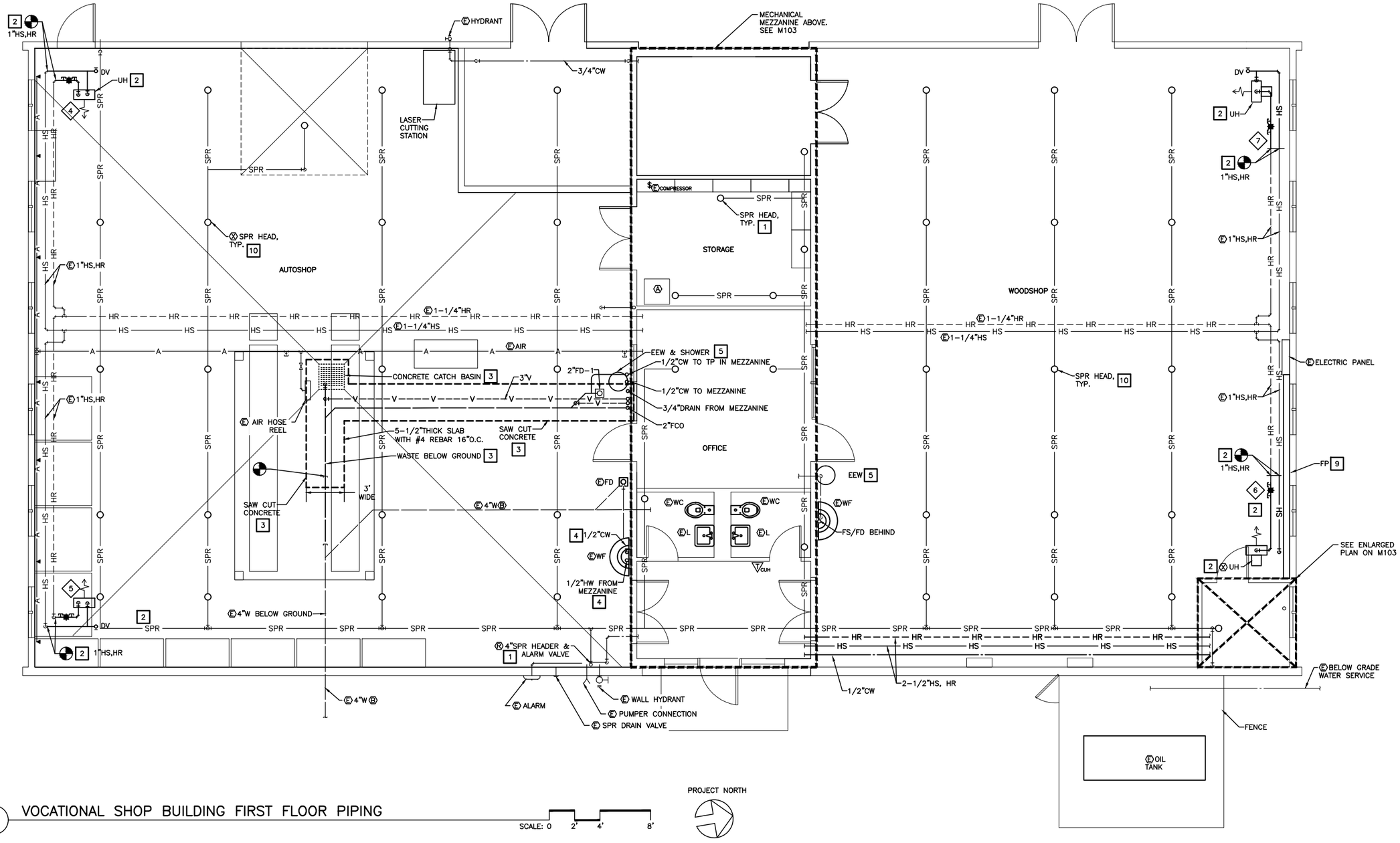
SHEET NO.
M002

JOB NO. M-463

TASK NOTES:

1. MODIFY EXISTING SPRINKLER HEADER. RAISE ALARM WET ALARM ASSEMBLY APPROX. 3 FEET. INSTALL 4"SIZE REDUCED PRESSURE BACK FLOW PREVENTER & (2) TAMPER SWITCHES ON ISOLATION VALVES. CONNECT 4" SPR TO RAISED WET ALARM ASSEMBLY.
2. REPLACE UNIT HEATERS. INSTALL NEW FLOWSETTERS, CONTROL VALVES, ISOLATION VALVES, AND APPURTENANCES.
3. INSTALL NEW OIL WATER SEPARATOR. OIL WATER SEPARATOR WILL BE AN ENCLOSED, VENTED TANK. SAWCUTING AND EXCAVATION WILL BE REQUIRED FOR THE INSTALLATION OF THE OIL WATER SEPARATOR, VENT, AND WASTE. BACKFILL AND REPLACE CONCRETE FLOOR.
4. CONNECT 1/2" CW & HW TO EXISTING SUPPLIES ABOVE FIXTURE
5. REPLACE EMERGENCY EYEWASH AND EYEWASH/SHOWER COMBINATION UNITS IN SAME LOCATIONS. NEW UNITS TO BE INSTALLED WITH WATER TEMPERING MEANS TO TEMPER OUTLET WATER TO 80'F AS REQUIRED BY OSHA REGULATIONS. UNIT SHALL BE ADA COMPLIANT.
6.
7. PREPARE FOR INSTALLATION OF NEW CUH. CUT AND PATCH FINISHES AS REQUIRED.
8.
9. REMOVE AND REPLACE FINNED PIPE, ASSOCIATED PIPING, AND CONTROLS.
10. REPLACE ALL SPRINKLER HEADS.



1 VOCATIONAL SHOP BUILDING FIRST FLOOR PIPING

SCALE: 0 2' 4' 8'

PROJECT NORTH

STATE OF ALASKA — 19th — DOUGLAS H. MURRAY — ME 7870 — ELECTRICAL PROFESSIONAL ENGINEER
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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
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HAINES, ALASKA

SHEET TITLE:
VOCATIONAL SHOP BUILDING FIRST FLOOR PIPING

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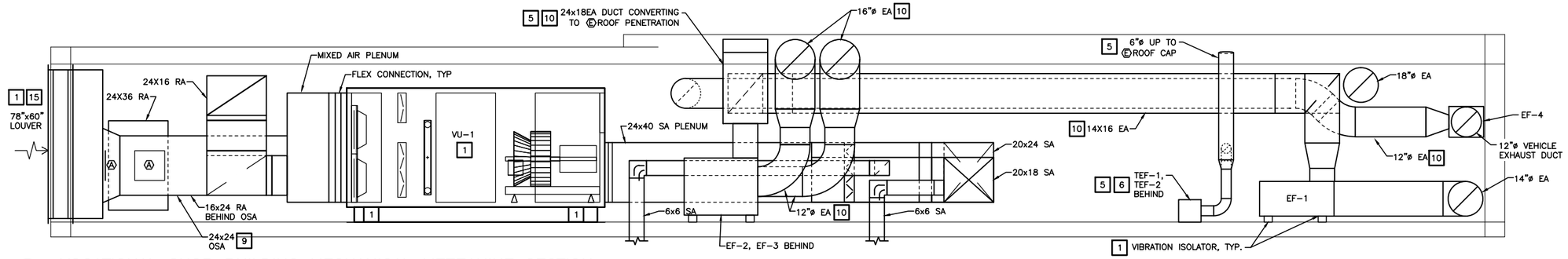
SHEET NO.
M101
JOB NO. M-463

CONSTRUCTION NOTES:

1. INSTALL VIBRATION ISOLATION PADDING BETWEEN ENTIRE SUPPORT RAILS OF VU-1. SECURE VU-1 TO FLOOR WITH SEISMIC TYPE RESTRAINTS.
2. REUSE PENETRATION, CUT AND PATCH FINISHES AS REQUIRED.
3. REPLACE ALL SPRINKLER HEADS IN AREA.
4. DDC DEVICE, COORDINATION LOCATION.
5. INSTALL EA DUCTS TO EXISTING ROOF PENETRATION AND CAP. SEE DETAIL ON SHEET M501.
6. REPLACE TOILET EXHAUST FAN SYSTEMS. SYSTEM INCLUDES TEF, GRILLES, DUCTWORK, AND CONTROLS. PREPARE FOR INSTALLATION OF NEW TEF SYSTEM. CUT AND PATCH FINISHES AS REQUIRED.
7. INSTALL 18"x18" EAD IN VERTICAL. INSTALL EG-1 IN CEILING APPROXIMATELY 5 FEET BELOW, CONNECT DUCTWORK BETWEEN WEATHERHOOD AND GRILLE.
8. LOCATE CUH ON FLOOR AND OVER RETURN GRILLE. SEAL AIR TIGHT.
9. INSULATE PLENUM AND DUCT.
10. INSULATE EA DUCTS AND PLENUM IN MEZZANINE.
11. INSTALL EEW TEMPERING VALVE. CONNECT TO EXISTING HW & CW ISOLATING VALVES.
12. COMBINATION 3"VENT FROM OWS & FD.
13. PROVIDE DUCT TRANSITION FROM CUH TO EXISTING GRILLE INCLUDING ELBOW DOWN TO GRILLE CONNECT EXISTING CUH SG.
14. INSTALL TRAP PRIMER AND ISOLATING VALVE TO COLD WATER. ROUTE 1/2" TO FLOOR DRAIN BELOW IN AUTOSHOP.
15. ENLARGE OPENING IN WALL FOR VU-1 INSTALLATION AND LOUVER PLACEMENT. INSTALL HEADER ACROSS OPENING. FLASH LOUVER TO EXISTING MATERIALS AS REQUIRED FOR WATER TIGHT INSTALLATION, CUT AND PATCH FINISH AS REQUIRED.

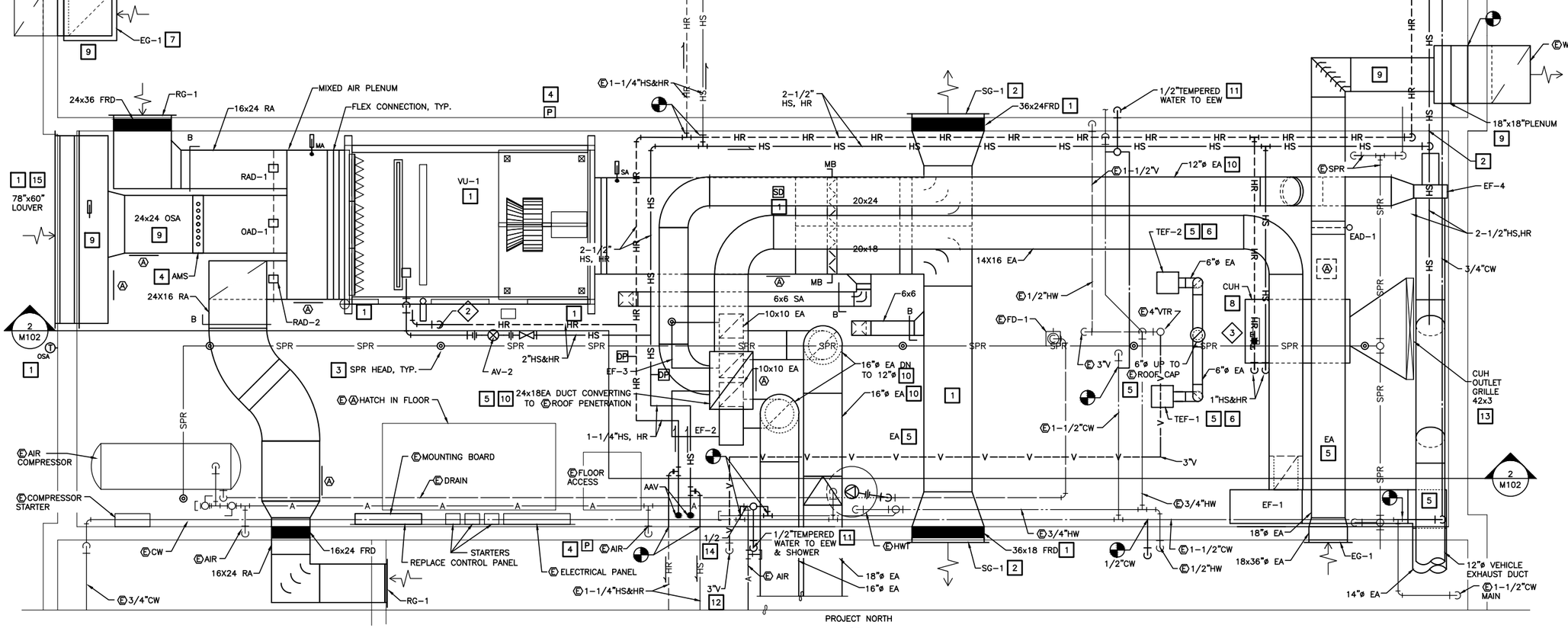
SHEET NOTES:

1. REMOVE ALL PNEUMATIC CONTROLS COMPONENTS AND REPLACE WITH DDC CONTROLS INTEGRATED WITH EXISTING SCHOOL DISTRICT DDC CONTROLS.
2. NO WORK ANTICIPATED TO THE SHOP COMPRESSED AIR SYSTEM. EXCEPT AIR COMPRESSOR CONNECTION TO PNEUMATIC CONTROLS WILL BE DEMOLISHED AND AIR COMPRESSOR CONNECTION CAPPED.
3. MEZZANINE FLOOR HAS EXTENSIVE WATER DAMAGE. FLOOR COVERING REQUIRED TO BE REMOVED AND REPLACED. ALL FINISHES IN MEZZANINE FAN ROOM TO BE PATCHED AND REPAIRED AND PAINTED. FOR BIDDING PURPOSES REMOVE AND REPLACE 200 SQFT OF 3/4"PLYWOOD. PRIME PAINT ENTIRE MEZZANINE FLOOR WITH MINIMUM TWO COATS.



2 VOCATIONAL SHOP BUILDING MECHANICAL MEZZANINE SECTION

SCALE: 0 1' 2' 4'



PROJECT NORTH

1 VOCATIONAL SHOP BUILDING MECHANICAL MEZZANINE PLAN

SCALE: 0 1' 2' 4'

STATE OF ALASKA
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SHEET TITLE:
VOCATIONAL SHOP BUILDING MECHANICAL MEZZANINE

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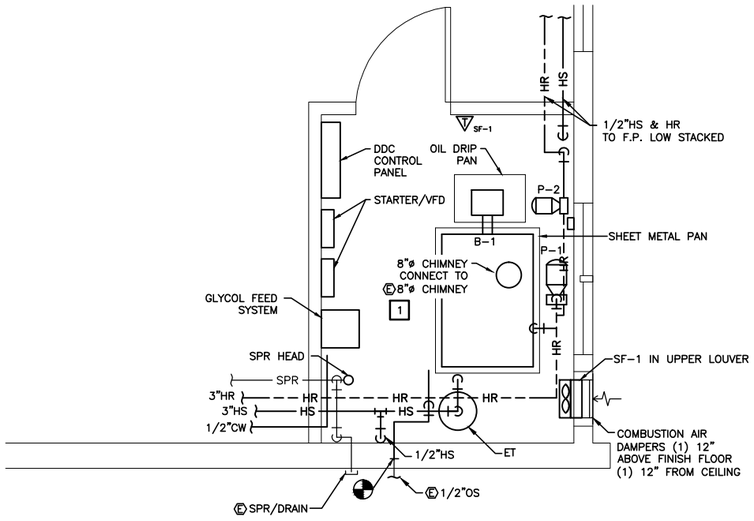
SHEET NO.
M102
JOB NO. M-463

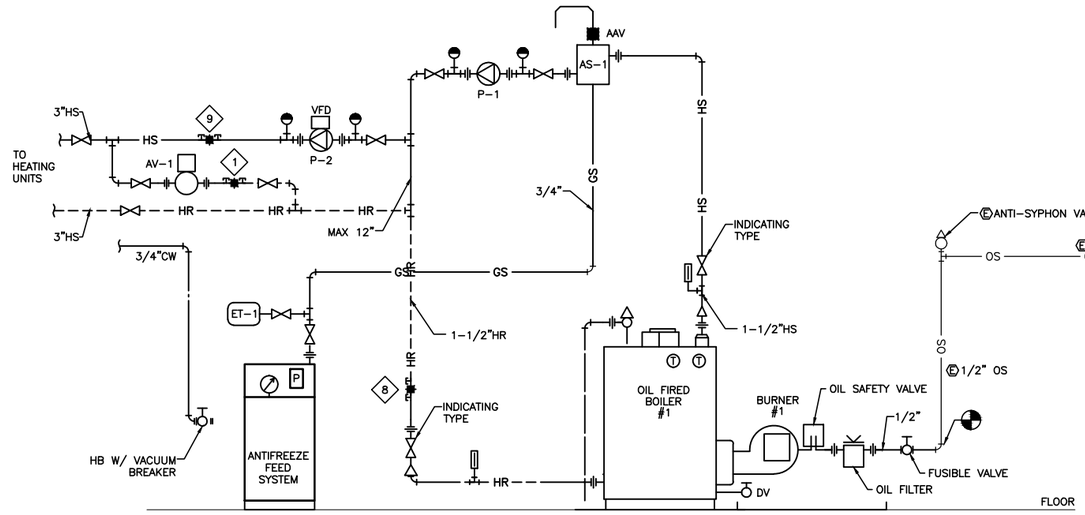
CONSTRUCTION NOTES:

1 PROVIDE NEW STORM COLLAR AT ROOF PENETRATION.



1 VOC-ED ENLARGED BOILER ROOM PLAN

NO SCALE



2 BOILER ROOM – PIPING DIAGRAM

NO SCALE

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SHEET TITLE:
ENLARGED BOILER ROOM PLAN

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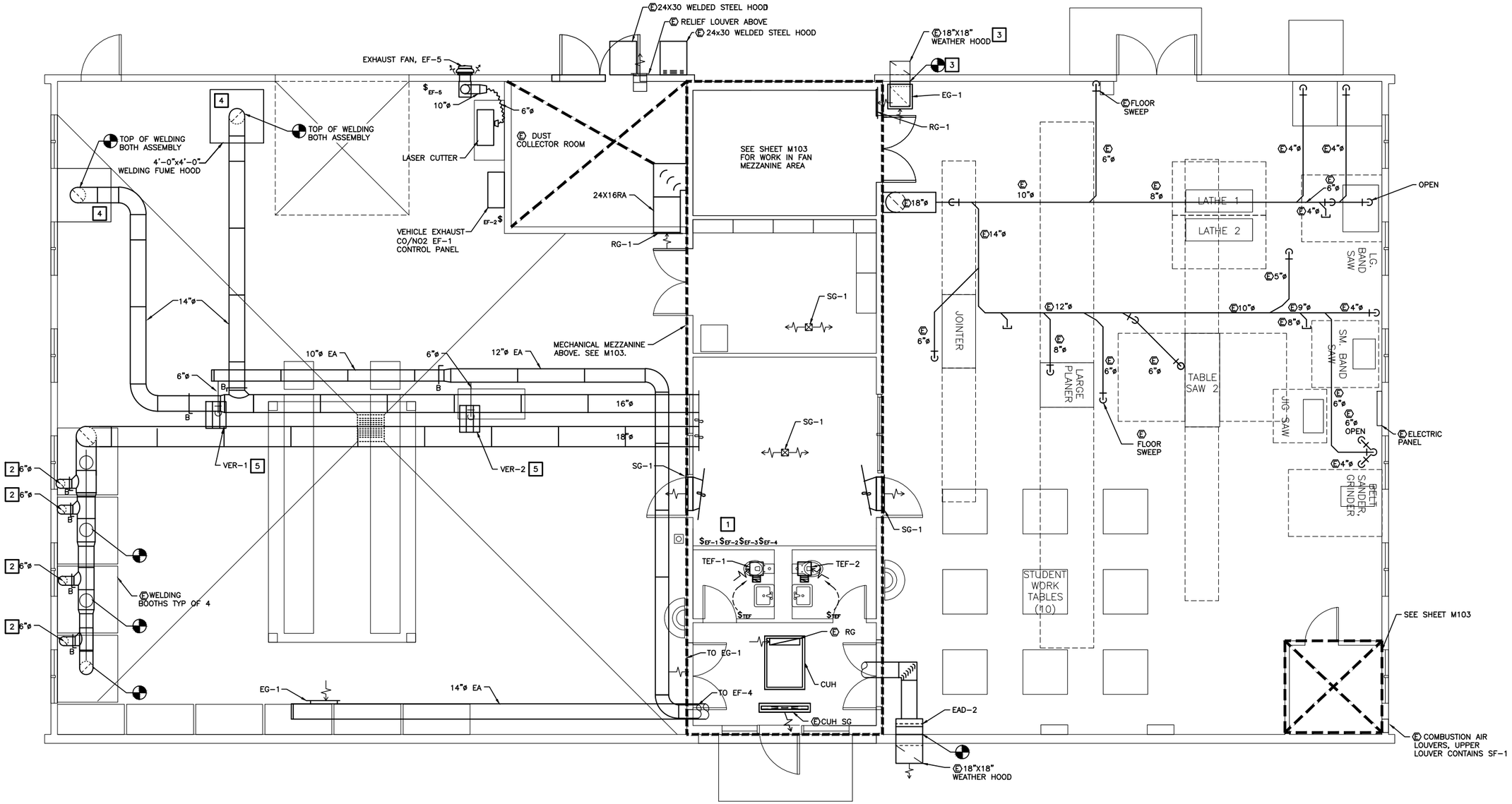
SHEET NO.
M103
JOB NO. M-463

CONSTRUCTION NOTES:

1. ON-OFF SWITCH CONTROL OF EXHAUST FANS IN MEZZANINE. LABEL ALL FANS.
2. INSTALL 6"ø TO 12" ABOVE WORK SURFACE AT APPROX. 4'-0" AFF.
3. EXISTING WEATHERHOOD WITH NEW ELBOW DOWN, APPROXIMATELY 5-FEET TO RELIEF GRILLE IN CEILING. INSTALL 18"x18" RELIEF AIR AUTOMATIC DAMPER IN DUCT. TIE DIFFERENTIAL PRESSURE TO DAMPER OPERATION.
4. INSTALL WELDING BOOTH STATION WITH FUME ARM.
5. INSTALL VEHICLE EXHAUST REEL TO CEILING STRUCTURE USING CHANNEL FRAMING.
6. REPLACE GRILLE. CUT, PATCH, AND PATCH TO MATCH.



1 VOCATIONAL SHOP BUILDING FIRST FLOOR DUCTWORK

SCALE: 0 2' 4' 8'

PROJECT NORTH

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SHEET TITLE:
VOCATIONAL SHOP BUILDING FIRST FLOOR DUCTWORK

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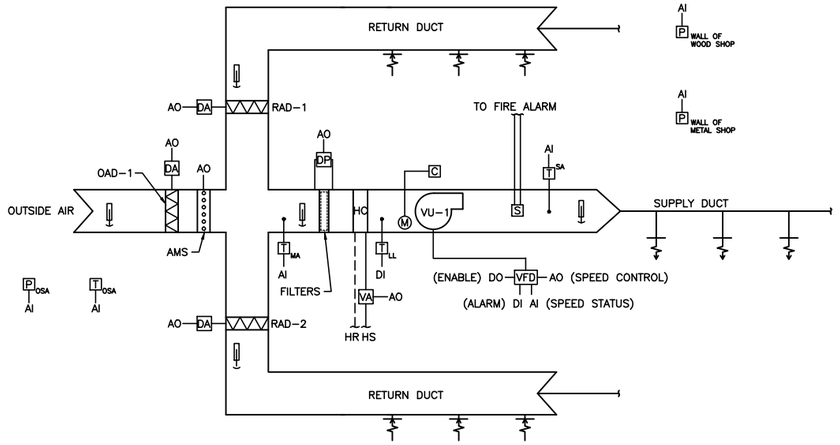
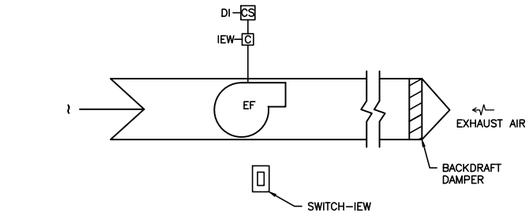
SHEET NO.
M201
JOB NO. M-463



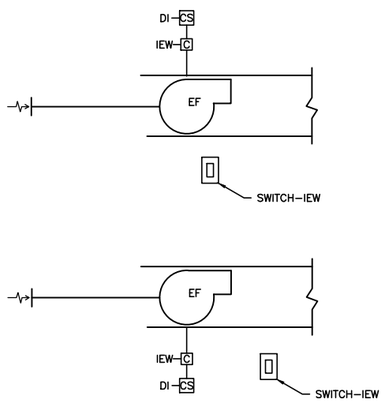
1 CONTROL SCHEMATIC FOR VU-1

NO SCALE



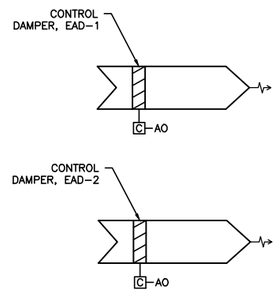
2 CONTROL SCHEMATIC FOR EF-4 (VEHICLE), EF-5 (LASER CUTTER)

NO SCALE



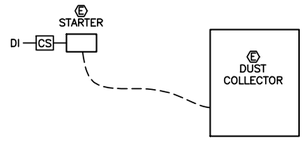
3 CONTROL SCHEMATIC FOR EF-2, EF-3 (WELDING)

NO SCALE



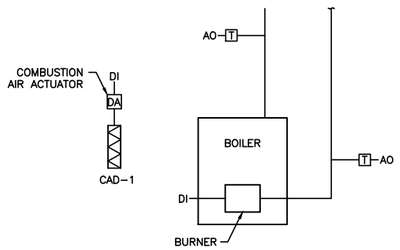
4 RELIEF/MAKEUP AIR DAMPERS

NO SCALE



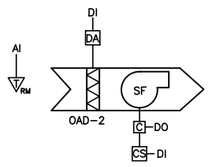
5 CONTROL SCHEMATIC FOR DUST COLLECTOR

NO SCALE



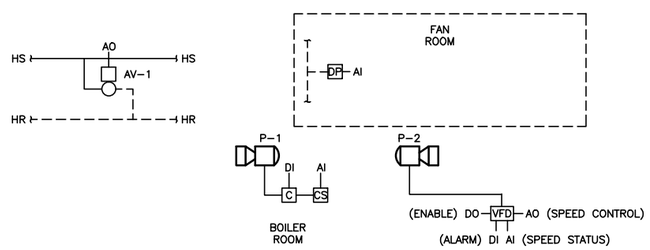
6 CONTROL SCHEMATIC FOR COMBUSTION AIR DAMPER

NO SCALE



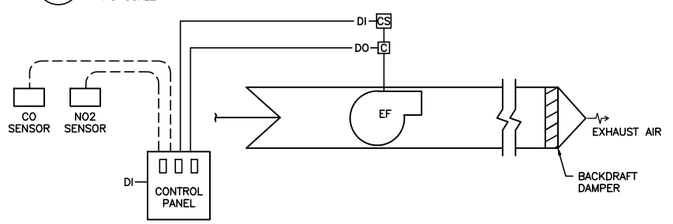
7 CONTROL SCHEMATIC FOR SF-1 (BOILER ROOM)

NO SCALE



8 P-1/P-2 CONTROL SCHEMATIC

NO SCALE



9 CONTROL SCHEMATIC FOR EF-1 (GENERAL DUTY)

NO SCALE

CONTROLS LEGEND

AMS	AIR MEASURING STATION	AHU	AIR HANDLING UNIT
C	CONTROLLER	AI	ANALOG INPUT
H	HUMIDITY	AMS	AIR MEASURING STATION
P	PRESSURE SENSOR	AO	ANALOG OUTPUT
S	SMOKE SENSOR	AV	AUTOMATIC VALVE
T	IMMERSION THERMOSTAT OR THERMOSTATIC SENSOR	B-1	BOILER
		BC	BOOSTER COIL
VA	VALVE ACTUATOR	CD	CARBON DIOXIDE SENSOR
DA	DAMPER ACTUATOR	COM	COMMON
F	FLOW SWITCH	CUH	CABINET UNIT HEATER
CD	CARBON DIOXIDE SENSOR	CV	CONVECTOR
DP	DIFFERENTIAL PRESSURE SENSOR	DHW	DOMESTIC HOT WATER HEATER
OS	OCCUPANCY SENSOR	DI	DIGITAL INPUT
CS	CURRENT SENSOR	DO	DIGITAL OUTPUT
FM	FLOW METER	EAD	EXHAUST AIR DAMPER
		EF	EXHAUST FAN
P	PUMP	EHWH	ELECTRIC HOT WATER HEATER
	ROOM THERMOSTAT	GSHR	GROUND SOURCE HEATING RETURN
	AIR DIRECTION	GSHS	GROUND SOURCE HEATING SUPPLY
	THERMOMETER	GSWS	GROUND SOURCE WATER SUPPLY
M	MOTOR	GSWR	GROUND SOURCE WATER RETURN
$	CONTROL SWITCH	HC	HEATING COIL
		HR	HEATING RETURN
		HS	HEATING SUPPLY
		HWR	HOT WATER RECIRCULATING
		HX	HEAT EXCHANGER
		LL	LOW LIMIT CONTROL
		MA	MIXED AIR
		NO	NORMALLY OPEN
		NC	NORMALLY CLOSED
		OAD	OUTSIDE AIR DAMPER
		OSA	OUTSIDE AIR
		P-1	PUMP
		RA	RETURN AIR
		RAD	RETURN AIR DAMPER
		RF	RETURN FAN
		SA	SUPPLY AIR
		SF	SUPPLY FAN
		TYP	TYPICAL
		UH	UNIT HEATER
		VFD	VARIABLE FREQUENCY DRIVE

GENERAL NOTES:

1. THE NOTES, DIAGRAMS, AND POINTS SHOWN HERE ARE SCHEMATIC ONLY. REFER TO SEQUENCE OF OPERATIONS, 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 DIAGRAMS, FOR RESPECTIVE ROOM THERMOSTAT SENSORS, IMMERSION THERMOSTAT, AND PRESSURE SENSOR LOCATIONS. SEE PLANS FOR OTHER CONTROL EQUIPMENT LOCATIONS. COORDINATE WITH DIVISION 21, 22, 23 AND 26 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. SEE DIVISION 26 FOR ADDITIONAL REQUIREMENTS CONCERNING RACEWAYS AND BOXES.

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HAINES SCHOOL DISTRICT

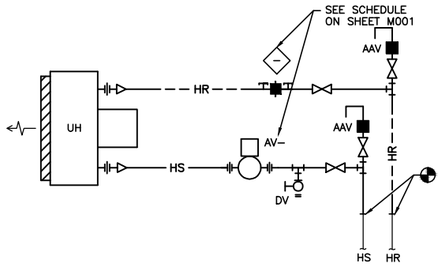
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
CONTROLS

SCALE:	AS SHOWN:
DATE:	MARCH 2015
DRAWN:	KB
DESIGNED:	BS
CHECKED:	DM

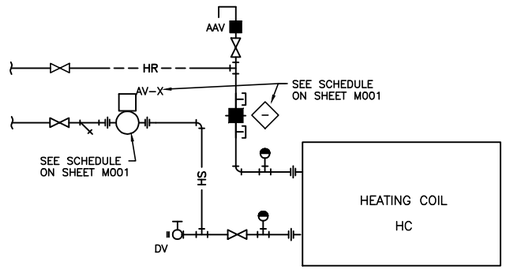
SHEET NO.
M401

JOB NO. M-463

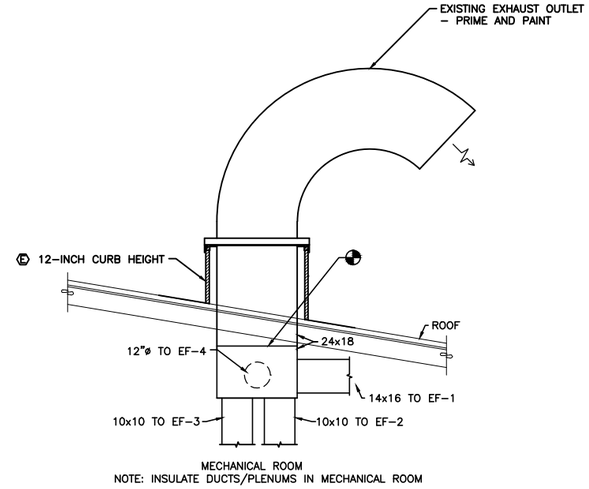


NOTE: CUH SIMILAR

1 UNIT HEATER DETAIL
NO SCALE

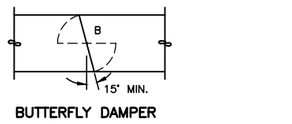


2 HEATING COIL DETAIL
NO SCALE

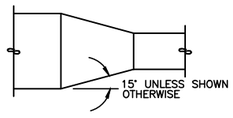


NOTE: INSULATE DUCTS/PLENUMS IN MECHANICAL ROOM

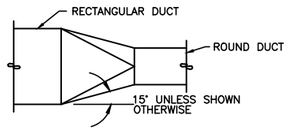
3 EXHAUST AIR OUTLET DETAIL
NO SCALE



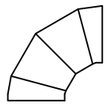
BUTTERFLY DAMPER



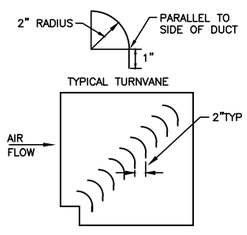
TRANSITION



RECTANGULAR TO ROUND TRANSITION

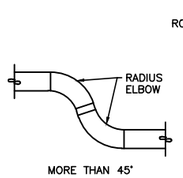


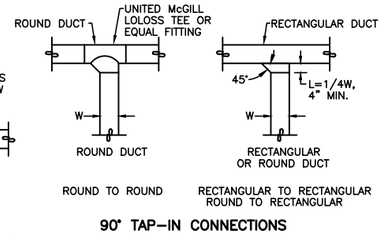
FOUR PIECE ELBOW



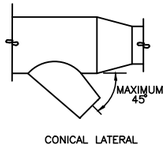
RECTANGULAR MITER ELBOW

RECTANGULAR DUCTS



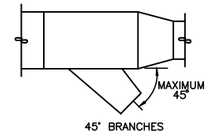


90° TAP–IN CONNECTIONS

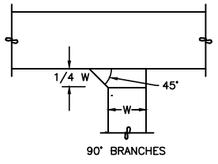


CONICAL LATERAL

BRANCH DUCT CONNECTIONS



45° BRANCHES

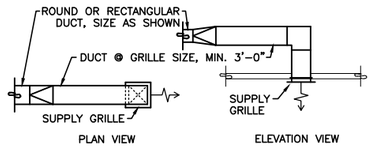


RECTANGULAR DUCTS

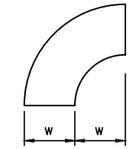
BRANCH DUCT CONNECTIONS

ROUND DUCTS

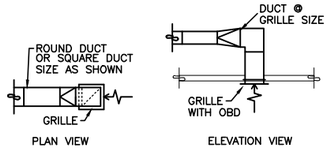
RECTANGULAR AND ROUND DUCTS



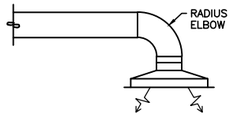
SUPPLY GRILLE CONNECTIONS



RADIUS ELBOW



RETURN/EXHAUST CEILING GRILLE CONNECTIONS



SUPPLY DIFFUSER

NOTE: ALL DUCTWORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THESE DETAILS AND THE SPECIFICATIONS.

4 DUCT CONSTRUCTION DETAILS
NO SCALE

STATE OF ALASKA
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HAINES SCHOOL DISTRICT
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
DETAILS

SCALE:	AS SHOWN:
DATE:	MARCH 2015
DRAWN:	KB
DESIGNED:	BS
CHECKED:	DM

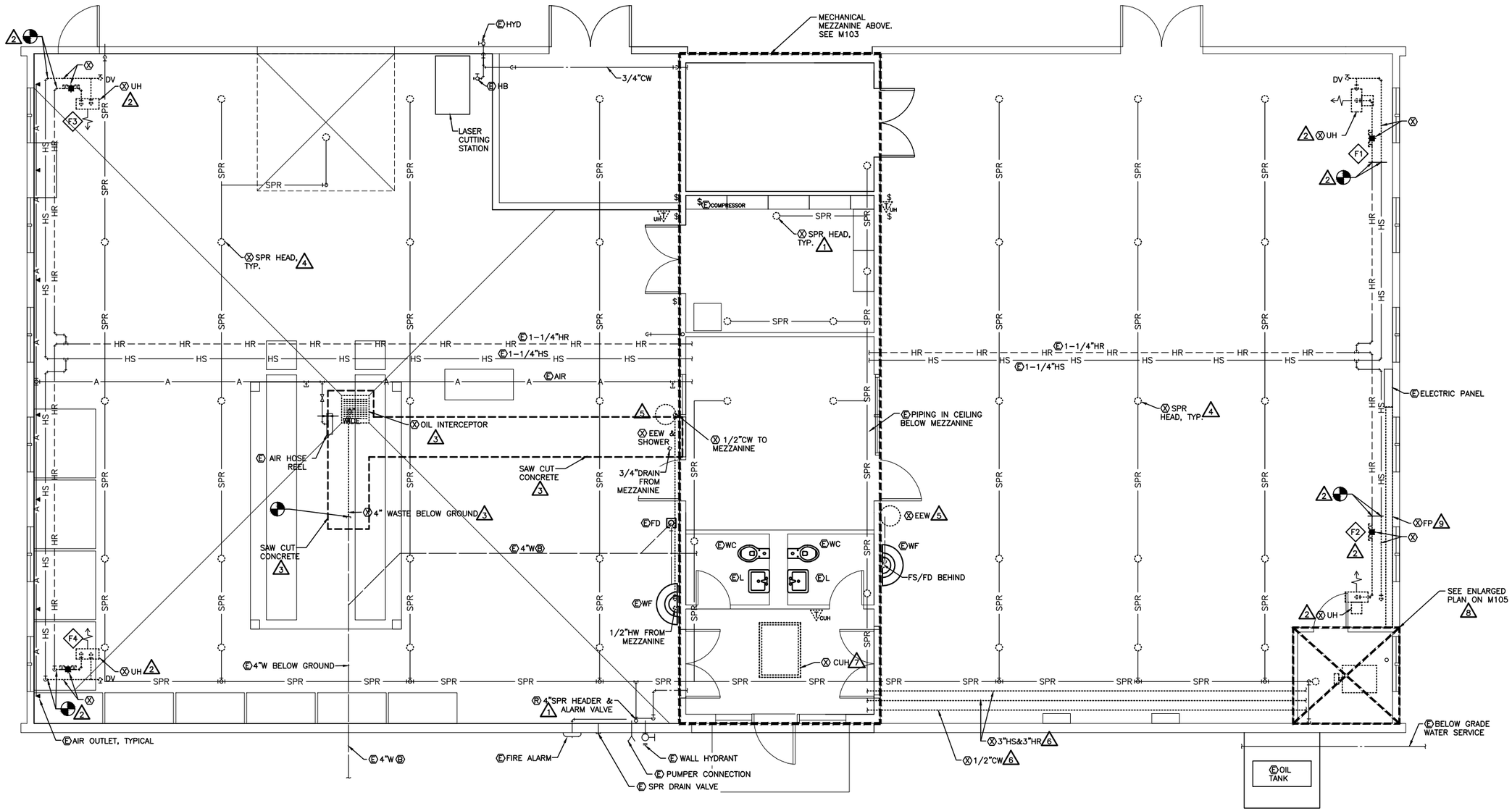
SHEET NO.
M501
JOB NO. M–463

SHEET NOTES:

1. REMOVE ALL PNEUMATIC CONTROL COMPONENTS, PNEUMATIC TUBING, AND REPLACE WITH DDC TYPE CONTROLS COMPATIBLE WITH EXISTING SCHOOL DISTRICT CONTROL SYSTEM.

DEMOLITION NOTES:

1. MODIFY EXISTING SPRINKLER HEADER. INSTALL REDUCED 4"SIZE PRESSURE BACK FLOW PREVENTER, (2) TAMPER SWITCHES ON ISOLATION VALVES, EXISTING FLOW SWITCH, AND FIRE ALARM APPURTENANCES.
2. REMOVE AND REPLACE UNIT HEATERS. DEMOLISH PIPING BACK TO CONNECTION POINT SHOWN. INSTALL NEW FLOWSETTERS, CONTROL VALVES, ISOLATION VALVES, AND APPURTENANCES.
3. REMOVE AND REPLACE OIL WATER SEPARATOR. CAP CONNECTION TO SANITARY SEWER BELOW GRADE. INSTALL NEW OIL WATER SEPARATOR. OIL WATER SEPARATOR WILL BE AN ENCLOSED, VENTED TANK. SAWCUTING AND EXCAVATION WILL BE REQUIRED FOR THE INSTALLATION OF THE OIL WATER SEPARATOR, VENT, AND WASTE.
4. REMOVE AND REPLACE ALL SPRINKLER HEADS.
5. REMOVE AND REPLACE EMERGENCY EYEWASH AND EYEWASH/SHOWER COMBINATION UNITS. NEW UNITS TO BE INSTALLED WITH WATER TEMPERING MEANS TO TEMPER OUTLET WATER TO 80°F AS REQUIRED BY OSHA REGULATIONS. UNIT SHALL BE ADA COMPLIANT.
6. REMOVE 3" HS&HR MAINS, AND 1/2"CW TO BOILER ROOM AT CEILING. PREPARE FOR INSTALLATION OF NEW HEATING MAINS AND COLD WATER FEED TO BOILER. NEW MAINS WILL BE 3 INCH HS, HR, AND 3/4"CW.
7. REMOVE AND REPLACE CUH. REMOVE ASSOCIATED DUCTWORK, HEATING PIPING, AND CONTROLS. MAJORITY IS IN THE FAN ROOM ABOVE. PREPARE FOR INSTALLATION OF NEW CUH. CLEAN SG & RG, REUSE.
8. FOR WORK IN BOILER ROOM SEE SHEET M103.
9. REMOVE AND REPLACE FINNED PIPE, ASSOCIATED PIPING, AND CONTROLS.



1 VOCATIONAL SHOP BUILDING FIRST FLOOR PIPING – DEMO

SCALE: 0 2' 4' 8'

PROJECT NORTH

STATE OF ALASKA
DOUGLAS H. MURRAY
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MECHANICAL ENGINEER
ISSUE DATE: 03/02/2015

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
VOCATIONAL SHOP BUILDING FIRST FLOOR PIPING - DEMO

SCALE:	AS SHOWN:
DATE:	MARCH 2015
DRAWN:	KB
DESIGNED:	BS
CHECKED:	DM

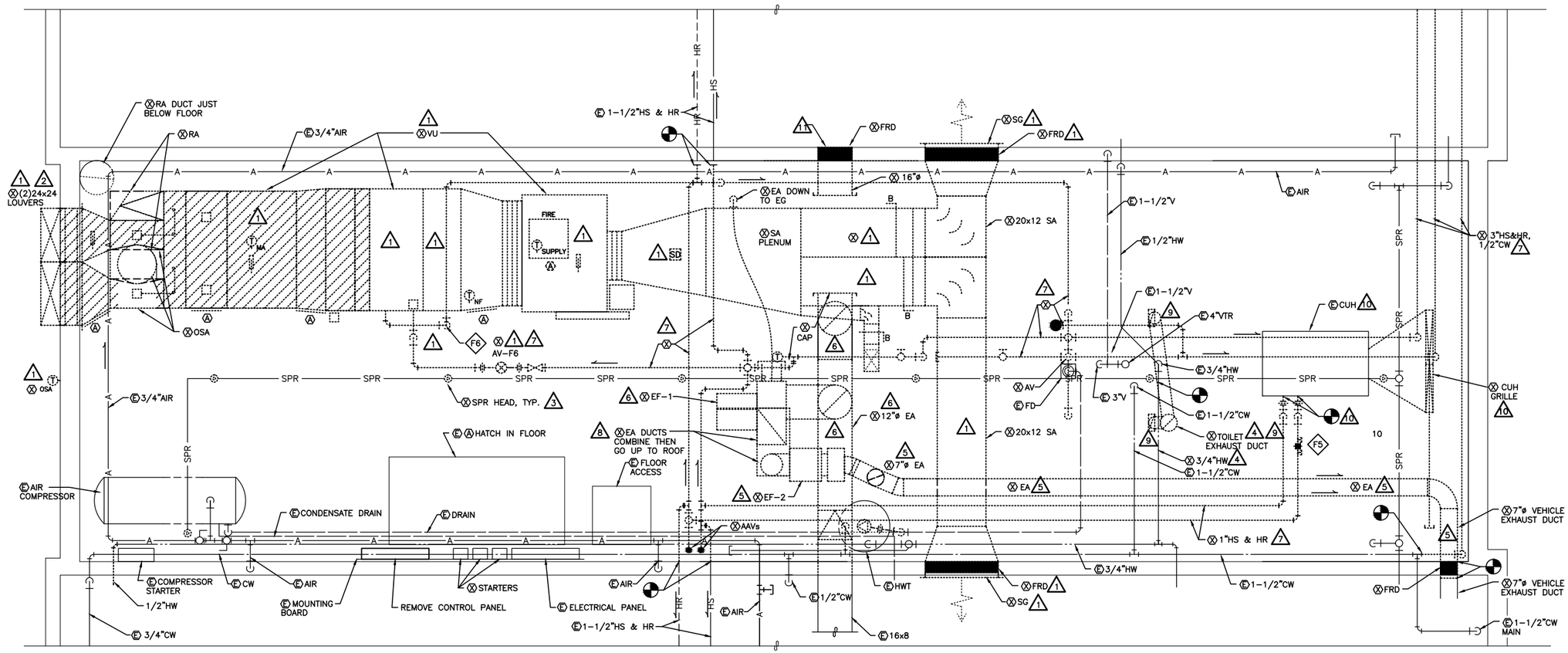
SHEET NO.
MD101
JOB NO. M-463

SHEET NOTES:

1. REMOVE ALL PNEUMATIC CONTROLS COMPONENTS AND REPLACE WITH DDC CONTROLS INTERGRATED WITH EXISTING SCHOOL DISTRICT DDC CONTROLS.
2. NO WORK ANTICIPATED TO THE SHOP COMPRESSED AIR SYSTEM. EXCEPT AIR COMPRESSOR CONNECTION TO PNEUMATIC CONTROLS WILL BE DEMOLISHED AND AIR COMPRESSOR CONNECTION CAPPED.
3. ACM ABATEMENT REQUIRED FOR DEMOLITION THIS AREA. COORDINATE ABATEMENT WORK WITH HAZARDOUS MATERIAL DRAWINGS SPECIFICATION.
4. MEZZANINE FLOOR HAS EXTENSIVE WATER DAMAGE. FLOOR COVERING REQUIRED TO BE REMOVED AND REPLACED. ALL FINISHES IN MEZZANINE FAN ROOM TO BE PATCHED AND REPAIRED AND PAINTED. FOR BIDDING PURPOSES REMOVE AND REPLACE 200 SQFT OF 3/4"PLYWOOD. PRIME PAINT ENTIRE MEZZANINE FLOOR WITH MINIMUM TWO COATS.

DEMOLITION NOTES:

1. REMOVE VU SYSTEM. SYSTEM INCLUDES, VU AIR HANDLING UNIT SECTIONS, DUCTWORK, FIRE SMOKE DAMPERS, HEATING COIL, CONTROLS, THERMOMETERS, ASSOCIATED PIPING, AND HANGERS AND SUPPORTS.
2. REMOVE AND REPLACE OSA LOUVER. CUT AND PATCH FINISHES AS REQUIRED,
3. REMOVE ALL SPRINKLER HEADS IN AREA.
4. REMOVE AND REPLACE ALL EXHAUST AIR DUCTWORK TO UNDERSIDE OF ROOF. REVISE EA CAPS. CLEAN EA AND CAP.
5. REMOVE EF-2 SYSTEM. SYSTEM INCLUDES DUCTWORK IN THE FAN ROOM, CONTROLS, AND ROOF CAP.
6. REMOVE EF-1 SYSTEM. SYSTEM INCLUDES CONTROLS, DUCTWORK, ROOF CAP. PREPARE FOR INSTALLATION OF NEW EF-1 SYSTEM.
7. REMOVE ALL HEATING SUPPLY AND RETURN PIPING IN FAN ROOM.
8. REMOVE AND REPLACE ALL EXHAUST AIR DUCTWORK AND ROOF CAPS. PREPARE ROOF CURBS AND PENETRATIONS FOR INSTALLATION OF NEW CAPS AND EXAUST AIR DUCTWORK.
9. REMOVE AND REPLACE TOILET EXHAUST FAN SYSTEMS. SYSTEM INCLUDES TEF, GRILLES, DUCTWORK, AND CONTROLS. PREPARE FOR INSTALLATION OF NEW TEF SYSTEM. CUT AND PATCH FINISHES AS REQUIRED.
10. REMOVE HEATING PIPING, VALVES, UNIONS, AND TRIM TO CUH. CLEAN CUH AND REUSE.
11. CAP PENETRATION.



1 VOCATIONAL SHOP BUILDING MECHANICAL MEZZANINE – DEMOLITION

SCALE: 0 1' 2' 4'

PROJECT NORTH

STATE OF ALASKA — 19th — DOUGLAS H. MURRAY — ME 7870 — MECHANICAL ENGINEER — PROFESSIONAL ENGINEER

ISSUE DATE: 03/02/2015

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

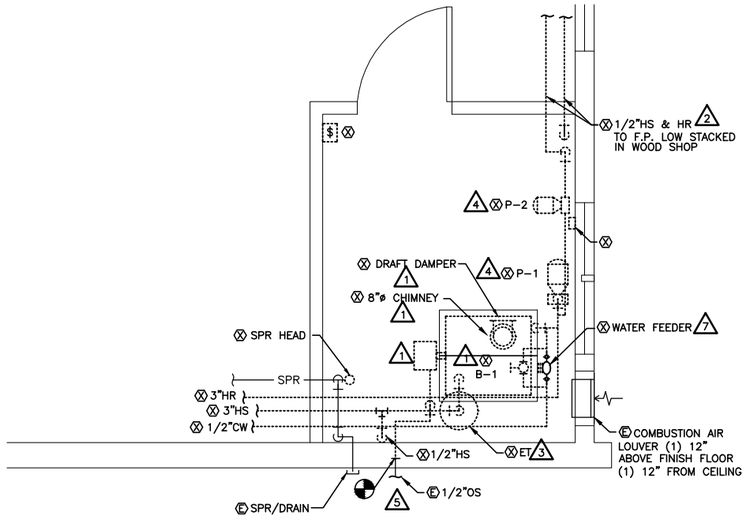
SHEET TITLE:
VOCATIONAL SHOP BUILDING MECHANICAL MEZZANINE - DEMOLITION

SCALE:	AS SHOWN:
DATE:	MARCH 2015
DRAWN:	KB
DESIGNED:	BS
CHECKED:	DM

SHEET NO.
MD102
JOB NO. M-463

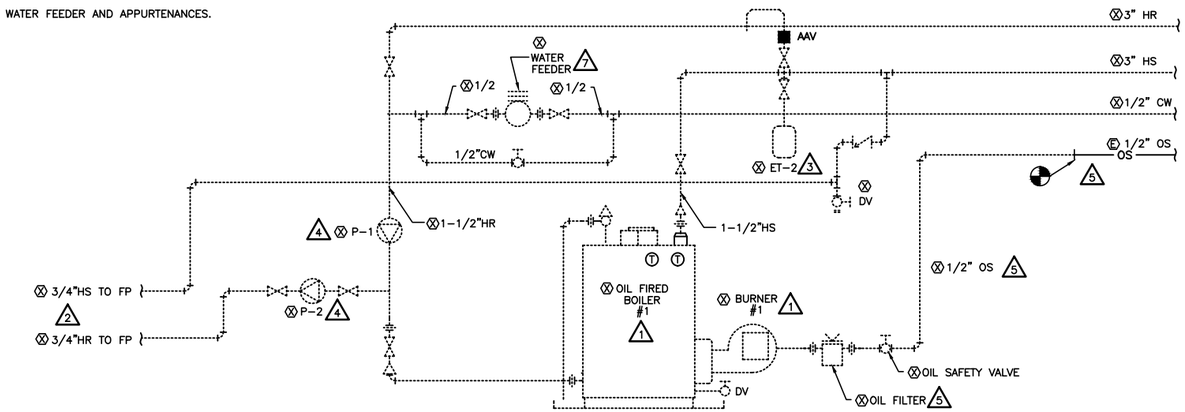
DEMOLITION NOTES:

1. REMOVE BOILER, BURNER. REMOVE CHIMNEY ONLY TO CONNECTION WITH DOUBLE WALL CHIMNEY AT THE CEILING.
2. REMOVE 1/2"HEATING SUPPLY AND RETURN TO LOW FINNED PIPE IN WOOD SHOP.
3. REMOVE AND REPLACE EXPANSION TANK.
4. REMOVE PUMPS P-1 AND P-2, STARTERS AND CONTROLS.
5. REMOVE OIL PIPING TO EXTERIOR WALL, OIL FILTER, AND OIL SAFETY FUSIBLE VALVE. CONNECTION TO OIL PIPING AT PIPE PENETRATION THROUGH WALL.
6. REMOVE WATER FEEDER AND APPURTENANCES.



2 VOC-ED ENLARGED BOILER ROOM PLAN - DEMO

NO SCALE



2 BOILER ROOM - PIPING DIAGRAM - DEMO

NO SCALE

STATE OF ALASKA
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ISSUE DATE: 03/02/2015

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
HEATING PIPING DIAGRAM

SCALE:	AS SHOWN:
DATE:	MARCH 2015
DRAWN:	KB
DESIGNED:	BS
CHECKED:	DM

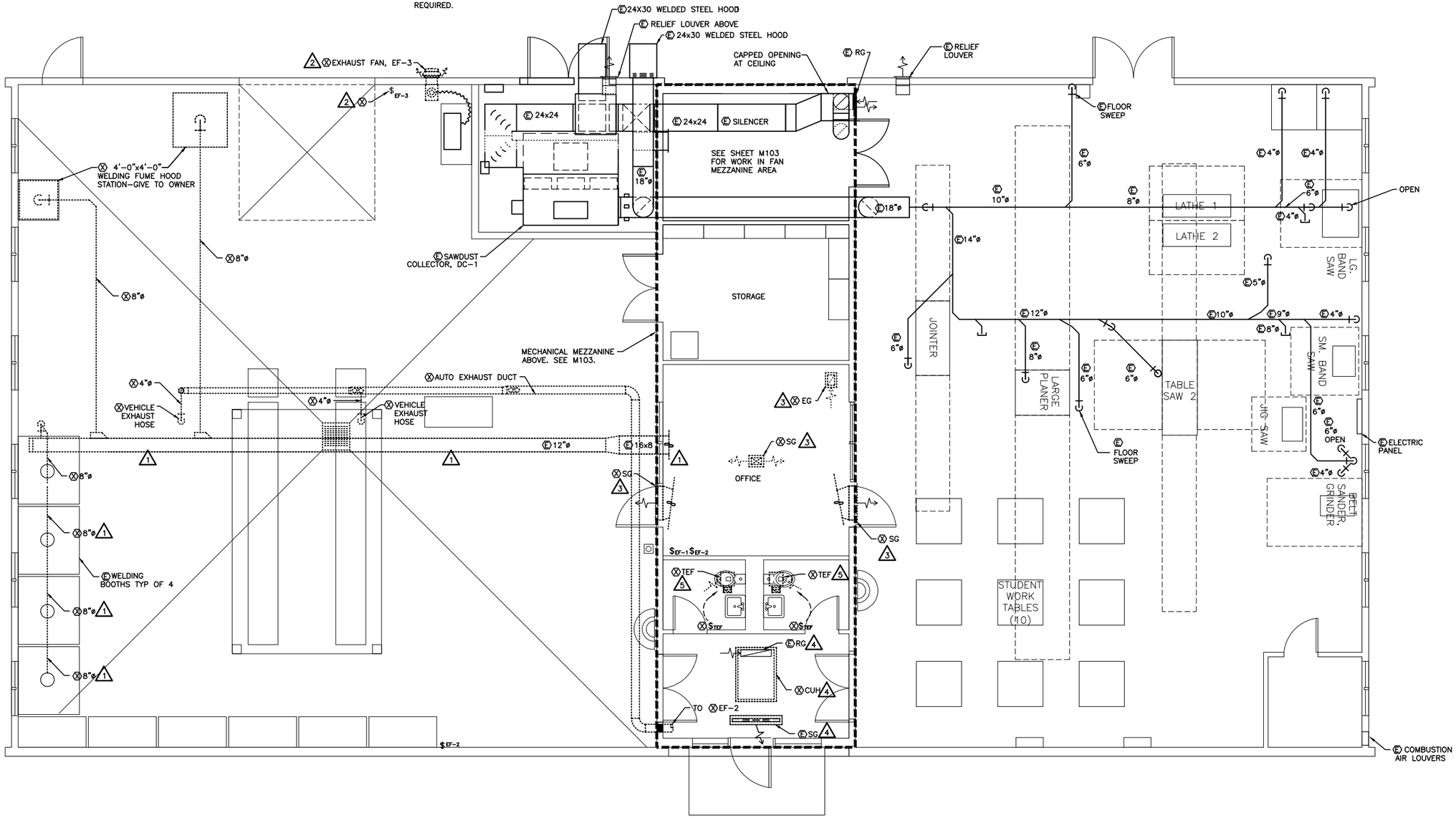
SHEET NO.
MD103
JOB NO. M-463

SHEET NOTES:

1. NO WORK ANTICIPATED FOR SAWDUST COLLECTION SYSTEM.
2. REMOVE ALL PNEUMATIC CONTROLS COMPONENTS AND REPLACE WITH DDC CONTROLS INTEGRATED WITH EXISTING SCHOOL DISTRICT DDC CONTROLS.
3. ACM ABATEMENT REQUIRED FOR DEMOLITION THIS AREA. COORDINATE ABATEMENT WORK WITH HAZARDOUS MATERIALS SPECIFICATION AND PLANS.

DEMOLITION NOTES:

1. REMOVE WELDING EXHAUST DUCTWORK.
2. REMOVAL AND REPLACE EF-3 AND DUCTWORK TO LASER CUTTER.
3. REMOVE AND REPLACE GRILLES. CUT AND PATCH FINISHES FOR REMOVAL AND INSTALLATION OF NEW SUPPLY GRILLES AND RETURN GRILLES.
4. REMOVE AND REPLACE CABINET UNIT HEATER. REMOVE ALL DUCTWORK, AND APPURTENANCES. CLEAN SG & RG, REUSE.
6. REMOVE AND REPLACE TOILET EXHAUST FANS. REMOVE GRILLE, SWITCHES, DUCTWORK, AND APPURTENANCES. CUT AND PATCH FINISHES AS REQUIRED.



1 VOCATIONAL SHOP BUILDING FIRST FLOOR DUCTWORK – DEMO

SCALE: 0 2' 4' 8'

PROJECT NORTH

STATE OF ALASKA — 49th — DOUGLAS H. MURRAY — ME 7870 — MECHANICAL PROFESSIONAL ENGINEER
ISSUE DATE: 03/02/2015

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
VOCATIONAL SHOP BUILDING FIRST FLOOR DUCTWORK - DEMO

SCALE:	AS SHOWN:
DATE:	MARCH 2015
DRAWN:	KB
DESIGNED:	BS
CHECKED:	DM

SHEET NO.
MD201
JOB NO. M-463

LEGEND

NOTE: ALL DEVICE HEIGHTS TO CENTER, UON.

ABBREVIATIONS:

ACH	ABOVE CABINET HEIGHT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
FACP	FIRE ALARM CONTROL PANEL
HOA	HAND–OFF–AUTO
LV	LOW VOLTAGE
M.B.	MOUNTING BOARD
UON	UNLESS OTHERWISE NOTED
WP	WEATHERPROOF
NS	NON–SWITCHED

DIAGRAM SYMBOLS:

- CIRCUIT BREAKER
- GROUND BUS
- GROUND ROD

POWER:

- SINGLE RECEPTACLE
- DUPLEX RECEPTACLE
- DOUBLE DUPLEX RECEPTACLE
- RECEPTACLE RACEWAY
- SPECIAL RECEPTACLE
- EQUIPMENT CONNECTION
- PUSH BUTTON
- JUNCTION BOX
- CONDULET OR CONDUIT BODY
- MOTOR CONNECTION
- MOTOR STARTER
- MANUAL STARTER
- HAND–OFF–AUTO CONTROL SWITCH
- THERMOSTAT, 46" AFF
- PANELBOARD

LIGHTING:

- SURFACE OR SUSPENDED LINEAR LUMINAIRE (LED OR FLUORESCENT)
- LUMINAIRE, EQUIP WITH EMERGENCY BATTERY PACK
- WALL MOUNTED LUMINAIRE (LED, OR FLUORESCENT)
- WALL MOUNTED EXIT LUMINAIRE
- LED OR FLUORESCENT STRIP LUMINAIRE
- EXTERIOR WALL MOUNTED LUMINAIRE

LIGHTING CONTROLS:

- S — SINGLE POLE SWITCH
- S_D — DIMMER SWITCH
- W — OCCUPANCY SENSOR: W=WALL SWITCH, U=ULTRASONIC, D=DUAL TECH

FIRE ALARM:

- CABINET
- SMOKE DETECTOR
- THERMAL DETECTOR
- DUCT DETECTOR
- MANUAL PULL STATION
- FIRE ALARM HORN/STROBE
- FIRE ALARM STROBE ONLY
- SPRINKLER FLOW SWITCH
- SPRINKLER TAMPER SWITCH

NETWORK DEVICES:

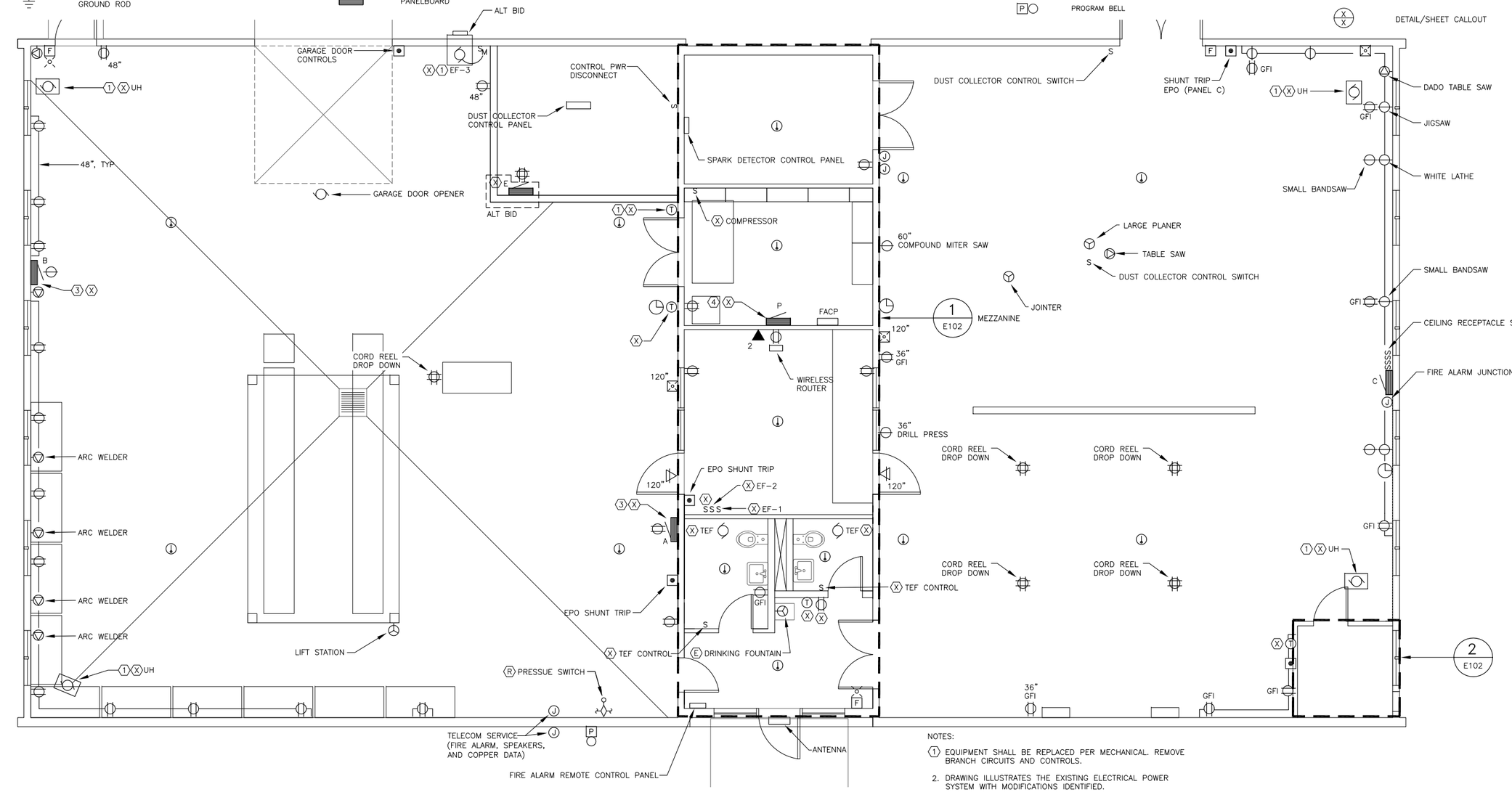
- DATA
- TELEPHONE
- CLOCK RECEPTACLE
- WALL SPEAKER
- PROGRAM BELL

CONDUIT & CONDUCTORS:

- HOME RUN
- CONDUIT: 1/2" UON.
- UNGROUNDED CONDUCTORS (#12 AWG)
- NEUTRAL: #10 WITH DOT, #12 OTHERWISE
- GROUND CONDUCTOR
- CONDUCTORS NOT SHOWN WHERE ONLY #12 NEUTRAL AND UNGROUNDED CONDUCTOR ARE REQUIRED
- FLEXIBLE CONDUIT

SHEET NOTE SYMBOLS:

- (E) EXISTING TO REMAIN
- (N) NEW
- (R) RELOCATE EXISTING
- (X) REMOVE EXISTING
- (X/X) DETAIL/SHEET CALLOUT



NOTES:

1. EQUIPMENT SHALL BE REPLACED PER MECHANICAL. REMOVE BRANCH CIRCUITS AND CONTROLS.
2. DRAWING ILLUSTRATES THE EXISTING ELECTRICAL POWER SYSTEM WITH MODIFICATIONS IDENTIFIED.
3. REPLACE PANELBOARD AND FEEDER CONDUCTORS.
4. REPLACE PANELBOARD.

1 / E101 FIRST FLOOR PLAN – EXISTING POWER/SIGNAL

1/4" = 1'–0"

GRAPHICAL SCALE IN FEET 0 5 10

102-66 STATE OF ALASKA 10th B.C. HAIGHT EE 4800 REGISTERED PROFESSIONAL 27FEB2015

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:

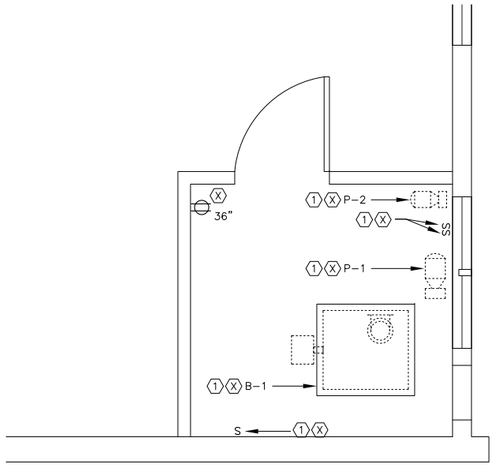
LEGEND & EXISTING FLOOR PLAN POWER/SIGNAL

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.

E101

JOB NO. M–463

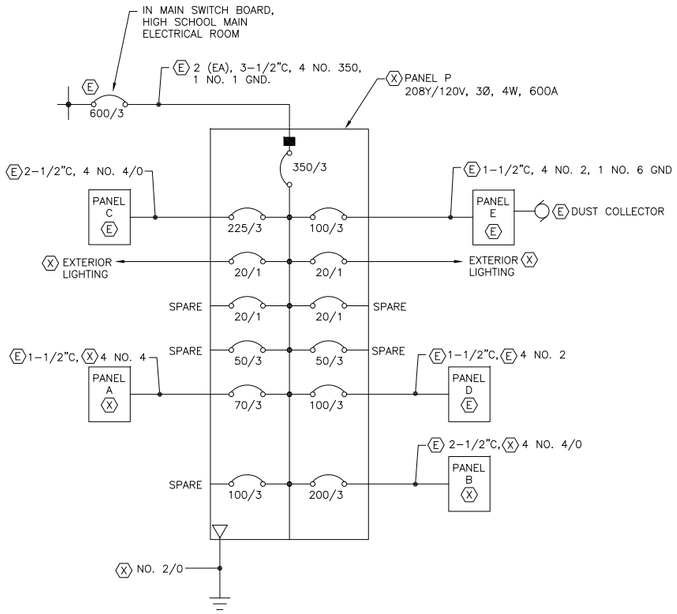


NOTE:

1. (1) EQUIPMENT SHALL BE REPLACED PER MECHANICAL. REMOVE BRANCH CIRCUITS AND CONTROLS.
2. REMOVE EXISTING LUMINAIRES, LIGHTING CONTROLS, CONDUITS AND FEEDERS.
3. DRAWING ILLUSTRATES THE EXISTING ELECTRICAL POWER SYSTEM WITH MODIFICATIONS IDENTIFIED.

2 E102 ENLARGED BOILER ROOM PLAN – EXISTING POWER

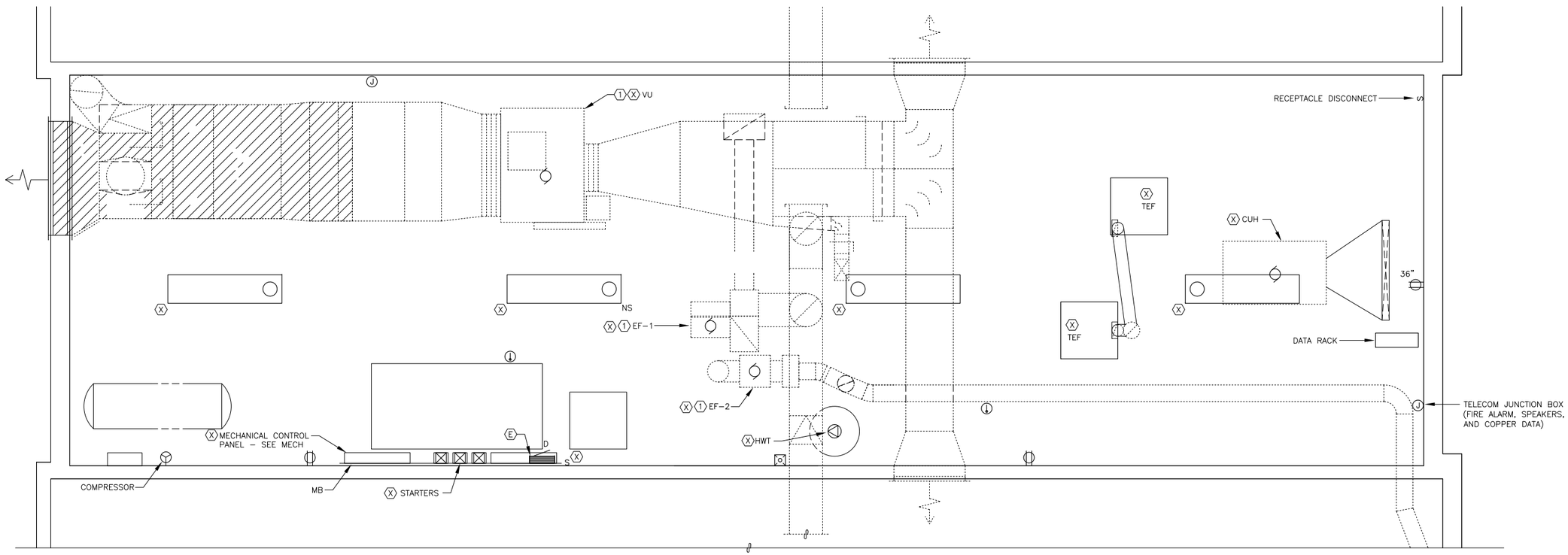
1/2" = 1'-0"



3 E102 SINGLE LINE DIAGRAM – EXISTING POWER DISTRIBUTION

NO SCALE

GRAPHICAL SCALE IN FEET
0 1 2 3 4 5



1 E102 MECHANICAL MEZZANINE FLOOR PLAN – EXISTING POWER/SIGNAL

1/2" = 1'-0"

GRAPHICAL SCALE IN FEET
0 1 2 3 4 5

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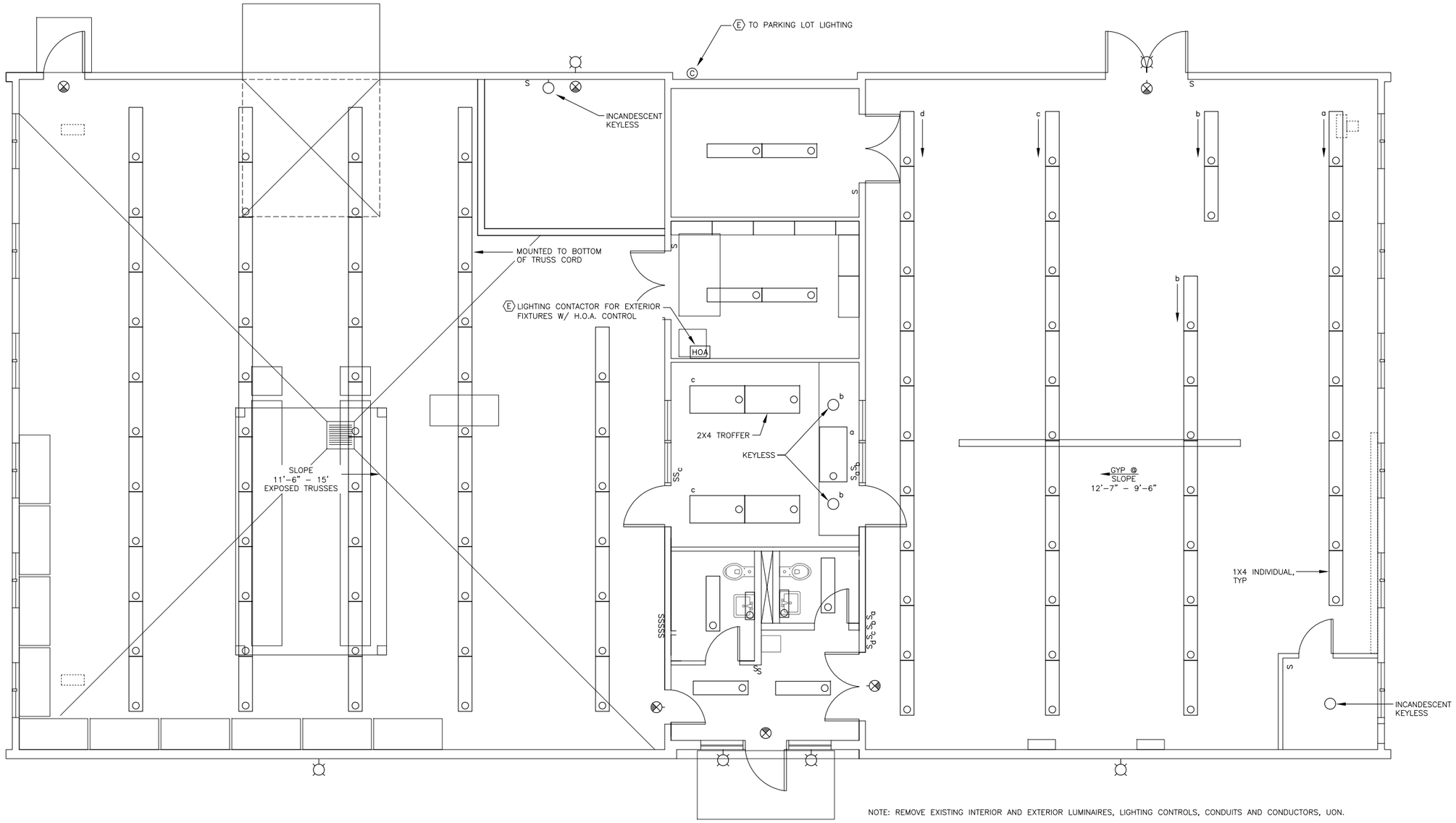
HAINES SCHOOL DISTRICT
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
EXISTING ENLARGED FLOOR PLANS POWER/SIGNAL

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.
E102
JOB NO. M-463



NOTE: REMOVE EXISTING INTERIOR AND EXTERIOR LUMINAIRES, LIGHTING CONTROLS, CONDUITS AND CONDUCTORS, UON.

1 / E101 FIRST FLOOR PLAN – EXISTING LIGHTING

1/4" = 1'-0"

GRAPHICAL SCALE IN FEET

0 5 10

102-66
STATE OF ALASKA
B.C. HAIGHT
EE 4801
27FEB2015

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
EXISTING FLOOR PLAN LIGHTING

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.
E103
JOB NO. M-463

PANEL A (X)

SIZE	VOLTS/PHASE	MAIN	LOCATION	MOUNT
100 AMPS	208Y/120V, 3 PH	MLO	AUTO SHOP	RECESSED

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	AØ	BØ	CØ	CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	ROOM 05 LTG	20/1	0.0	0.0			0.0	20/1	ROOM 07 LTG	2
3	ROOM 05	20/1	0.0		0.0		0.0	20/1	ROOM 07	4
5	ROOM 05	20/1	0.0			0.0	0.0	20/1	ROOM 07	6
7	ROOM 05	20/1	0.0	0.0			0.0	20/1	ROOM 07	8
9	ROOM 05	20/1	0.0		0.0		0.0	20/1	LTG ROOM 01, 02, 03 & TEF	10
11	ROOM 04, 06, 08 (O)	20/1	0.0			0.0	0.0	20/1	ROOM 04, 06, 08 LTG	12
13	ROOM 04, 05 (GFI)	20/1	0.0	0.0			0.0	20/1	HAND WASH SINK (O)	14
15	ROOM	20/1	0.0		0.0		0.0	20/1		16
17	DRINKING FOUNTAIN (GFI)	15/1	0.0			0.0	0.0	20/1		18
19			0.0	0.0			0.0			20
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

PANEL B (X)

SIZE	VOLTS/PHASE	MAIN	LOCATION	MOUNT
200 AMPS	208Y/120V, 3 PH	MLO	AUTO SHOP	SURFACE

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	AØ	BØ	CØ	CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	SPARE	15/3	0.0	0.0			0.0	15/3	SPARE	2
3	-----	--	0.0		0.0		0.0	--	-----	4
5	-----	--	0.0			0.0	0.0	--	-----	6
7	SPARE	60/2	0.0	0.0			0.0	50/2		8
9	-----	--	0.0		0.0		0.0	--	-----	10
11	BLANK	50/2	0.0			0.0	0.0	50/2		12
13	-----	--	0.0	0.0			0.0	--	-----	14
15	BLANK	50/2	0.0		0.0		0.0	20/1	WIRE MOLD RECEPTACLE #5	16
17	-----	--	0.0			0.0	0.0	20/1	WIRE MOLD RECEPTACLE #5	18
19		20/1	0.0	0.0			0.0	20/1	WIRE MOLD RECEPTACLE #5	20
21	WIRE MOLD RECEPTACLE #5 WITH EXHAUST FAN	20/1	0.0		0.0		0.0	20/1	WIRE MOLD RECEPTACLE #5 & DOOR OPENER	22
23	20 AMP DEDICATED OUTLET	20/1	0.0			0.0	0.0	20/1	WIRE MOLD RECEPTACLE #5 & LATHE	24
25	WIRE MOLD RECEPTACLES #5	20/1	0.0	0.0			0.0	20/1	SPARE	26
27	WIRE MOLD RECEPTACLES #5	20/1	0.0		0.0		0.0	20/1	SHUNT TRIP (GFI)	28
29	POWER REEL RECEPTACLE (GFI)	20/1	0.0			0.0	0.0	20/1	SPARE (GFI)	30
31	OUTLET (GFI)	20/1	0.0	0.0			0.0	20/1	WIRE MOLD RECEPTACLE #5 (GFI)	32
33	SPARE (GFI)	20/1	0.0		0.0		0.0	20/1	(GFI)	34
35	(GFI)	20/1	0.0			0.0	0.0	20/1	(GFI)	36
37			0.0	0.0			0.0	20/1		38
39			0.0		0.0		0.0	20/1		40
41			0.0			0.0	0.0	20/1		42
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

PANEL C (E)

SIZE	VOLTS/PHASE	MAIN	LOCATION	MOUNT
225 AMPS	208Y/120V, 3 PH	MLO	WOOD SHOP	SURFACE

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	AØ	BØ	CØ	CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	LATHE 1	20/1	0.0	0.0			0.0	20/1	OVERHEAD RECEPTS	2
3	LATHE 2	20/1	0.0		0.0		0.0	20/1	OVERHEAD RECEPTS	4
5	TABLE SAW	30/2	0.0			0.0	0.0	20/1	OVERHEAD RECEPTS	6
7	-----	--	0.0	0.0			0.0	20/1	OVERHEAD RECEPTS	8
9	JOINTER	20/2	0.0		0.0		0.0	20/2	LARGE BAND SAW	10
11	-----	--	0.0			0.0	0.0	--	-----	12
13	LARGE PLANER	30/3	0.0	0.0			0.0	20/1	SMALL BAND SAW	14
15	-----	--	0.0		0.0		0.0	20/1	HORIZONTAL SANDER	16
17	-----	--	0.0			0.0	0.0	20/1	JIG SAW	18
19	DADO TABLE SAW	30/2	0.0	0.0			0.0	20/1	DRILL PRESS	20
21	-----	--	0.0		0.0		0.0	20/1	BELT SANDER/GRINDER	22
23	RECEPT	20/1	0.0			0.0	0.0	15/1	SPARE	24
25	RECEPT	20/1	0.0	0.0			0.0	20/1	RECEPT	26
27	DRILL PRESS RECEPT	20/1	0.0		0.0		0.0	20/1	COMPOUND MITER SAW	28
29	SPARE	20/1	0.0			0.0	0.0	20/1	BOILER	30 (X)
31	RECEPT	20/1	0.0	0.0			0.0	20/1	BOILER RM CIRC PUMPS	32 (X)
33	RECEPT	20/1	0.0		0.0		0.0	20/1	BOILER RM RECEPT/LIGHT	34 (X)
35	RECEPT	20/1	0.0			0.0	0.0	20/1	SPARE	36
37	SPARE	20/1	0.0	0.0			0.0	15/2	WHITE LATHE	38
39	GARAGE	100/2	0.0		0.0		0.0	--	-----	40
41	-----	--	0.0			0.0	0.0	15/1	SHUNT TRIP DUST CONTROLS	42
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

PANEL D (E)

SIZE	VOLTS/PHASE	MAIN	LOCATION	MOUNT
100 AMPS	208Y/120V, 3 PH	MLO	MEZZANINE	SURFACE

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	AØ	BØ	CØ	CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
(X) 1	EXHAUST FAN #1	20/3	0.0	0.0			0.0	15/3	CIRCULATION PUMP	2
3	-----	--	0.0		0.0		0.0	--	-----	4
5	-----	--	0.0			0.0	0.0	--	-----	6
(X) 7	VENTILATION UNIT	15/3	0.0	0.0			0.0	40/3	COMPRESSOR	8
9	-----	--	0.0		0.0		0.0	--	-----	10
11	-----	--	0.0			0.0	0.0	--	-----	12
13	CIRCULATION PUMP	15/3	0.0	0.0			0.0	30/2	T&I HOUSE	14
15	-----	--	0.0		0.0		0.0	--	-----	16
17	-----	--	0.0			0.0	0.0	20/1	CONTROL CIRCUIT	18
19	HOT WATER HEATER	30/2	0.0	0.0			0.0	20/1	EXHAUST FAN #2	20 (X)
21	-----	--	0.0		0.0		0.0	20/1	MEZZANINE LTG	22
23	CIRCULATION UNIT HEATER	20/1	0.0			0.0	0.0	20/1	UNIT HEATERS IN WOOD SHOP	24 (X)
25	MEZZANINE (O)	20/1	0.0	0.0			0.0	20/1	CIRCULATION PUMP #3	26 (X)
27	SPARE	20/1	0.0		0.0		0.0	20/1	UNIT HEATERS IN AUTO SHOP	28 (X)
29	SPARE	20/1	0.0			0.0	0.0	20/1	VENT FAN	30 (X)
31	SPARE	20/1	0.0	0.0			0.0	20/1	SPARE	32
33	SPARE	20/1	0.0		0.0		0.0			34
35			0.0			0.0	0.0			36
37			0.0	0.0			0.0			38
39			0.0		0.0		0.0			40
41			0.0			0.0	0.0			42
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

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102-66
STATE OF ALASKA
B.C. HAIGHT
EE 4801
27FEB2015

HAINES SCHOOL DISTRICT

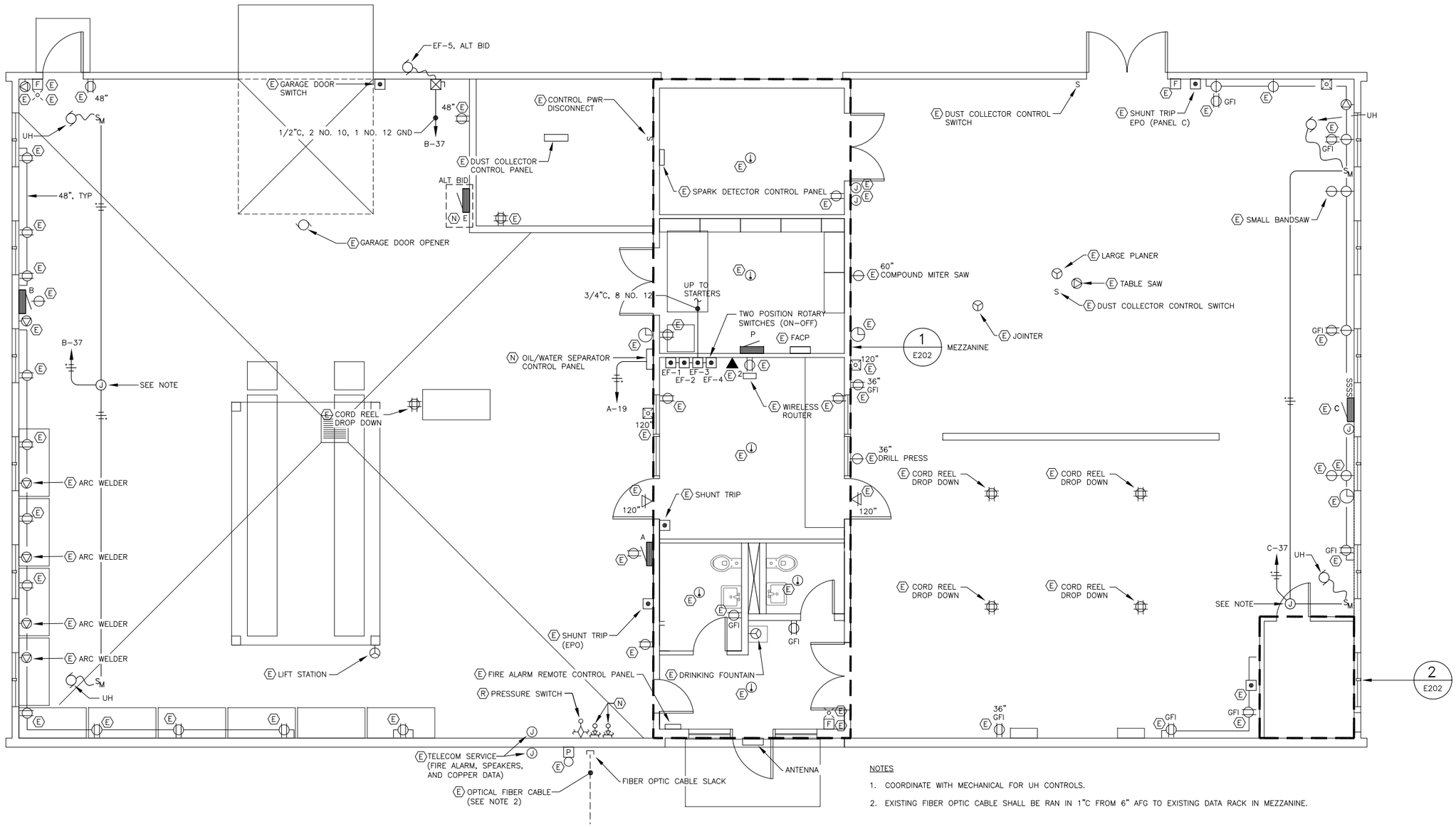
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
EXISTING PANEL SCHEDULES

SCALE: AS SHOWN:
DATE: 02/27/2015
DRAWN: KHD
DESIGNED: BCH
CHECKED: BCH

SHEET NO.
E104

JOB NO. M-463



NOTES

1. COORDINATE WITH MECHANICAL FOR UH CONTROLS.
2. EXISTING FIBER OPTIC CABLE SHALL BE RAN IN 1"C FROM 6" AFG TO EXISTING DATA RACK IN MEZZANINE.

1 / E201 FIRST FLOOR PLAN – NEW POWER/SIGNAL

1/4" = 1'-0"

N

GRAPHICAL SCALE IN FEET

0 5 10

102-66
STATE OF ALASKA
B.C. HAIGHT
EE 4801
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HAINES SCHOOL DISTRICT

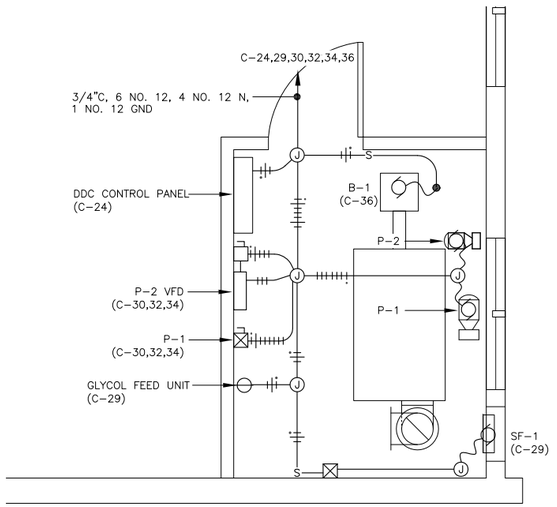
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
NEW FLOOR PLAN
POWER/SIGNAL

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.
E201

JOB NO. M-463



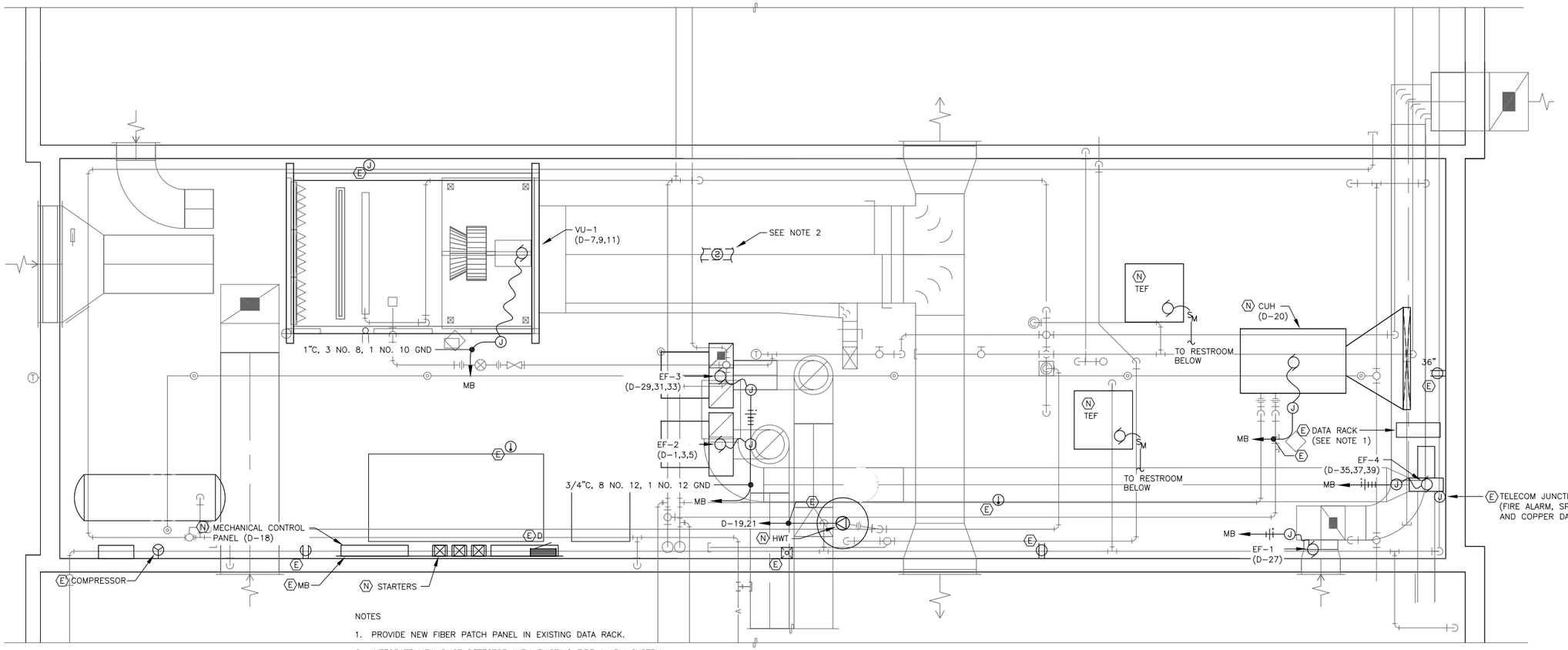
2 / E202 ENLARGED BOILER ROOM PLAN – NEW POWER

1/2" = 1'-0"

GRAPHICAL SCALE IN FEET 0 1 2 3 4 5

MECHANICAL EQUIPMENT SCHEDULE

DESIGNATION			LOAD					CIRCUITING				CONTROL		
ITEM	DESCRIPTION	LOCATION	HP	KW	AMPS	VOLTS	PHASE	RATING	CONDUCTORS	DISCONNECT SWITCH	DISCONNECT FUSE	STARTER SIZE	CONTROL	REMARKS
EF-1	EXHAUST FAN	MEZZANINE	1/2			120	1	20/1	2 NO. 12, 1 NO. 12 GND			00	ON-OFF	REMOTE CONTROL SWITCH
EF-2	EXHAUST FAN	MEZZANINE	2			208	3	15/3	3 NO. 12, 1 NO. 12 N, 1 NO. 12 GND			0	ON-OFF	REMOTE CONTROL SWITCH
EF-3	EXHAUST FAN	MEZZANINE	2			208	3	15/3	3 NO. 12, 1 NO. 12 N, 1 NO. 12 GND			0	ON-OFF	REMOTE CONTROL SWITCH
EF-4	EXHAUST FAN	MEZZANINE	3			208	3	20/3	3 NO. 12, 1 NO. 12 N, 1 NO. 12 GND			0	ON-OFF	REMOTE CONTROL SWITCH
EF-5	EXHAUST FAN	AUTO SHOP	3/4			120	1	30/1	2 NO. 10, 1 NO. 12 GND			00	ON-OFF	
TEF	TOILET EXHAUST FAN	RESTROOMS		0.03		120	1	20/1	2 NO. 12, 1 NO. 12 GND				◇W	WITH LIGHTING
SF-1	COMBUSTION AIR	BOILER ROOM	1/4			120	1	20/1	2 NO. 12, 1 NO. 12 GND	S		00	HOA	
CUH	CABINET UNIT HEATER	MEZZANINE	1/40			120	1	20/1	2 NO. 12, 1 NO. 12 GND	SM				
UH	UNIT HEATER	AUTO SHOP, WOOD SHOP	1/15			120	1	20/1	2 NO. 12, 1 NO. 12 GND	SM				
VU-1	VENTILATING UNIT		7-1/2			208	3	50/3	3 NO. 8, 1 NO. 12 N, 1 NO. 10 GND				VFD	BY MECHANICAL
P-1	PUMP	BOILER ROOM	3/4			208	3	15/3	3 NO. 12, 1 NO. 12 N, 1 NO. 12 GND	30A		00	HOA	
P-2	PUMP	BOILER ROOM	1			208	3	15/3	3 NO. 12, 1 NO. 12 N, 1 NO. 12 GND	30A			VFD	BY MECHANICAL
B-1	BOILER	BOILER ROOM	1/3			120	1	20/1	2 NO. 12, 1 NO. 12 GND	S				
	GLYCOL FEED UNIT	BOILER ROOM	1/4			120	1	20/1	2 NO. 12, 1 NO. 12 GND	S				
HWT	HOT WATER TANK	MEZZANINE		4.5		208	1	30/2	2 NO. 10, 1 NO. 12 N, 1 NO. 12 GND					



NOTES

1. PROVIDE NEW FIBER PATCH PANEL IN EXISTING DATA RACK.
2. INTEGRATE NEW DUCT DETECTOR WITH EXISTING FIRE ALARM SYSTEM.

1 / E202 MECHANICAL MEZZANINE FLOOR PLAN – NEW POWER/SIGNAL

1/2" = 1'-0"

N

GRAPHICAL SCALE IN FEET 0 1 2 3 4 5

102-66 STATE OF ALASKA 10th B.C. HAIGHT EE 4801 REGISTERED PROFESSIONAL 27FEB2015

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HAINES SCHOOL DISTRICT

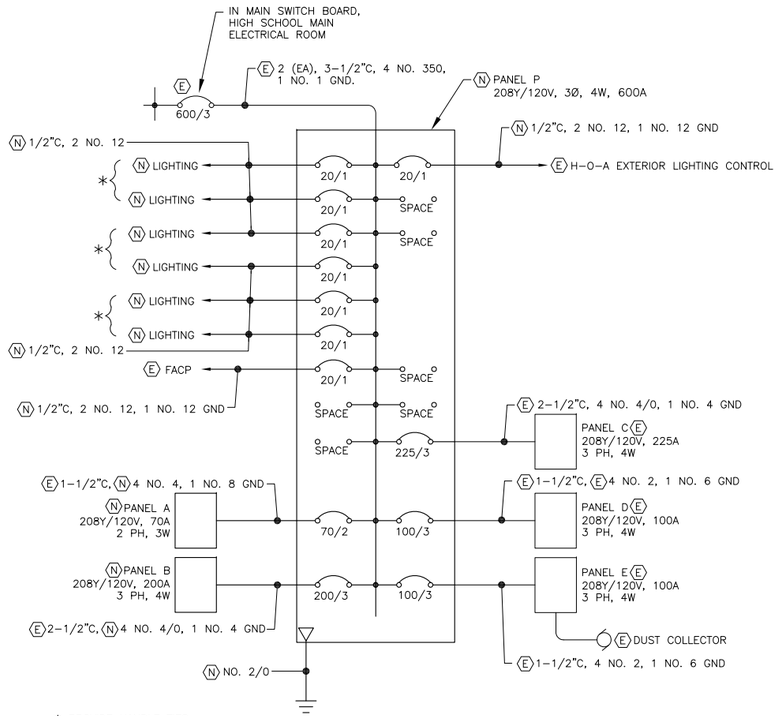
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
NEW ENLARGED FLOOR PLANS POWER/SIGNAL

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.
E202

JOB NO. M-463



* PROVIDE HANDLE TIES

1 / E203 SINGLE LINE DIAGRAM – NEW POWER DISTRIBUTION

NO SCALE

PANEL A (N)

SIZE: 100 AMPS | VOLTS/PHASE: 208Y/120V, 3 PH | MAIN: MLO | LOCATION: AUTO SHOP | MOUNT: RECESSED

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	KVA AØ	KVA BØ	KVA CØ	KVA CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	AUTO SHOP LTG	20/1	0.0	0.0			0.0			2
3		20/1	0.0		0.0		0.0			4
5		20/1	0.0			0.0	0.0			6
7			0.0	0.0			0.0			8
9			0.0		0.0		0.0			10
11	ROOM 04, 06, 08 (D)	20/1	0.0			0.0	0.0			12
13	ROOM 04, 05 (GFI)	20/1	0.0	0.0			0.0	20/1	HAND WASH SINK (D)	14
15	ROOM	20/1	0.0		0.0		0.0			16
17	DRINKING FOUNTAIN (GFI)	15/1	0.0			0.0	0.0			18
(N) 19	OIL/WATER SEPARATOR CONTROL PANEL	15/1	0.0	0.0			0.0			20
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

PANEL B (N)

SIZE: 200 AMPS | VOLTS/PHASE: 208Y/120V, 3 PH | MAIN: MLO | LOCATION: AUTO SHOP | MOUNT: SURFACE

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	KVA AØ	KVA BØ	KVA CØ	KVA CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	SPARE	15/3	0.0	0.0			0.0	15/3	SPARE	2
3	-----	--	0.0		0.0		0.0	--	-----	4
5	-----	--	0.0			0.0	0.0	--	-----	6
7	SPARE	60/2	0.0	0.0			0.0	50/2	SPARE	8
9	-----	--	0.0		0.0		0.0	--	-----	10
11	BLANK	50/2	0.0			0.0	0.0	50/2	SPARE	12
13	-----	--	0.0	0.0			0.0	--	-----	14
15	BLANK	50/2	0.0		0.0		0.0	20/1	WIRE MOLD RECEPTACLE #5	16
17	-----	--	0.0			0.0	0.0	20/1	WIRE MOLD RECEPTACLE #5	18
19		20/1	0.0	0.0			0.0	20/1	WIRE MOLD RECEPTACLE #5	20
21	WIRE MOLD RECEPTACLE #5	20/1	0.0		0.0		0.0	20/1	WIRE MOLD RECEPTACLE #5 & DOOR OPENER	22
23	20 AMP DEDICATED OUTLET	20/1	0.0			0.0	0.0	20/1	WIRE MOLD RECEPTACLE #5 & LATHE	24
25	WIRE MOLD RECEPTACLES #5	20/1	0.0	0.0			0.0			26
27	WIRE MOLD RECEPTACLES #5	20/1	0.0		0.0		0.0	20/1	SHUNT TRIP (GFI)	28
29	POWER REEL RECEPTACLE (GFI)	20/1	0.0			0.0	0.0			30
31	OUTLET (GFI)	20/1	0.0	0.0			0.0	20/1	WIRE MOLD RECEPTACLE #5 (GFI)	32
33			0.0		0.0		0.0	20/1	(GFI)	34
35	(GFI)	20/1	0.0			0.0	0.0	20/1	(GFI)	36
(N) 37	AUTO SHOP UNIT HEATERS	20/1	0.0	0.0			0.0			38
(N) 39	EF-5	30/1	0.0		0.0		0.0			40
41			0.0			0.0	0.0			42
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

PANEL D (E)

SIZE: 100 AMPS | VOLTS/PHASE: 208Y/120V, 3 PH | MAIN: MLO | LOCATION: MEZZANINE | MOUNT: SURFACE

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	KVA AØ	KVA BØ	KVA CØ	KVA CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	EF-2	15/3	0.0	0.0			0.0	15/3	CIRCULATION PUMP	2
3	-----	--	0.0		0.0		0.0	--	-----	4
5	-----	--	0.0			0.0	0.0	--	-----	6
7	VU-1	50/3	0.0	0.0			0.0	40/3	COMPRESSOR	8
9	-----	--	0.0		0.0		0.0	--	-----	10
11	-----	--	0.0			0.0	0.0	--	-----	12
13	CIRCULATION PUMP	15/3	0.0	0.0			0.0	30/2	T&I HOUSE	14
15	-----	--	0.0		0.0		0.0	--	-----	16
17	-----	--	0.0			0.0	0.0	20/1	CONTROL CIRCUIT	18
19	HOT WATER TANK (HWT)	30/2	0.0	0.0			0.0	20/1	CUH	20
21	-----	--	0.0		0.0		0.0	20/1		22
23			0.0			0.0	0.0	20/1		24
25	MEZZANINE (D)	20/1	0.0	0.0			0.0	20/1		26
27	EF-1	20/1	0.0		0.0		0.0	20/1		28
29	EF-3	15/3	0.0			0.0	0.0	20/1		30
31	-----	--	0.0	0.0			0.0	20/1		32
33	-----	--	0.0		0.0		0.0			34
35	EF-4	20/3	0.0			0.0	0.0			36
37	-----	--	0.0	0.0			0.0			38
39	-----	--	0.0		0.0		0.0			40
41			0.0			0.0	0.0			42
BALANCED CONNECTED LOAD: 0.0 KVA / 0.0 AMPS				0.0	0.0	0.0				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

PROVIDE ALL NEW CIRCUIT BREAKERS.

PANEL C (E)

SIZE: 225 AMPS | VOLTS/PHASE: 208Y/120V, 3 PH | MAIN: MLO | LOCATION: WOOD SHOP | MOUNT: SURFACE

CKT NO	DESCRIPTION	BREAKER AMP/POLE	KVA CKT	KVA AØ	KVA BØ	KVA CØ	KVA CKT	BREAKER AMP/POLE	DESCRIPTION	CKT NO
1	LATHE 1	20/1	0.0	0.0			0.0	20/1	OVERHEAD RECEPTS	2
3	LATHE 2	20/1	0.0		0.0		0.0	20/1	OVERHEAD RECEPTS	4
5	TABLE SAW	30/2	0.0			0.0	0.0	20/1	OVERHEAD RECEPTS	6
7	-----	--	0.0	0.0			0.0	20/1	OVERHEAD RECEPTS	8
9	JOINTER	20/2	0.0		0.0		0.0	20/2	LARGE BAND SAW	10
11	-----	--	0.0			0.0	0.0	--	-----	12
13	LARGE PLANER	30/3	0.0	0.0			0.0	20/1	SMALL BAND SAW	14
15	-----	--	0.0		0.0		0.0	20/1	HORIZONTAL SANDER	16
17	-----	--	0.0			0.0	0.0	20/1	JIG SAW	18
19	DADO TABLE SAW	30/2	0.0	0.0			0.0	20/1	DRILL PRESS	20
21	-----	--	0.0		0.0		0.0	20/1	BELT SANDER/GRINDER	22
23	RECEPT	20/1	0.0			0.0	0.0	15/1	BOILER ROOM DDC CONTROL PANEL	24 (N)
25	RECEPT	20/1	0.0	0.0			0.0	20/1	RECEPT	26
27	DRILL PRESS RECEPT	20/1	0.0		0.0		0.0	20/1	COMPOUND MITER SAW	28
(N) 29	SF-1 & GLYCOL FEED UNIT	20/1	0.0			0.6	0.6	20/3	BOILER PUMPS P-1 & P-2	30 (N)
31	RECEPT	20/1	0.0	0.6			0.6	--	-----	32
33	RECEPT	20/1	0.0		0.6		0.6	--	-----	34
35	RECEPT	20/1	0.0			0.0	0.0	20/1	BOILER B-1	36 (N)
(N) 37	WOOD SHOP UNIT HEATERS	20/1	0.0	0.0			0.0	15/2	WHITE LATHE	38
39	GARAGE	100/2	0.0		0.0		0.0	--	-----	40
41	-----	--	0.0			0.0	0.0	15/1	SHUNT TRIP DUST CONTROLS	42
BALANCED CONNECTED LOAD: 1.8 KVA / 5.0 AMPS				0.6	0.6	0.6				
MAXIMUM PHASE LOAD: 0.0 KVA / 0.0 AMPS										

102-66 STATE OF ALASKA 10th B.C. HAIGHT EE 4800 REGISTERED PROFESSIONAL 27FEB2015

MURRAY & ASSOCIATES, P. C.
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HAINES SCHOOL DISTRICT

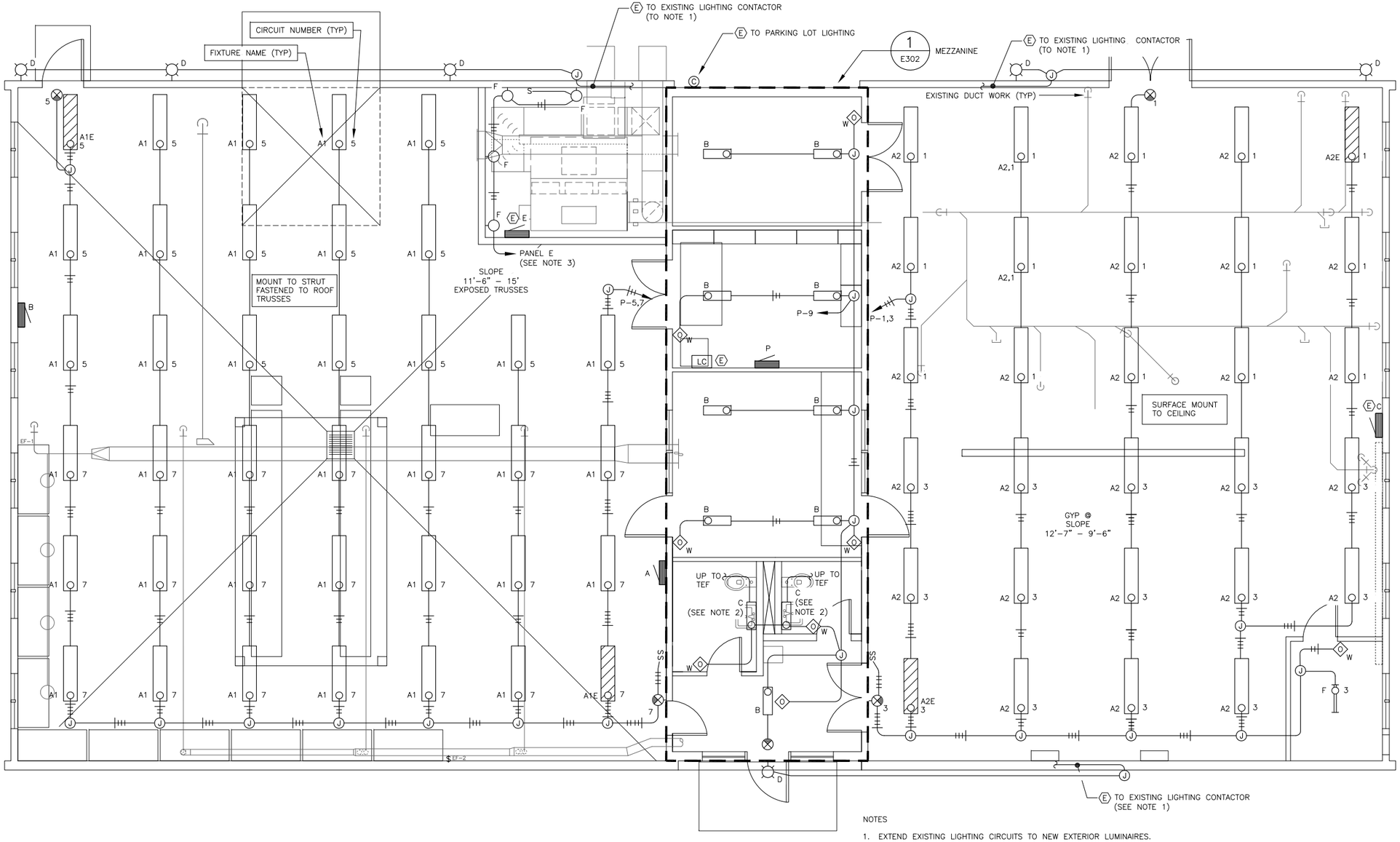
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
NEW SINGLE LINE DIAGRAM & NEW PANEL SCHEDULES

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.
E203

JOB NO. M-463



NOTES

1. EXTEND EXISTING LIGHTING CIRCUITS TO NEW EXTERIOR LUMINAIRES.
2. WALL MOUNT TYPE C LUMINAIRE AT 7'-0" AFF, UON.
3. UTILIZE EXISTING LIGHTING CIRCUIT BREAKER IN PANEL E FOR TYPE F LUMINAIRES.

1 E301 FIRST FLOOR PLAN – NEW LIGHTING

1/4" = 1'-0"

GRAPHICAL SCALE IN FEET 0 5 10

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
NEW FLOOR PLAN LIGHTING

SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

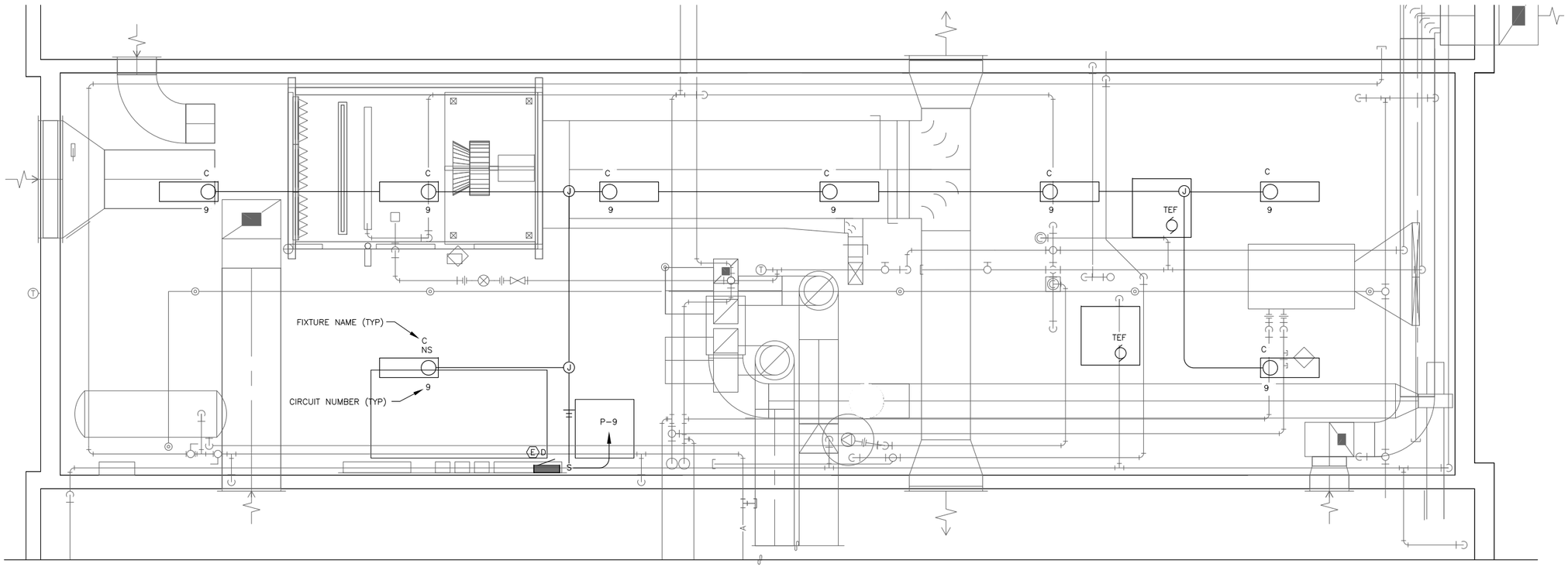
SHEET NO.
E301

JOB NO. M–463

LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	LAMPS	REMARKS
A1	SURFACE MOUNT 4' LED, CLOSED-CELL GASKET, ALUMINUM HOUSING, POLYCARBONATE LENS, SYMMETRICAL DISTRIBUTION, INTEGRATED ELECTRONIC DRIVER	LITHONIA VAP-39LED-35-SYM	39W LED 3500K, CRI 65	
A1E	SURFACE MOUNT 4' LED, CLOSED-CELL GASKET, ALUMINUM HOUSING, POLYCARBONATE LENS, SYMMETRICAL DISTRIBUTION, INTEGRATED ELECTRONIC DRIVER, INTEGRATED EMERGENCY BATTERY PACK	LITHONIA VAP-39LED-35-SYM-120-BSL722	39W LED 3500K, CRI 65	
A2	SURFACE MOUNT 4' LED, CLOSED-CELL GASKET, ALUMINUM HOUSING, POLYCARBONATE LENS, SYMMETRICAL DISTRIBUTION, INTEGRATED ELECTRONIC DRIVER	LITHONIA VAP-59LED-35-SYM	59W LED 3500K, CRI 65	
A2E	SURFACE MOUNT 4' LED, CLOSED-CELL GASKET, ALUMINUM HOUSING, POLYCARBONATE LENS, SYMMETRICAL DISTRIBUTION, INTEGRATED ELECTRONIC DRIVER, INTEGRATED EMERGENCY BATTERY PACK	LITHONIA VAP-59LED-35-SYM-120-BSL722	59W LED 3500K, CRI 65	
B	SURFACE MOUNT 2' LED, STEEL HOUSING, ACRYLIC LENS, INTEGRAL ELECTRONIC DRIVER	LITHONIA STL2-22L-EZ1-LP835-NX	26W WHITE LED 3500K, CRI 82	
C	2' WALL MOUNT LED, STEEL HOUSING, ACRYLIC DIFFUSER, INTEGRAL ELECTRONIC DRIVER	LITHONIA WL2-18L-LP835	20W WHITE LED 3500K, CRI 82	
D	EXTERIOR LED SCONCE, ALUMINUM HOUSING, CLEAR GLASS LENS, MOTION SENSOR, INTEGRATED ELECTRONIC DRIVER	GARDCO 121-MR-MT-18LA-NW-UNIV-BLP	18W WHITE LED 4000K, CRI 70	MOUNT AT 10'-0" AFG, UON.
F	LED VAPORPROOF FIXTURE, HAZARDOUS LOCATION RATED (CLASS 1, DIV 2), LOW-COPPER ALUMINUM ALLOY HOUSING, FROSTED HEAT-TREATED GLASS LENS, INTEGRATED ELECTRONIC DRIVER	PHOENIX VA-W-LED-12-NW-FGC-G	16W WHITE LED	MOUNT AT 6'-6" AFF, UON.
⊗	SURFACE MOUNT LED EXIT SIGN, THERMOPLASTIC HOUSING, INTEGRATED EMERGENCY BATTERY	LITHONIA LQM-W-G	GREEN LED	
◇O	CEILING MOUNT OCCUPANCY SENSOR, LINE VOLTAGE, DUAL TECHNOLOGY, WHITE COLOR	WATTSTOPPER LMDC-100	--	
◇O W	LINE VOLTAGE WALL MOUNTED OCCUPANCY SENSOR, DUAL TECHNOLOGY, WHITE COLOR	WATTSTOPPER DSW-100-W	--	

NOTE: ALL LUMINAIRE MOUNTING HEIGHTS ARE TO THE BOTTOM OF THE LUMINAIRE, UNLESS OTHERWISE NOTED AND OR APPLICABLE.



1 / E302 MECHANICAL MEZZANINE FLOOR PLAN – NEW LIGHTING

1/2" = 1'-0"

N

GRAPHICAL SCALE IN FEET

0 1 2 3 4 5

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STATE OF ALASKA
10th
B.C. HAIGHT
EE 4800
REGISTERED PROFESSIONAL ENGINEER
27FEB2015

HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
CONSTRUCTION DOCUMENTS
HAINES, ALASKA

SHEET TITLE:
NEW ENLARGED FLOOR PLANS LIGHTING

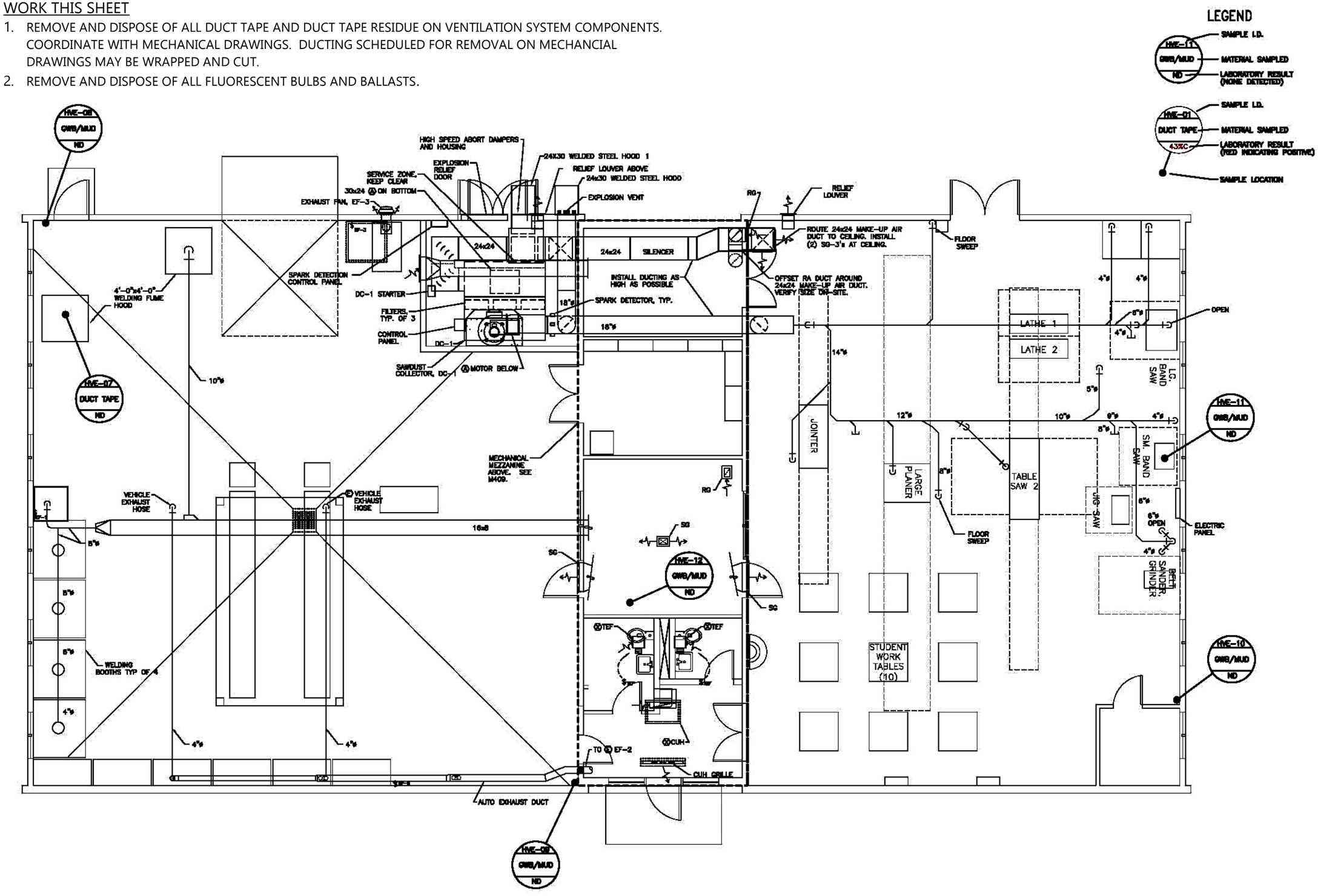
SCALE:	AS SHOWN:
DATE:	02/27/2015
DRAWN:	KHD
DESIGNED:	BCH
CHECKED:	BCH

SHEET NO.
E302

JOB NO. M-463

WORK THIS SHEET

1. REMOVE AND DISPOSE OF ALL DUCT TAPE AND DUCT TAPE RESIDUE ON VENTILATION SYSTEM COMPONENTS. COORDINATE WITH MECHANICAL DRAWINGS. DUCTING SCHEDULED FOR REMOVAL ON MECHANCIAL DRAWINGS MAY BE WRAPPED AND CUT.
2. REMOVE AND DISPOSE OF ALL FLUORESCENT BULBS AND BALLASTS.



VOCATIONAL EDUCATION BUILDING FIRST FLOOR
HAZARDOUS MATERIALS DEMOLITION

N

GRAPHICAL SCALE IN FEET
0 5 10

STATE OF ALASKA 49TH
Sigrid K. Dahlberg
EE 11030
REGISTERED PROFESSIONAL ENGINEER
2-27-2013

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HAINES SCHOOL DISTRICT
VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES
HAINES, ALASKA

SHEET TITLE:
VOCATIONAL SHOP BUILDING
FIRST FLOOR
HAZMAT

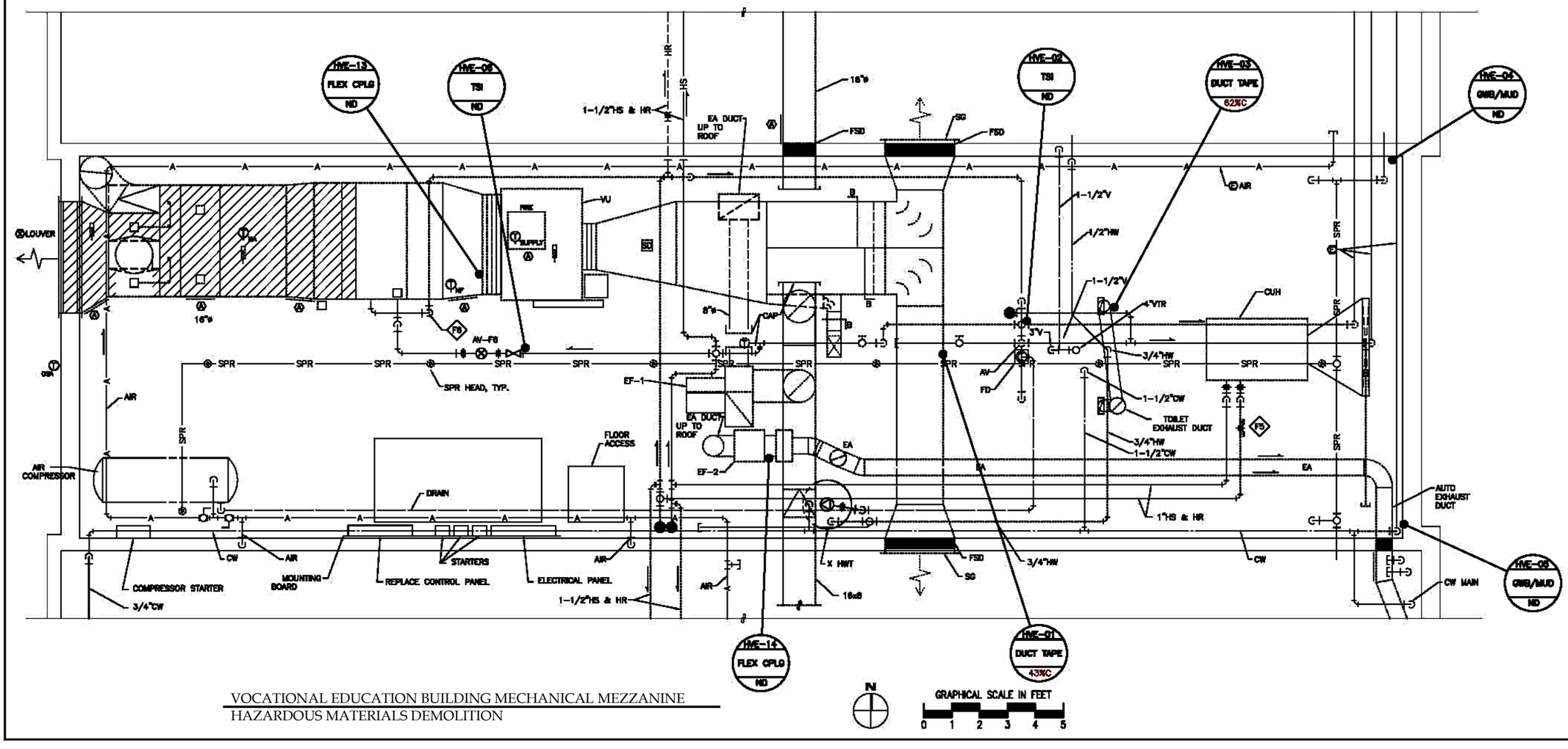
SCALE:	AS SHOWN:
DATE:	08/20/2012
DRAWN:	RAS
DESIGNED:	SKD
CHECKED:	SKD

SHEET NO.
HAZ102

JOB NO. M-463

WORK THIS SHEET

1. REMOVE AND DISPOSE OF ALL DUCT TAPE AND DUCT TAPE RESIDUE ON VENTILATION SYSTEM COMPONENTS. COORDINATE WITH MECHANICAL DRAWINGS. DUCTING SCHEDULED FOR REMOVAL ON MECHANCIAL DRAWINGS MAY BE WRAPPED AND CUT.
2. REMOVE AND DISPOSE OF ALL FLUORESCENT BULBS AND BALLASTS.



VOCATIONAL EDUCATION BUILDING MECHANICAL MEZZANINE
HAZARDOUS MATERIALS DEMOLITION

Sigfrid K. Dahlgren
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12-27-2012

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HAINES SCHOOL DISTRICT

VOCATIONAL TECHNOLOGY BUILDING
MECHANICAL AND ELECTRICAL UPGRADES

HAINES, ALASKA

SHEET TITLE:
VOCATIONAL SHOP
BUILDING
MECHANICAL
MEZZANINE
HAZMAT

SCALE:	AS SHOWN:
DATE:	08/20/2012
DRAWN:	RAS
DESIGNED:	SKD
CHECKED:	SKD

SHEET NO.
HAZ103

JOB NO. M-463