Invitation to Bid

20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL

Responses to an Invitation to Bid will be received by the Purchasing Supervisor, Sumner County Board of Education, 1500 Airport Road, Gallatin, TN 37066 for 20141014 – HVAC RENOVATION until 9:00 a.m. CDT Tuesday, October 14, 2014. Bid responses will be opened at that time, taken under advisement and evaluated. Should you have any questions please contact Bruce Atkins, HVAC Supervisor at bruce.atkins@sumnerschools.org. All proposals are subject to the Board of Education's conditions and specifications which are available from Vicky Currey, Purchasing Supervisor (615) 451-6560. All bids can be viewed on line at www.sumnerschools.org.

NOTICE TO RESPONDENTS

Responses to an Invitation to Bid will be received by the Purchasing Supervisor in the SUPPORT SERVICE FACILITY CONFERENCE ROOM, Sumner County Board of Education, 1500 Airport Road Gallatin, TN 37066. They will be received until **9:00 A.M. Local Time TUESDAY, OCTOBER 14, 2014** for **20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL**, at which time the responses will be opened, taken under advisement and evaluated. ***BIDS WILL BE POSTED ON www.sumnerschools.org***

GENERAL REQUIREMENTS AND CONDITIONS

1. The Sumner County Board of Education reserves the right to accept or reject any and/or all responses in whole or in part, and to waive informalities therein.

2. Any responses received after the scheduled closing time for the receipt for responses will not be considered.

3. If a mistake is discovered after the responses are received, only the Sumner County Board of Education may allow the respondent to withdraw the entire response.

4. Partial payments will not be approved unless justification for such payment can be shown. Terms will be net 30 days.

5. Payment will not be made until the said **20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL** are inspected and approved as meeting all specifications by persons appointed by the Sumner County Board of Education.

6. Responses submitted must be in a sealed envelope and marked on the outside as follows: **RESPONSE: 20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL DEADLINE: 9:00 A.M., TUESDAY, OCTOBER 14, 2014**

7. Facsimile responses will not be considered.

8. If a successful bidder violates any terms of their bid, the contract, school board policy or any law they may be disqualified from bidding for a period of two years for minor violations or longer for major violations. Bids from disqualified bidders will not be accepted during the period of disqualification.

9. Prices quoted on the response (if any) are to be considered firm and binding until the said **20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL** are in the possession of the Sumner County Board of Education.

10. No purchase or contract is authorized or valid until the issuance of a Board Purchase Order in accordance with Board Policy. No Board Employee is authorized to purchase equipment, supplies or services prior to the issuance of such a Purchase Order.

11. Any deviation from these stated terms, specifications and conditions must be coordinated with and approved in writing by the Purchasing Supervisor, Vicky Currey (615) 451-6560.

12. All bids that exceed $25,000 must have the Company Name, License Number, Expiration Date thereof and License Classification of Contractor listed on outside of sealed envelope. As required by State of Tennessee Code Annotated 62-6-119.

13. The awarded bidder will be required to post a performance and payment bond in the amount of 25% of the contract price if it exceeds $100,000 as stated by State of Tennessee Code Annotated 12-4-201.

14. If the project cost in excess of $25,000 a performance bond must be secured by the requesting party in an amount equal to the market improvement value.

STATE OF TENNESSEE
DEPARTMENT OF COMMERCE AND INSURANCE
STATE FIRE MARSHAL'S OFFICE
CODES ENFORCEMENT SECTION
500 James Robertson Parkway
Tenth Floor, Davy Crockett Tower
Nashville, Tennessee 37243-1162
PHONE: 615-741-7190 FAX: 615-253-3267

September 22, 2014

Timothy W. Little
Oliver Little Gipson, Inc.
301 Industrial Blvd.
Tullahoma, TN 37388

RE: Approval of Plans
Portland Vocational Bldg., HVAC Installation
TFM # 17904
Project # 2014-09-18-01
SBC #
619 S. College Street
Portland, TN 37148
Sumner County

Dear Mr. Little:

The plans, specifications and/or addenda received by our office for the above referenced project have been reviewed for compliance with the minimum standards for fire prevention, fire protection, and building construction safety (Rule 0780-02-02-.01) as required by the 2006 International Building Code (excluding Chapters 11 and 27), 2006 International Mechanical Code, 2006 International Fire Code, the 2006 NFPA 101 Life Safety Code [Rule 0780-2-2-.01], 2008 National Electrical Code NFPA 70 [Rule 0780-02-01-.02], and the following standards for the enforcement of the Tennessee Public Building Accessibility Act -2010 ADA Standards for Accessible Design. Plans approval does not certify compliance with either the State or Federal Statute referenced above.

Please note that stipulations must be satisfied by contractual documents prior to a Certificate of Occupancy being issued by the Codes Enforcement Officer.

This approval does not relieve the designing architect or engineer, contractor, or owner of responsibility for correcting plans or construction found in noncompliance with applicable codes. [Rule 0780-2-3.05(5), statutory authority TCA 68-120-204(a)(1)].

We are sending you an approved set of plans which, under Rule 0780-2-3.05(4), are required to be kept at the job site. The approved plans shall be placed on the job site prior to the commencement of construction and shall be retained on the job site until a certificate of

occupancy has been issued by the Division per Rule 0780-02-03-05. If these plans are not on the job site, a stop work order may result.
All field Change Orders must be submitted to this office for review and approval.

Requests for inspection should be directed to the Codes Enforcement Section at 615-741-7190. A Certificate of Occupancy (CO) is required prior to occupancy of this project. [Rule 0780-02-03-10(1), statutory authority TCA 68-120-102]

If you have any questions, please contact me at **(615) 532 5839**.

Sincerely,

M. Reza Kheshti, FCS III
Deputy State Fire Marshal
Codes Enforcement Section

cc: DSFM (e-mail)
DSFM Supervisor (e-mail)
Owner
Fire Official
Building Official

Educational Occupancy, One Story, Construction Type II-B, Non-Protected, Non-Sprinkled, Existing Building, New Installation

The approved drawing, approval letter, review letter, transfer to the field letter, no review determination letter, or any other document should be available by the end of business today on the State Fire Marshal's Portal at: http://www.tennesseeanytime.org/tnsfmo . When printing the approved construction drawings (Field Set) that is to be placed on the construction site for use by SFMO inspector, please ensure that the **Printer / Comments and Forms** tab is set to **"Documents & Markups"** or **"Documents & Stamps".** These drawings, in their entirety are to be printed with all stamps and placed on the project site for review by the SFMO Field Inspector(s). The approval letter along with any addendums, calculations etc. included with the approval set are to be printed in their native size and attached in the upper left corner of the "Field Set" of drawings.

REQUEST FOR QUOTE

20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL

SUMNER COUNTY BOARD OF EDUCATION

SUMNER COUNTY, TENNESSEE

DEADLINE: TUESDAY, OCTOBER 14, 2014 @ 9:00 A.M.

INTRODUCTION

The Sumner County Board of Education, herein known as the "School System", is requesting a quote for 20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL.

GENERAL INFORMATION

I. Proposal Package

All sealed proposal packages must include all the following, when applicable. Any sealed proposals shall be rejected as a non-conforming bid if any applicable item is missing.

- Three (3) complete copies of proposal
- Evidence of a valid State of Tennessee Business License and Sumner County Business License
- Evidence of compliance with the School System's Insurance Requirements, if work is performed on School System Property
- Signed and completed Statement of Non-Collusion (Attachment 1)
- Properly completed Internal Revenue Service Form W-9
- Evidence of company's safety program and, if supported, a drug testing program (Attachment 2) Drug-Free Workplace Affidavit
- If bid is in excess of $25,000, a certification of non-debarment must be completed (Attachment 3) Certification Regarding Debarment, Suspension, and Other Responsibility Matters
- Certification by Contractor (Attachment 4)

New Vendors

To comply with Internal Revenue Service requirements, all vendors who perform any type of service are required to have a current IRS Form W-9 on file with the School System. At the time of requisition, the individual requesting a purchase order or disbursement will be informed if it is a new vendor and if a Form W-9 is required. If Form W-9 is required for a new vendor, the department head shall forward a completed Form W-9 to the finance department. It can be obtained from the Internal Revenue Service's website (www.irs.gov).

To comply with the Tennessee Lawful Employment Act, non-employees (individuals hired as independent contractors) must have on file any two (2) of the following documents:

- Valid Tennessee Driver License or photo ID issued by the Department of Safety
- Valid out-of-state Driver License
- U.S. Birth Certificate
- Valid U.S. Passport
- U.S. Certificate of Birth Abroad
- Report of Birth Abroad of a U.S. Citizen
- Certificate of Citizenship
- Certificate of Naturalization
- U.S. Citizen Identification Card
- Valid Alien Registration Documentation or Proof of Current Immigration Registration

In addition, for all vendors with annual purchases in excess of $50,000 (if a business license is required), a business license must be on file in the finance department, or the requisitioner must submit a copy with the purchase order requisition form or the payment requisition form, as applicable.

II. Responses

- Proposal must include point-by-point responses to the RFQ
- Proposal must include a list of any exceptions to the requirements
- Proposal must include the legal name of the vendor and must be signed by a person or persons legally authorized to bind the vendor to a contract
- If applicable, proposal must include a copy of the contract(s) the vendor will submit to be signed
- Any and All proposal requirements must be met prior to submission
- The bidder understands and accepts the non-appropriation of funds provision of School System
- If noted in the section "proposal requirements" or later requested, the contractor will be required to provide a reference list of clients that have a current contract for services with their company

III. Clarification and Interpretation of RFQ

The words "must" and "shall" in this Request for Quote indicate mandatory requirements. Taking exception to any mandatory requirement shall be grounds for rejection of the proposal. There are other requirements that the School System considers important but not mandatory. It is important to respond in a concise manner to each section of this document and submit an itemized list of all exceptions.

In the event that any interest vendor finds any part of the listed specifications, terms, or conditions to be discrepant, incomplete, or otherwise questionable in any respect, it shall be the responsibility of the concerned party to notify the School System, via email at chris.harrison@sumnerschools.org of such matters immediately upon receipt of this Request for Quote. Questions directly related to engineering/mechanical portions of the specifications shall be directed to Tim Little, Oliver Little Gipson Inc., at twlittle@olgengineering.com. All questions must be received a minimum of five business days before proposal's "deadline".

IV. Proposal Guarantee

Vendors must guarantee that all information included in their proposal will remain valid for a period of 90 days from the date of proposal opening to allow for evaluation of all proposals.

V. Related Costs

The School System is not responsible for any costs incurred by any vendor pursuant to the Request for Quote. The vendor shall be responsible for all costs incurred in connection with the preparation and submission of its proposal.

VI. Insurance Requirements and Liability.

Each bidder or respondent to the RFQ who may have employees, contractors, or agents working on School System properties shall provide copies of current certificates for general and professional liability insurance and for workers' compensation of a minimum of $250,000. The owner or principal of each respondent must also be insured by workers' compensation if they perform any of the services on School System properties. There will be no exceptions to the insurance requirement.

VII. Payment Terms

Payment terms shall be specified in the bid response, including any discounts for early payment. All payments, unless agreed upon differently, will be after receipt of service or product and School System's approval of conformance with specifications.

VIII. Deadline

Sealed proposals will be accepted until TUESDAY, OCTOBER 14, 2014 @ 9:00 A.M. Proposals received after that time will be deemed invalid. There will be no exceptions.

IX. Withdrawal or Modification of Proposal

A withdrawn proposal may be resubmitted up to the time designated for the receipt of proposals provided that it fully conforms to the same general terms and requirements.

X. Package

The package containing the proposal must be sealed and clearly marked "**20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL**" on the outside of the package. Responses may be hand delivered or mailed to the following address.

Sumner County Board of Education
Attn: Purchasing Coordinator
1500 Airport Road
Gallatin, TN 37066

The package containing the proposal must be clearly marked with the following information:

Contractor Name
Contractor Address
License Number
Expiration Date
Class
Limit

Sub-Contractor Name
License Number
Expiration Date
Class

XI. Right to Seek a New Proposal

School System reserves the right to accept or reject any and all proposals for any reason. Proposals will be awarded to the best overall respondent as determined by that which is in the best interests of the School System.

XII. Procedures for Evaluating Proposals and Awarding Contract

In comparing the responses to this RFQ and making awards, the School System may consider such factors as quality and thoroughness of a proposal, the record of experience, the references of the respondents, and the integrity, performance, and assurances in the proposal in addition to that of a proposal price.

- Proposals will be examined for compliance with all requirements set forth herein
- Proposals that do not comply shall be rejected without further evaluation
- Proposals will be subjected to a technical analysis and evaluation
- Oral presentations and written questions for further clarifications may be required of some or all vendors

XIII. Discussions

Discussions may be conducted with the vendors which have submitted proposals determined to be reasonably likely of being considered for selection to assure a full understanding of and responsiveness to the RFQ requirements. Every effort shall be afforded to assure fair and equal treatment with respect to the opportunity for discussion and/or revision of their respective proposals. Revisions may be permitted after the submission and prior to the award for the purpose of obtaining the best offers.

XIV. Open Records

After the bid is awarded, all proposals will be subject to the Tennessee Open Records Act, and the proposals will be available to the public upon written request.

Summary information on bids submitted will be posted on the School System website at www.sumnerschools.org under “Invitation to Bid” link.

XV. Assignment

Neither the vendor nor the School System may assign this agreement with prior written consent of the other party.

XVI. Liabilities

The vendor shall indemnify the School System against liability for any suits, actions, or claims of any character arising from or relating to the performance under this contract by the vendor or its subcontractors.

The School System has no obligation for the payment of any judgment or the settlement of any claim made against the vendor or its subcontractors as a result of obligations under this contract.

XVII. Tax Status

School System is tax exempt.

XVIII. Invoicing

Invoices are to be submitted to:

Sumner County Board of Education
1500 Airport Road
Gallatin, TN 37066

The vendor must provide an invoice(s) detailing the terms and amounts due and the dates due. All invoices shall indicate payment terms and any prepayment discounts.

XIX. Contract Nullification

The School System may, at any time, nullify the agreement if, in the judgment of School System, the contractor(s) has failed to comply with the terms of the agreement. In the event of nullification, any payment due in arrears will be made to the contractor(s), but no further sums shall be owed to the contractor(s). The agreement between the School System and the contractor(s) is contingent upon an approved annual budget allotment, and is subject, with thirty (30) days notification, to restrictions or cancellation if budget adjustments are deemed necessary by School System.

XX. Applicable Law

The School System is an equal opportunity employer. The School System does not discriminate towards any individual or business on the basis of race, sex, color, age, religion, national origin, disability or veteran status.

The successful contractor(s) agrees that they shall comply will all local, state, and federal law statutes, rules, and regulations including, but not limited to, the Rehabilitation Act of 1973 and the Americans with Disabilities Act.

In the event that any claims should arise with regards to this contract for a violation of any such local, state, or federal law, statues, rules or regulations, the provider will indemnify and hold the School System harmless for any damages, including court costs or attorney fees, which might be incurred.

Any contract will be interpreted under the laws and statutes of the State of Tennessee.

The School System does not enter into contracts which provide for mediation or arbitration.

Any action arising from any contract made from these specifications shall be brought in the state courts in Sumner County, Tennessee or in the United States Federal District Court for the Middle District of Tennessee.

Additionally, it is a violation of state statues to purchase materials, supplies, services, or any other item from a vendor that is a commissioner, official, employee, or board member that has any financial or beneficial interest in such transaction.

XXI. Specific Information

The School System is soliciting quotes from contractors to complete a HVAC renovation at the Portland Vocational Building. The quote shall include the cost for all equipment (as outlined in the Attachment – 50414.2), installation materials, and labor by the contractor/sub-contractor. The project must be completed by January 31, 2015.

The project is located adjacent to Portland East Middle School. The contractor shall take necessary measures to ensure minimal disruption to the activities of Portland East Middle School and any adjoining property.

The contractor shall be required to provide the School System with a performance and payment bond (as outlined in the NOTICE TO RESPONDENTS).

A mandatory pre-bid meeting will be held on October 7, 2014 @ 9:00 a.m. at the jobsite. A sign-in sheet shall be made available. Any contractor submitting a bid that has not attended the pre-bid meeting shall have their bid rejected.

JOBSITE: Portland Vocational
604 South Broadway
Portland, TN 37148

PROJECT TIMELINE

Bid Advertised	September 28, 2014
Pre-Bid Meeting	October 7, 2014 @ 9:00 a.m.
Bid Opening	October 14, 2014 @ 9:00 a.m.
Project Approval	October 21, 2014 (estimated)
Purchase Order Issuance / Notice to Proceed	October 22, 2014 (estimated)
Project Completion Date	January 30, 2015

SUMNER COUNTY BOARD OF EDUCATION

Purchasing Department
1500 Airport Road
Gallatin, TN 37066

COMPANY NAME _____

ADDRESS _____

_____

TELEPHONE _____

EMAIL _____

AUTHORIZED COMPANY REPRESENTATIVE _____*SIGNATURE*

AUTHORIZED COMPANY REPRESENTATIVE _____*PRINTED*

DATE _____

BID TITLE 20141014 – HVAC RENOVATION @ PORTLAND VOCATIONAL

DEADLINE TUESDAY, OCTOBER 14, 2014 @ 9:00 A.M.

BID AMOUNT $_____ MATERIALS

$_____ LABOR

$_____ GRAND TOTAL

BID GOOD THRU _____

NOTES: _____

_____

_____

ATTACHMENT 1

STATEMENT OF NON-COLLUSION

The undersigned affirms that they are duly authorized to execute this contract, that this company, corporation, firm, partnership or individual has not prepared this proposal in collusion with any other respondent, and that the contents of this proposal as to prices, terms or conditions of said proposal have not been communicated by the undersigned nor by an employee or agent to any other person engaged in this type of business prior to the official opening of this proposal.

Company _____

Address _____

_____

Phone _____

Fax _____

Respondent _____
(*Signature*)

Respondent _____
(*Print Name and Title*)

Authorized Company Official _____
(*Print Name*)

ATTACHMENT 2

DRUG – FREE WORKPLACE

The School System is committed to maintaining a safe and productive work environment for its employees and to providing high quality service to its citizens. The goal of this policy is for School System employees and contractors to remain, or become and remain, drug-free. Abuse and dependency on alcohol and/or drugs can seriously affect the health of employees, contractors, and citizens, jeopardize personal safety, impact the safety of others and impair job performance.

Drug – Free Workplace Act of 1988 – The School System is governed by the Drug-Free Workplace Act of 1988 (Pub. L. 100-690, Title V, Subtitle D).

Omnibus Transportation Employee Testing Act of 1991 – The School System is governed by the Omnibus Transportation Employee Testing Act of 1991 (Pub. L. 102-143, Title V).

Right to an Alcohol and Drug – Free Workplace – Employees have the right to work in an alcohol and drug-free environment and to work with persons free from the effects of alcohol and/or drugs.

Required Alcohol and Drug Tests – Alcohol and drug testing for safety sensitive employees shall be in accordance with the provisions contained in the School System Alcohol and Drug Policy adopted by departments which have safety sensitive positions.

Contracts – Any contractor(s) providing goods or services to School System must comply with all State and Federal drug-free workplace laws, rules and regulations and so certify this compliance by completion of the DRUG-FREE WORKPLACE AFFIDAVIT (attached page 2).

DRUG – FREE WORKPLACE AFFIDAVIT (page 2)

STATE OF _____

COUNTY OF _____

The undersigned, principal officer of _____, an employer of five (5) or more employees contracting with the Sumner County Board of Education to provide goods or services, hereby states under oath as follows:

1. The undersigned is a principal officer of _____ (hereinafter referred as the "Company") and is duly authorized to execute this Affidavit on behalf of the Company.

2. The Company submits this Affidavit because it shall be receiving pay pursuant to a contract with the state or any local government to provide goods or services.

3. The Company is in compliance with all State and Federal Laws, Rules and Regulations requiring a drug-free workplace program.

Further affiant saith not.

Principal Officer: _____

STATE OF _____

COUNTY OF _____

Before me personally appeared _____, with whom I am personally acquainted (or proved to me on the basis of satisfactory evidence) and who acknowledged that such person executed the foregoing affidavit for the purposes therein contained.

Witness my hand and seal at office this _____ day of _____, 20_____.

_____
Notary Public

My commission expires: _____

ATTACHMENT 3

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

The prospective participant certifies, to the best of its knowledge and belief, that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in transactions under federal non-procurement programs by any federal department or agency;

2. Have not, within the three year period preceding this proposal, had one or more public transactions (federal, state, or local) terminated for cause or default; and

3. Are not presently indicted or otherwise criminally or civilly charged by a government entity (federal, state, or local) and have not, within the three year period preceding the bid, been convicted or had a civil judgment rendered against it:

A. For the commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public transaction (federal, state, or local) or a procurement contract under such a public transaction;

B. For the violation of federal or state antitrust statutes, including those proscribing price fixing between competitors, the allocation of customers between competitors, or bid rigging; or

C. For the commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.

I understand that a false statement on this certification may be grounds for the rejection of this proposal or the termination of the award. In addition, under 18 U.S.C. § 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to five years, or both.

_____

Name of Participant Agency

_____

Name and Title of Authorized Representative

_____ _____

Signature of Authorized Representative Date

_____ I am unable to certify to the above statement. Attached is my explanation.

ATTACHMENT 4

CERTIFICATION BY CONTRACTOR

I, the undersigned, certify that on behalf of Contractor, I am authorized to attest and obligate the above certification and to legally bind Contractor to these terms, conditions and obligations.

_____ Title

_____ Name

_____ Date

_____ Witness

Portland Vocational Building
HVAC Repairs

Sumner County Schools
Portland, Tennessee

STATE FIRE MARSHAL INFORMATION

PROJECT NAME:	PORTLAND VOCATIONAL BUILDING - HVAC UPGRADES
PROJECT ADDRESS:	619 SOUTH COLLEGE STREET; PORTLAND, TN 37148
FIRE DISTRICT:	PORTLAND, TENNESSEE
CONTACT PERSON:	TIM LITTLE, PE - OLIVER LITTLE GIPSON ENGINEERING, INC. - 931.454.9940

BUILDING INFORMATION

BUILDING INFORMATION:	PORTLAND VOCATIONAL BUIDLING - HVAC UPGRADES
NEW/EXISTING:	EXISTING BUILDING

THIS INFORMATION IS INTENDED ONLY FOR USE BY THE TENNESSEE STATE FIRE MARSHAL'S OFFICE AND NOT THE CONTRACTOR/BIDDER(S).

OCCUPANCY CLASS:	EDUCATIONAL
BUIDLING HEIGHT:	25' +/-
NUMBER OF STORIES:	1 (PLUS MEZZANINE)
BUILDING AREA:	EXISTING
CONSTRUCTION TYPE:	TYPE IIb
	UNPROTECTED
	UNSPRINKLED

CURRENT CODE STATUTES

2006	INTERNATIONAL BUILDING CODE
2006	INTERNATIONAL MECHANICAL CODE
2006	INTNATIONAL FIRE CODE
2006	INTERNATIONAL FUEL GAS CODE
2006	INTERNATIONAL PLUMBING CODE
2006	INTERNATIONAL ENERGY EFFICIENCY CODE
2008	NFPA 70 - NATIONAL ELECTRIC CODE
2006	NFPA 101 - LIFE SAFETY CODE
2007	A.S.H.R.A.E STANDARD 90.1
2010	2010 ADA STANDARDS FOR ACCESSIBLE DESIGN

DRAWING INDEX

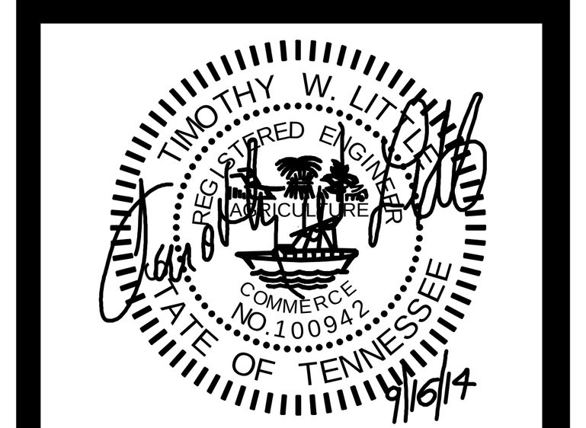
PROJECT DESCRIPTION

PROJECT INCLUDES INSTALLATION OF NEW CLASSROOM HVAC UNITS AND ROOFTOP UNITS TO SERVE THE EXISTING BUILDING. ADDITIONAL WORK INCLUDES INSTALLATION OF NEW SEPARATED COMBUSTION UNIT HEATERS IN THE SHOP AREAS.

THIS INDIVIDUAL SHEET COMPRISES ONE OF MANY SHEETS ISSUED AS BIDDING AND CONTRACT DOCUMENTS. INFORMATION CONTAINED HEREIN MAY NOT BE ALL INCLUSIVE OF INFORMATION NEEDED FOR BIDDING AND/OR CONSTRUCTION. REFER TO ENTIRE BIDDING AND CONTRACT DOCUMENTS FOR ASSOCIATED INFORMATION.

REVISIONS

Oliver • Little • Gipson
OLG
Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.9940 ~ Fax: 931.454.2338
www.olgengineering.com



Cover Sheet

Portland Vocational Building

Portland, Tennessee

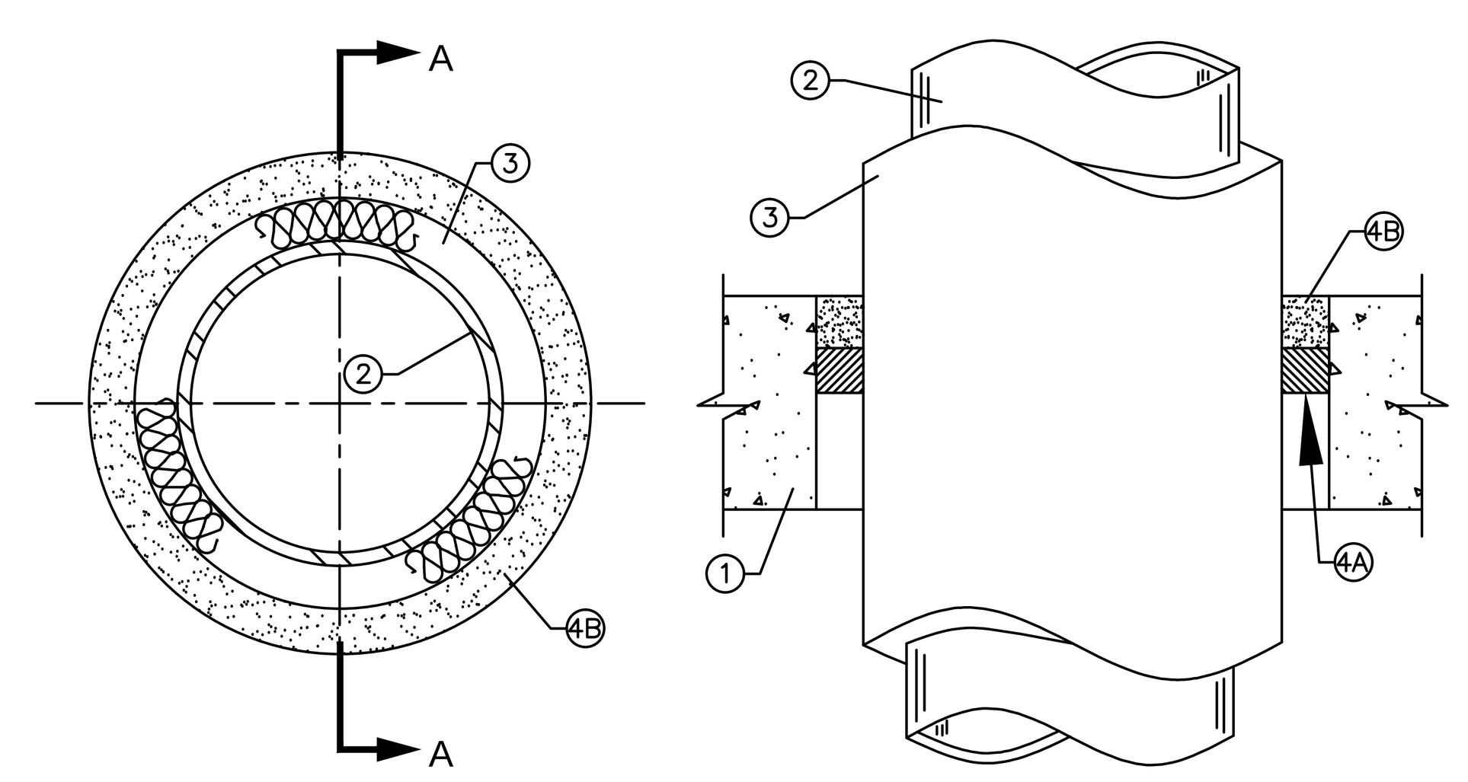
JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

CS

THROUGH PENETRATION FIRESTOP SYSTEMS

System No. C-AJ-5001

September 03, 2004
(Formerly System No. 91)
F Ratings - 1-1/2, 2 and 3 Hr (See Item 4)
T Ratings - 0, 1/2, 3/4 and 1 Hr (See Items 1A and 4)
L Rating At Ambient - 2 CFM per sq ft
L Rating At 400 F - less than 1 CFM per sq ft



SECTION A-A

1. **Floor or Wall Assembly -** Min 2-1/2 in. thick reinforced lightweight or normal weight (100-150) pcf concrete. Wall may also be constructed of any UL Classified **Concrete Blocks*.** Max diam of opening is 18 in.

See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

1A. **Steel Sleeve -** (Optional, not shown) - Nom 10 in. (or smaller) Schedule 10 (or heavier) steel sleeve cast or grouted into floor or wall assembly. Sleeve may extend a max of 2 in. above top of floor or beyond either surface of wall. **T Rating is 0 Hr when sleeve is used.**

2. **Through Penetrant -** Nom 4 in. diam (or smaller) Type L (or heavier) copper pipe, nom 12 in. diam (or smaller) service weight (or heavier) cast iron soil pipe, nom 12 in. diam (or smaller) Class 50 (or heavier) ductile iron pressure pipe or nom 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe centered in the opening and rigidly supported on both sides of the floor or wall assembly.

3. **Pipe Covering* -** Nom 1/2 to 2 in. thick hollow cylindrical heavy density (min. 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt strip tape supplied with the product.

See **Pipe and Equipment Covering - Materials*** (BRGU) category in Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

4. **Firestop System -** The details of the firestop system shall be as follows:

A. **Packing Material -** Min 1 in. thickness of firmly packed mineral wool batt insulation used as a permanent form. Packing material to be recessed from top surface of floor or sleeve or from both surfaces of wall as required to accommodate the required thickness of caulk fill material (Item B).

B. **Fill, Void or Cavity Material* - Caulk or Sealant -** Applied to fill the annular space flush with the top surface of the floor or sleeve or flush with both surfaces of wall. When nom pipe covering thickness is 2 in., min thickness of caulk fill material is 2 in. When nom pipe covering thickness is 1-1/2 in. or less, min thickness of caulk fill material is 1 in. The hourly F and T Ratings of the firestop system are dependent upon the thickness of the floor or wall, the size of pipe, the thickness of pipe covering material and the size of the annular space (between the pipe covering material and the edge of the circular through opening), as shown in the following table:

Min. Floor or Wall Thk. In.	Max. Pipe Dia. In.	Nominal Pipe Covering Thk. In.	Annular Space In.	F Rating Hr.	T Rating Hr.
2-1/2	4	1 or 1-1/2	1/2 to 2-3/8	2	1
4-1/2	4	2	1/4 to 3-5/8	2	1-1/2
2-1/2	12	1	1/2 to 1-1/2	2	1/2
4-1/2	12	1	1/2 to 2-3/8	3	1
2-1/2	12	1/2	1/2 to 2-3/8	2	0

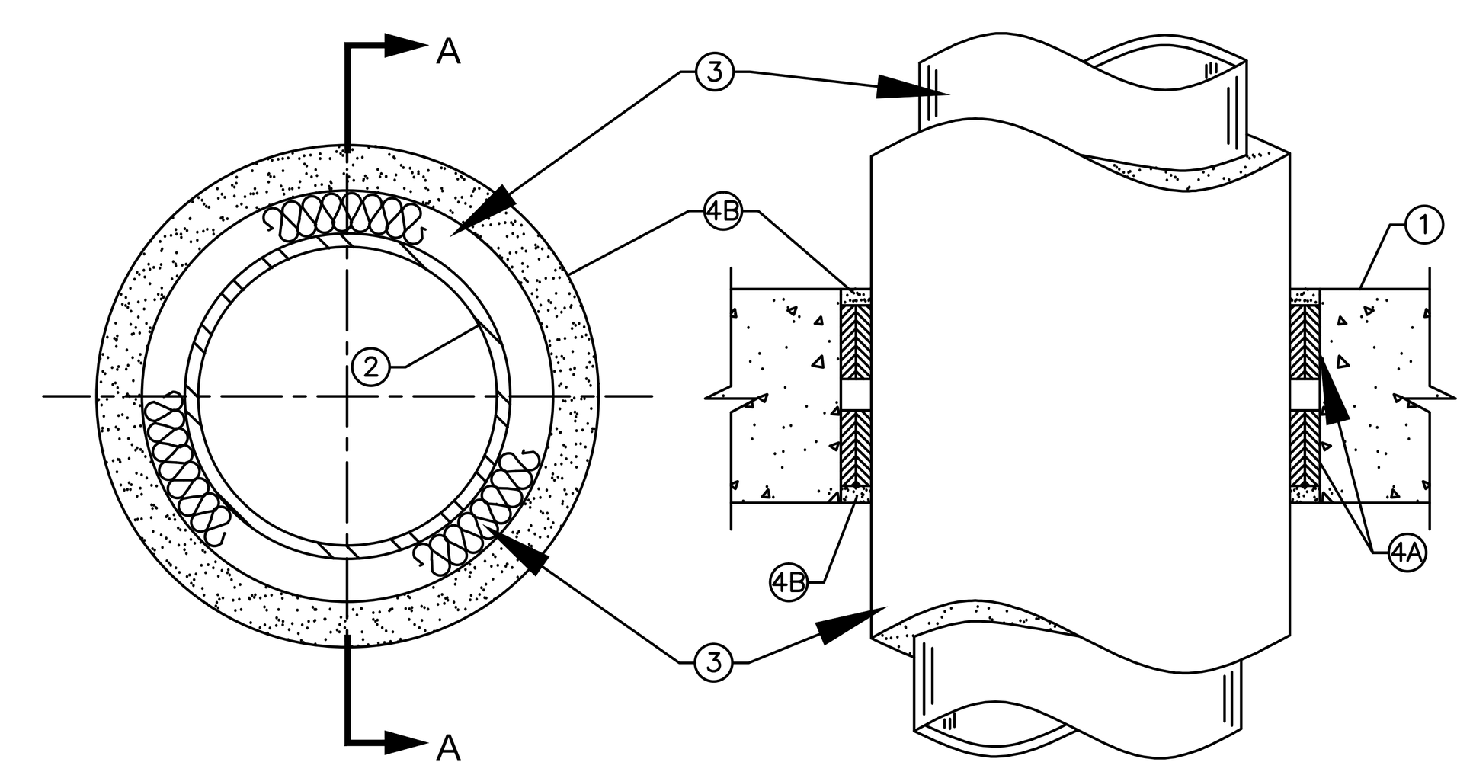
3M COMPANY - CP 25WB+ or FB-3000 WT

*Bearing the UL Classification Mark

THROUGH PENETRATION FIRESTOP SYSTEMS

System No. C-BJ-5003

September 07, 2004
(Formerly System No. 91-E)
F Ratings - 4 Hr
T Ratings - 1 and 2 Hr (See Item 2)
L Rating At Ambient - 2 CFM/sq ft
L Rating At 400 F - Less than 1 CFM/sq ft



SECTION A-A

1. **Floor or Wall Assembly -** Min 5-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be be constructed of any UL Classified **Concrete Blocks*.** Diam of opening to be 1 in. to 1-1/4 in. larger than outside diam of insulated pipe. Max diam of opening is 18 in.

See **Concrete Blocks** (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. **Pipe -** Nom 4 in. diam (or smaller) Type L (or heavier) copper pipe or nom 12 in. diam (or smaller) Schedule 10 (or heavier) steel pipe centered in the opening and rigidly supported on both sides of the floor or wall assembly. **When max 6 in. diam pipe is used, T Rating is 2 hr. When pipe is larger than 6 in. diam, T Rating is 1 hr.**

3. **Pipe Covering* -** Nom 1 or 2 in. thick hollow cylindrical heavy density (min. 3.5 pcf) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt strip tape supplied with the product.

See **Pipe and Equipment Covering - Materials*(BRGU)** category in Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index of 50 or less may be used.

4. **Firestop System -** The details of the firestop system shall be as follows:

A. **Fill, Void or Cavity Materials* - Wrap Strip -** Nom 1/4 in. thick intumescent elastomeric material faced on one side with aluminum foil, supplied in 2 in. wide by 24 in. long strips. Two layers of the nom 2 in. wide strips tightly-wrapped around pipe covering (foil side exposed) and slid into annular space on each side of the floor or wall assembly such that the exposed edges are recessed 1/4 to 1/2 in. from the floor or wall surfaces. Each layer is to be installed with a butted seam secured with aluminum foil tape.

3M COMPANY - Type FS-195+

B. **Fill, Void or Cavity Materials* - Caulk or Sealant -** Applied to fill the annular space (over edges of wrap strip layers) to a depth of 1/4 to 1/2 in., flush with both surfaces of floor or wall.

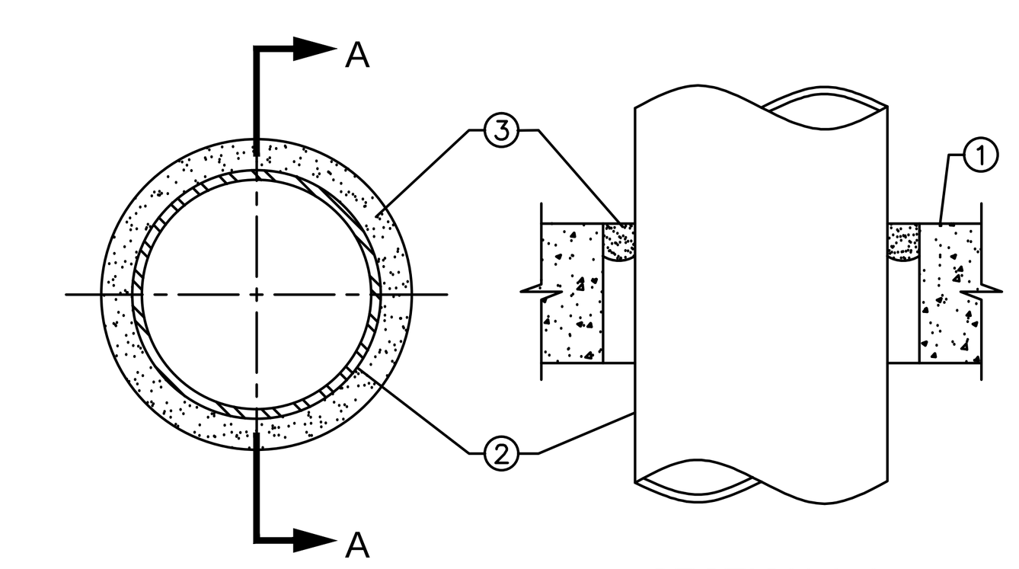
3M COMPANY - CP 25WB+ or FB-3000 WT

*Bearing the UL Classification Mark

THROUGH PENETRATION FIRESTOP SYSTEMS

System No. C-AJ-1027

January 18, 1999
(Formerly System No. 202)
F Rating - 3 Hr.
T Rating - 0 Hr.



SECTION A-A

1. **Floor or Wall Assembly** - Min 4-1/2 in. thick lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified **Concrete Blocks*.** Max diam of through opening is 12-1/4 in.

See Concrete Blocks (CAZT) category in Fire Resistance Directory for names of manufacturers.

2. **Through Penetrants** One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. Min annular space between pipe, conduit or tubing and edge of opening is 0 in. (point contact). Max annular space is dependent on pipe, conduit or tubing type and size as well as the F Rating of the system, as shown in the table below. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:

A. **Steel Pipe** Nom 10 in. diam (or smaller) Schedule 10 (or heavier) steel pipe.
B. **Conduit** Nom 6 in. diam (or smaller) rigid steel conduit.
C. **Conduit** Nom 4 in. diam (or smaller) steel electrical metallic tubing or steel conduit.
D. **Copper Tubing** Nom 3 in. diam (or smaller) Type L (or heavier) copper tubing.
E. **Copper Pipe** Nom 3 in. diam (or smaller) Regular (or heavier) copper pipe.
F. **Iron Pipe** Nom 10 in. diam (or smaller) cast or ductile iron pipe.

Pipe Conduit or Tubing Type	Max. Nom. Pipe Conduit or Tubing Dia. Inches	F Rating Hr.	Max Annular Space Inches
A or F	10	3	3/4
B	6	3	3/4
C	4	3	1-1/2
D and E	3	3	3/4
D and E	3	2	7/8

Fill, Void or Cavity Materials* - Putty Moldable putty material kneaded by hand and applied to fill annular space to a min depth of 1 in., flush with top surface of floor. In wall assemblies, required putty thickness to be installed symmetrically on both sides of wall.

3M COMPANY - MPS-2+.

*Bearing the UL Classification Mark

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.0040 Fax: 931.454.2336
www.olgengineering.com

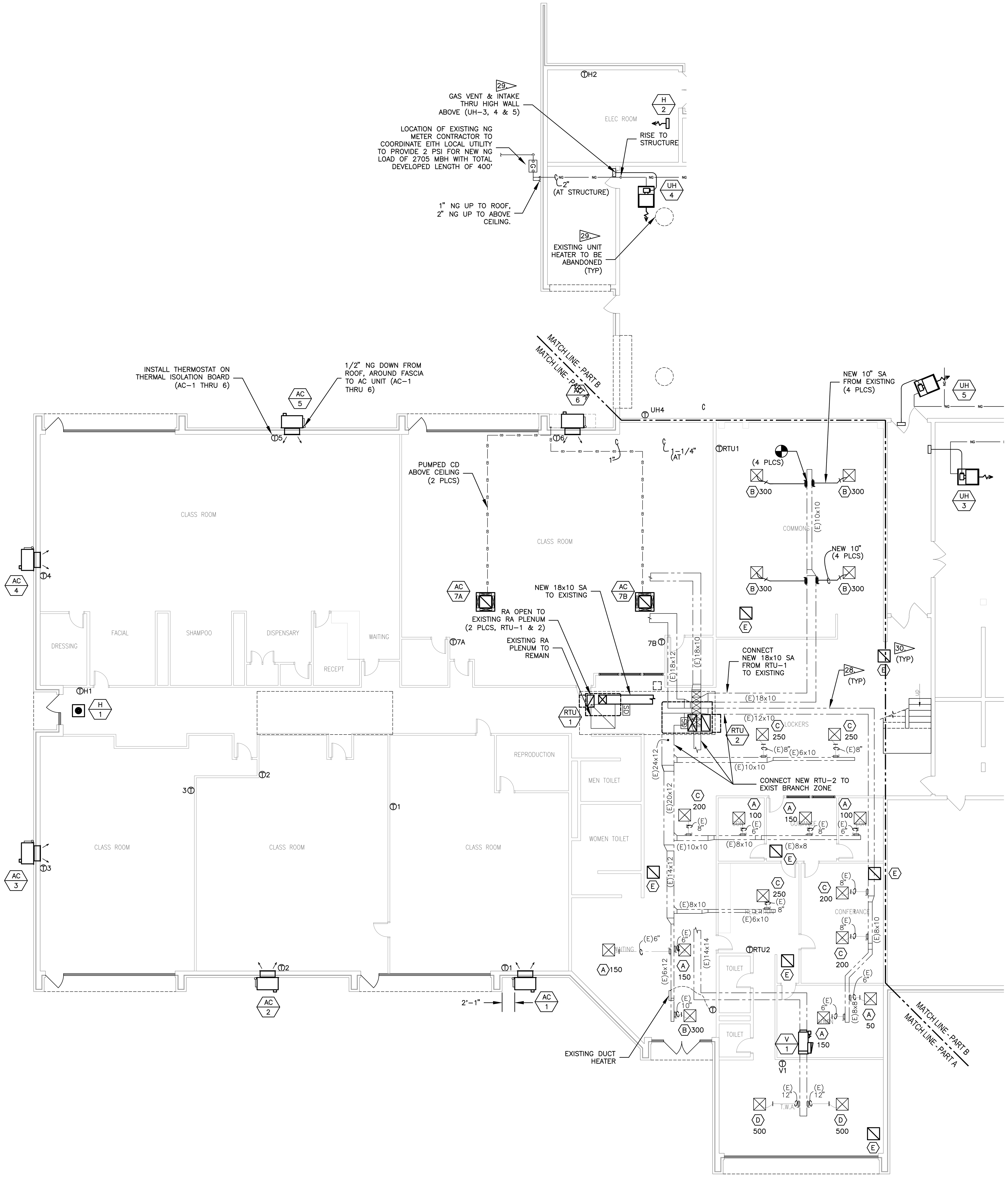
UL Details

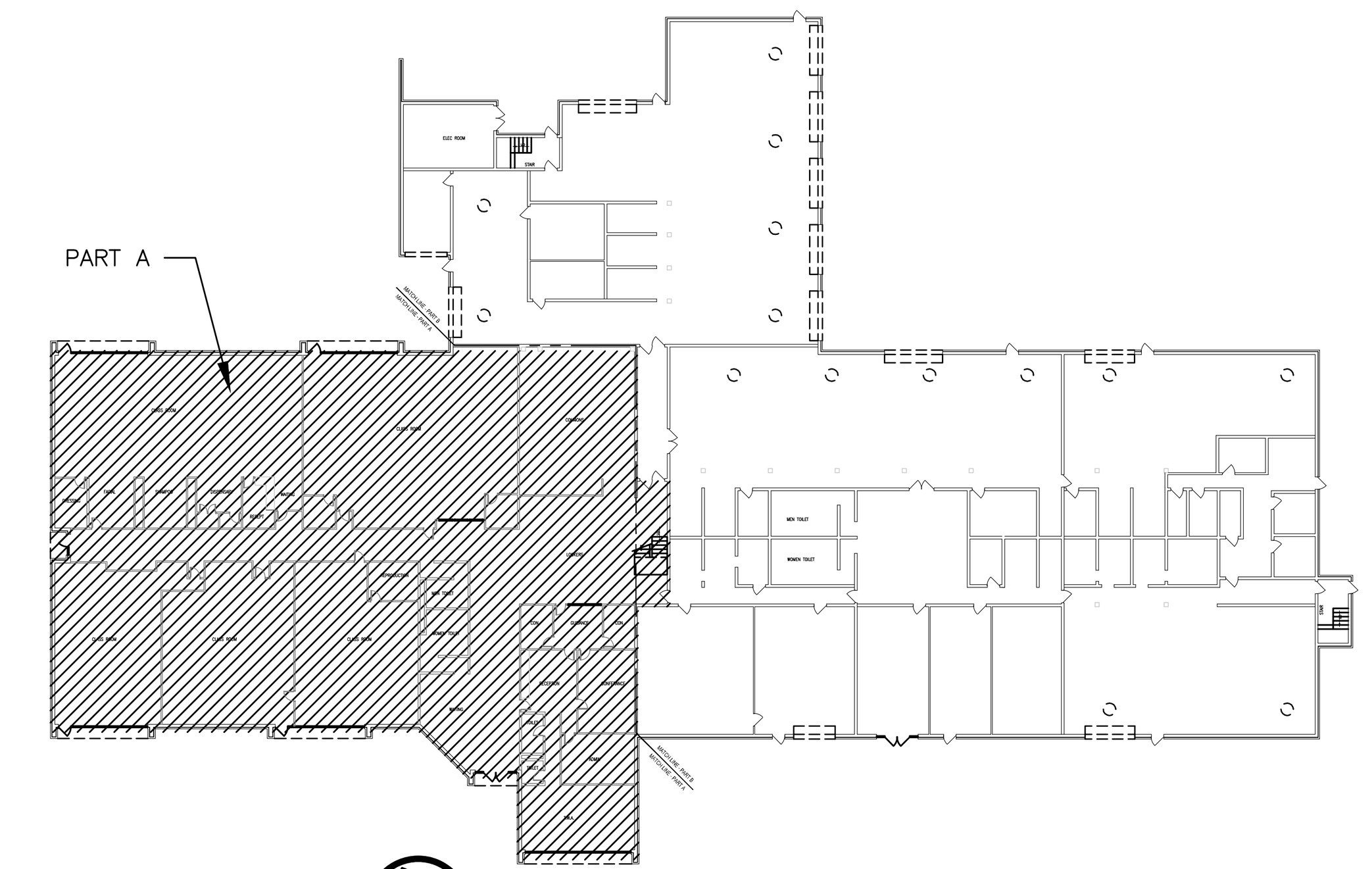
Portland Vocational Building

Portland, Tennessee

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

G1.0





NORTH

Key Plan
SCALE: 1" = 40'

NORTH

HVAC Plan - Part 'A'
SCALE: 1/8" = 1'-0"

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.0940 Fax: 931.454.2336
www.olgengineering.com

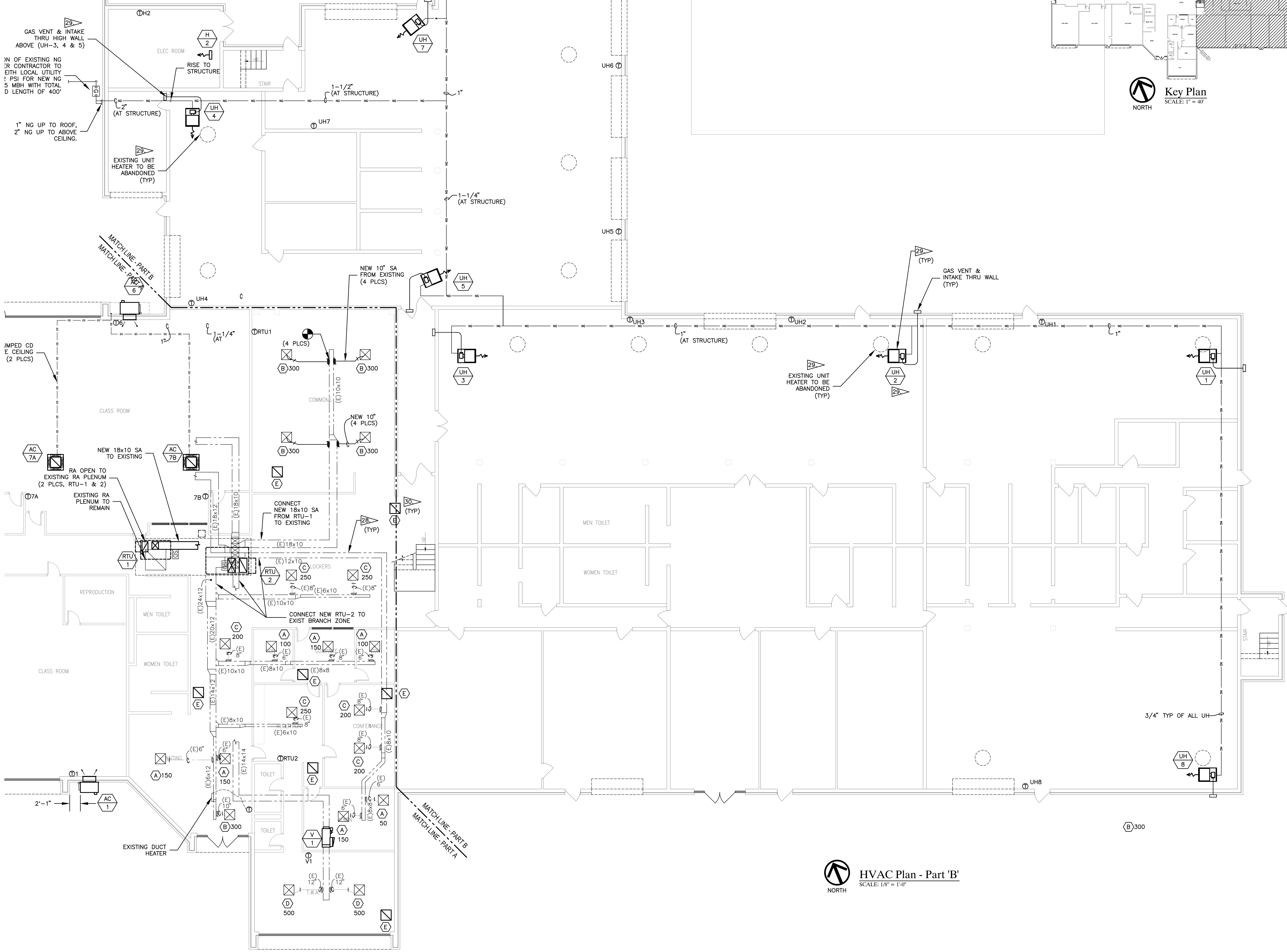
HVAC Plan - Part 'A'

Portland Vocational Building

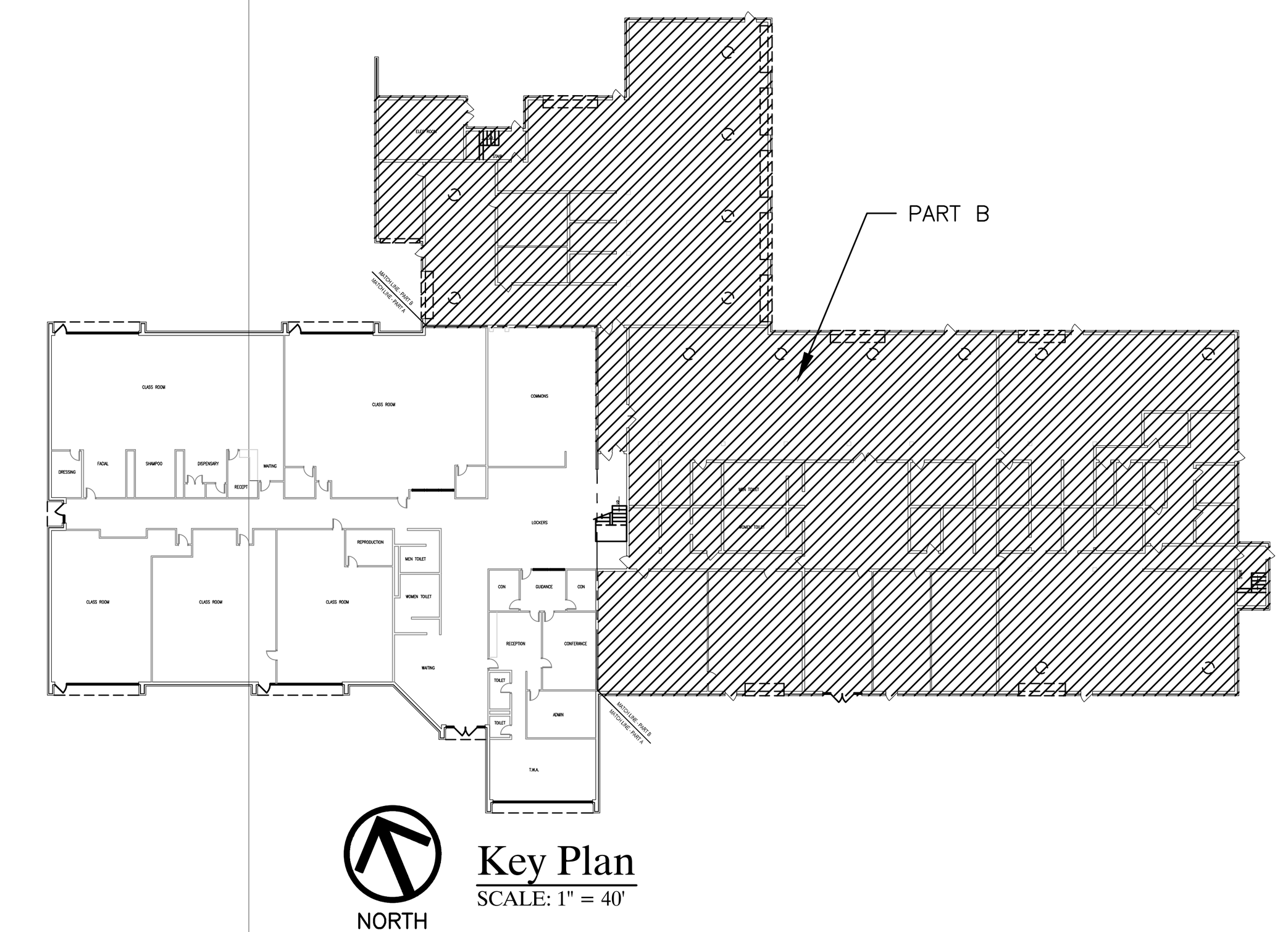
Portland, Tennessee

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

M1.1



HVAC Plan - Part 'B'
SCALE: 1/8" = 1'-0"
NORTH



Key Plan
SCALE: 1" = 40'
NORTH

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.0940 Fax: 931.454.2336
www.olgengineering.com

HVAC Plan - Part 'B'

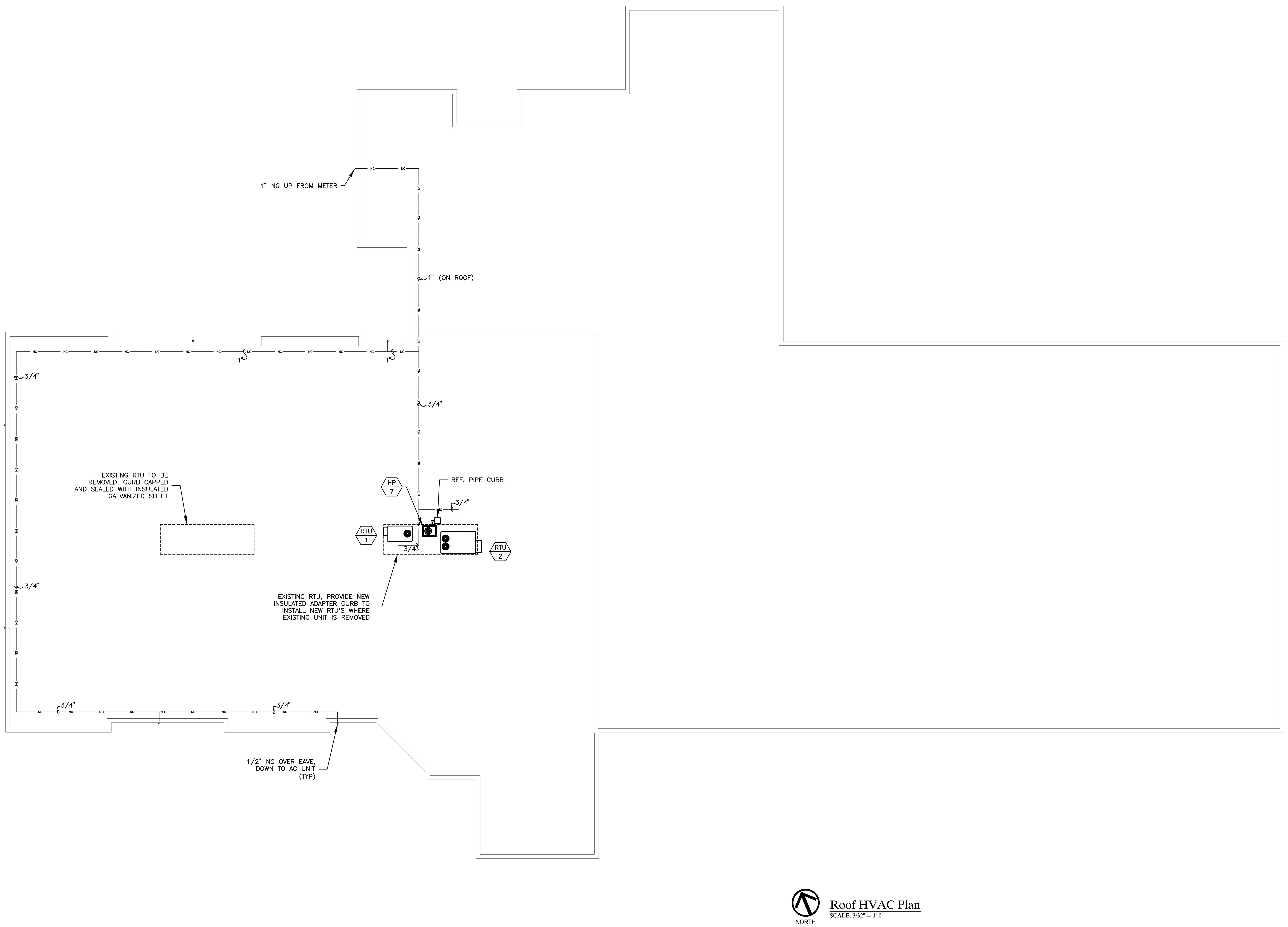
Portland Vocational Building

Portland, Tennessee

SUMNER COUNTY SCHOOLS TENNESSEE

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

M1.2



Roof HVAC Plan
SCALE: 3/32" = 1'-0"

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.9940 Fax: 931.454.2336
www.olgengineering.com

TIMOTHY W. LITTLE
REGISTERED ENGINEER
STATE OF TENNESSEE

Roof HVAC Plan

Portland Vocational Building

Portland, Tennessee

SUMNER COUNTY SCHOOLS TENNESSEE

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

M1.3

AIR DEVICE SCHEDULE

MARK	NECK SIZE (INCHES)	TYPE: DIFFUSER	TYPE: REGISTER	TYPE: GRILLE	TYPE: LOUVER	TYPE: DOOR GRILLE	MAXIMUM AIRFLOW (CFM)	MOUNTING: LAY-IN	MOUNTING: SURFACE	MOUNTING: WALL	MOUNTING: FLOOR	MOUNTING: DUCT	MOUNTING: ROOF	AIR PATTERN	DUTY: SUPPLY	DUTY: RETURN	DUTY: EXHAUST	DUTY: INTAKE	AIR THROW (FT@50 FPM)	STATIC PRESSURE DROP AT MAX CFM	TITUS MODEL NUMBER	MAX NC	NOTES
A	6	X					175	X						4-WAY	X				8	0.03	TMS	20	1,3,6,8,12,16,18
B	10	X					400	X						4-WAY	X				13	0.02	TMS	20	1,3,6,8,12,16,18
C	8	X					275	X						4-WAY	X				11	0.02	TMS	20	1,3,6,8,12,16,18
D	12	X					550	X						4-WAY	X				16	0.02	TMS	21	1,3,6,8,12,16,18
E	22X22		X				2000	X						–		X				0.02	50F	20	2,3,6,10,12,16,18

AIR DEVICE NOTES (SOME NOTES MAY NOT BE USED ON THIS PROJECT)

1. STEEL
2. ALUMINUM
3. WHITE FINISH
4. MILL FINISH
5. ARCHITECT TO SELECT COLOR
6. FIXED PATTERN
7. ADJUSTABLE PATTERN
8. LOUVERED FACE
9. HINGED, PERFORATED FACE
10. 1/2 X 1/2 X 1/2 INCH EGGCRATE FACE
11. 12 X 12 INCH MODULE
12. 24 X 24 INCH MODULE – FULL FACE
13. 24 X 24 INCH MODULE – FILLER PANEL
14. 48 X 24 INCH MODULE
15. 24 X 12 INCH MODULE
16. OPPOSED BLADE DAMPER
17. SQUARE TO ROUND ADAPTER AS REQUIRED (FIELD FAB OR FACTORY)
18. PROVIDE PLASTER FRAME IN GYP BOARD OR PLASTER CEILINGS AS REQ'D.
19. SIGHT TIGHT CHEVRON BLADE DOOR GRILLE W/AUXILIARY FRAME
20. ADJUSTABLE COUNTERBALANCED BACKDRAFT/RELIEF DAMPER; RUSKIN MODEL CBD-2.
21. 4 INCH DRAINABLE STATIONARY LOUVER WITH BIRD SCREEN; UNITED ENERTECH MODEL FL-D-4
22. 4 INCH DRAINABLE ADJUSTABLE LOUVER WITH BIRD SCREEN AND 120V MOTORIZED OPERATOR WITH SPRING RETURN UNITED ENERTECH MODEL AFL-D-4
23. NON DUCTED PANEL
24. 4 INCH DRAINABLE STATIONARY BRICK VENT WITH BIRD SCREEN; UNITED ENERTECH MODEL BV SERIES, VERIFY FLANGE RQMTS WITH ARCH.
25. 6 INCH DRAINABLE COMBINATION LOUVER WITH BIRD SCREEN AND 120V MOTORIZED OPERATOR WITH SPRING RETURN UNITED ENERTECH MODEL CFL-D-6
26. ADJUST FOR FULL VERTICAL DISCHARGE

NOTE: SUBMITTALS FOR AIR DEVICES OTHER THAN THE MANUFACTURER AND MODEL NO. SPECIFIED SHALL INCLUDE ALL APPLICABLE PERFORMANCE DATA (THROW, PRESSURE DROP, NC, ETC.).

PACKAGED ROOFTOP AC UNIT SCHEDULE

MARK	RTU-1	RTU-2
CONFIGURATION	DOWNFLOW	DOWNFLOW
NOMINAL TONNAGE	3	8.5
SUPPLY AIR DATA		
AIRFLOW (CFM)	1200	3400
EXTERNAL SP (IN WC)	1.2	1.2
OUTSIDE AIR (CFM)	400	550
COOLING		
TOTAL (MBH)	38.5	104.4
SENSIBLE (MBH)	28.0	81.6
ENTERING AIR DRY BULB (F)	80	80
ENTERING AIR WET BULB (F)	67	67
AMBIENT AIR TEMPERATURE (F)	95	95
HEATING		
HEAT SOURCE	NATURAL GAS	NATURAL GAS
INPUT CAPACITY (MBH)	80	150
OUTPUT CAPACITY (MBH)	64	122
AFUE	81	81
MISCELLANEOUS		
CONTROL TYPE	MICRO-PROCESSOR	MICRO-PROCESSOR
FILTERS	2" THROW-AWAY	2" THROW-AWAY
UNIT DATA		
EER/SEER	15 SEER	13 EER
ELECTRICAL (VOLTS/Ph/Hz)	460/3/60	460/3/60
MCA/MOCP	10.1/15	21.9/25
BLOWER DRIVE	BELT	BELT
BLOWER MOTOR HORSEPOWER	1	2
ACCESSORIES	INSULATED FULL PERIMETER ADAPTER CURB, DRY-BULB ECONOMIZER WITH BAROMETRIC RELIEF, LOUVERED CONDENSER COIL GUARDS, HONEYWELL VISION-PRO 8000/ TB8220 SERIES PROGRAMMABLE THERMOSTAT, DISCONNECT SWITCH, HINGED SERVICE PANEL W/ 1/4 TURN CAPTIVE FASTNERS	INSULATED FULL PERIMETER ADAPTER CURB, DRY-BULB ECONOMIZER WITH BAROMETRIC RELIEF, LOUVERED CONDENSER COIL GUARDS, HONEYWELL VISION-PRO 8000/ TB8220 SERIES PROGRAMMABLE THERMOSTAT, DISCONNECT SWITCH, HINGED SERVICE PANEL W/ 1/4 TURN CAPTIVE FASTNERS
MANUFACTURER	TRANE	TRANE
MODEL	YHC036	YHC102

NOTE: HVAC UNITS WITH MULTIPLE COMPRESSORS SHALL BE PROVIDED WITH INTERTWINED OR ROW-SPLIT EVAPORATOR COILS. FACE-SPLIT EVAPORATOR COILS SHALL NOT BE USED.

DUCTLESS SPLIT SYSTEM SCHEDULE

AIR HANDLING UNIT

MARK	AC-7A & B
CONFIGURATION	CASSETTE
SUPPLY AIR DATA	
AIRFLOW (CFM)	600
EXTERNAL SP (IN WC)	0.0
OUTSIDE AIR (CFM)	VIA AC-6
BLOWER DRIVE/HP	DIRECT 1.5 A
COOLING DATA	
TOTAL (MBH)	18
SENSIBLE (MBH)	-
ENTERING AIR DRY BULB (F)	80
ENTERING AIR WET BULB (F)	67
HEATING DATA	
CAPACITY (MBH)	20
ENTERING AIR TEMPERATURE (F)	70
AUX. ELECT. HEAT KW/STAGES	-
UNIT DATA	
ELECTRICAL (VOLTS/Ph/Hz)	208-230/1/60
ELECTRICAL (MCA/MOCP)	1/15
ACCESSORIES	CONDENSATE PUMP, REMOTE LOW VOLTAGE THERMOSTAT
FILTERS	PERMANENT CLEANABLE
MANUFACTURER	MITSUBISHI
MODEL	PLA-A18AA

CONDENSING UNIT

MARK	
COOLING DATA	
NOMINAL TONS TOTAL	28 TOTAL
AMBIENT TEMPERATURE (F)	95
SEER (BTU/W-HR)	16 SEER
HEATING DATA	
CAPACITY (MBH)	28.6 TOTAL
AMBIENT TEMPERATURE (F)	47
UNIT DATA	
REFRIGERANT	R-410A
NO. OF COMPRESSORS	2
ACCESSORIES	LOW AMBIENT COOLING, CONDENSER COIL GUARDS
ELECTRICAL (VOLTS/Ph/Hz)	208-230/1/60
ELECTRICAL (MCA/MOCP)	15/20
MANUFACTURER	MITSUBISHI
MODEL	MXZ-3A030NA

REFRIGERANT LINES AND ACCESSORIES: SIZE REFRIGERANT LINES AND PROVIDE ACCESSORIES PER EQUIPMENT MANUFACTURER RECOMMENDATIONS.

CLASSROOM AC UNITS

MARK	AC-1 & 2	AC-3, 4, & 5	AC-6
NOMINAL TONNAGE	4	3.5	5
SUPPLY AIR DATA			
AIRFLOW (CFM)	1550	1300	1650
OUTSIDE AIR (CFM)	370 VIA ERV	370 VIA ERV	370 VIA ERV
COOLING			
TOTAL (MBH)	49.6	43.2	58.5
SENSIBLE (MBH)	37..8	33.9	42.9
ENTERING AIR DRY BULB (F)	80	80	80
ENTERING AIR WET BULB (F)	67	67	67
AMBIENT AIR TEMPERATURE (F)	95	95	95
REFRIGERANT	R-410A	R-410A	R-410A
NUMBER OF COMPRESSORS	1	1	1
EER (BTU/W-HR)	9.7	9.8	9.8
HEATING			
FUEL SOURCE	NATURAL GAS	NATURAL GAS	NATURAL GAS
INPUT CAPACITY (MBH)	75	75	100
OUTPUT CAPACITY (MBH)	61.5	61.5	82
AFUE	82	82	82
ENERGY RECOVERY VENTILATOR			
OUTSIDE AIR (CFM)	370	370	370
EXHAUST AIR	280	280	280
SUMMER TOTAL LOAD (MBH)	12.9	12.9	12.0
SUMMER SENSIBLE LOAD (MBH)	5.8	5.8	5.8
WINTER CAPACITY (MBH)	17.1 @ 15 F	17.1 @ 15 F	17.1 @ 15 F
AFUE	82	82	82
MISCELLANEOUS			
CONTROL TYPE	THERMOSTAT	THERMOSTAT	THERMOSTAT
CABINET FINISH	DARK BRONZE	DARK BRONZE	DARKBRONZE
FILTERS	2-INCH PLEATED	2-INCH PLEATED	2-INCH PLEATED
UNIT DATA			
ELECTRICAL (VOLTS/Ph/Hz)	460/3/60	460/3/60	460/3/60
ELECTRICAL MCA/MOCP	13/20	12./15	14/20
BLOWER DRIVE	DIRECT	DIRECT	DIRECT
ACCESSORIES	SG-5W SUPPLY GRILLE WITH DAMPER, RG-5W RETURN AIR GRILLE, CS9B-THO COMPLETESTAT ENERGY CONTROL WITH TEMPERATURE, HUMIDITY, AND OCCUPANCY SENSOR, MAIN CIRCUIT BREAKER, ENERGY RECOVERY VENTILATOR, HOT-GAS RE-HEAT DEHUMIDIFICATION, LOW AMBIENT COOLING	SG-5W SUPPLY GRILLE WITH DAMPER, RG-5W RETURN AIR GRILLE, CS9B-THO COMPLETESTAT ENERGY CONTROL WITH TEMPERATURE, HUMIDITY, AND OCCUPANCY SENSOR, MAIN CIRCUIT BREAKER, ENERGY RECOVERY VENTILATOR, HOT-GAS RE-HEAT DEHUMIDIFICATION, LOW AMBIENT COOLING	SG-5W SUPPLY GRILLE WITH DAMPER, RG-5W RETURN AIR GRILLE, CS9B-THO COMPLETESTAT ENERGY CONTROL WITH TEMPERATURE, HUMIDITY, AND OCCUPANCY SENSOR, MAIN CIRCUIT BREAKER, ENERGY RECOVERY VENTILATOR, HOT-GAS RE-HEAT DEHUMIDIFICATION, LOW AMBIENT COOLING
MANUFACTURER	BARD	BARD	BARD
MODEL	W48 SERIES	W42 SERIES	W60 SERIES

VARIABLE VOLUME DAMPER SCHEDULE

MARK	V-1
DUCT SIZE (INCHES)	14 x14
MAXIMUM CFM	1000
MINIMUM CFM	400
CONTROL TYPE	24V
FUNCTION	CHANGEOVER W/REHEAT
ELECTRIC HEAT CAPACITY (Kw)	5
VOLTAGE	277/1/60
NOTES/ACCESSORIES	1,2,4
MAKE	TRANE
MODEL	VADA 14 ELEC

NOTES

1. 24 VOLT CONTROL TRANSFORMER - A SINGLE TRANSFORMER MAY SERVE MULTIPLE UNITS IF PROPERLY SIZED

2. DUCT TEMPERATURE SENSOR FOR AUTOMATIC COOLING/HEATING CHANGEOVER.

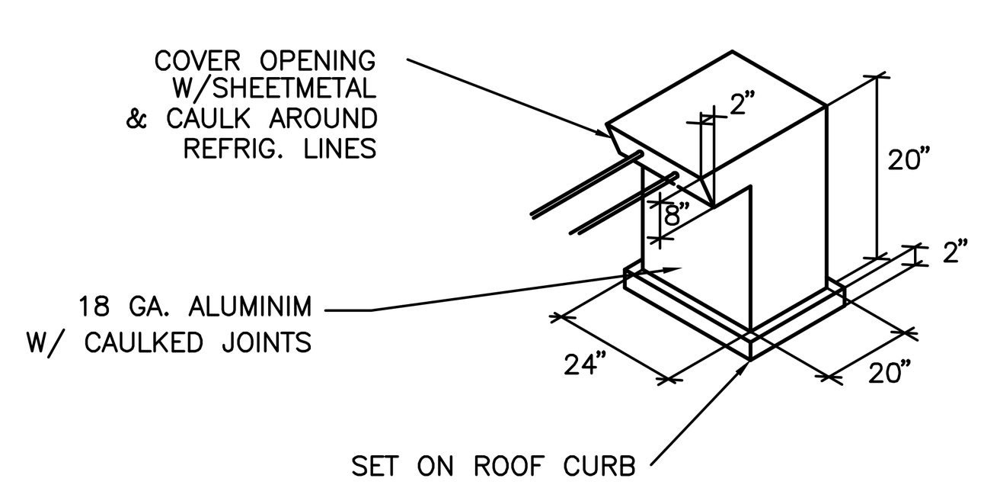
3. REMOTE SPACE TEMPERATURE SENSOR WITH SETPOINT ADJUSTMENT.
4. REMOTE SPACE TEMPERATURE SENSOR WITH SETPOINT ADJUSTMENT AND 3-STAGE HEATING CONTROL OUTPUT. ELECTRIC HEATING SHALL BE DISABLED WHEN DAMPER CHANGES OVER TO HEATING MODE

ELECTRIC HEATER SCHEDULE

MARK	H-1	H-2
TYPE	CEILING HEATER	SUSPENDED HEATER
SERVICE	CORRIDOR	CORRIDOR
CAPACITY (KW)	2.0	5.0
ELECTRICAL (VOLTS/Ph/Hz)	277/1/60	277/1/60
ACCESSORIES	REMOTE LOW VOLTAGE THERMOSTAT WITH LOCKING METAL COVER, DISCONNECT SWITCH	REMOTE LOW VOLTAGE THERMOSTAT, DISCONNECT SWITCH, HORIZONTAL DISCHARGE MOUNTING KIT
MANUFACTURER	MARKEL	MARKEL
MODEL	G3482	G1G5105N

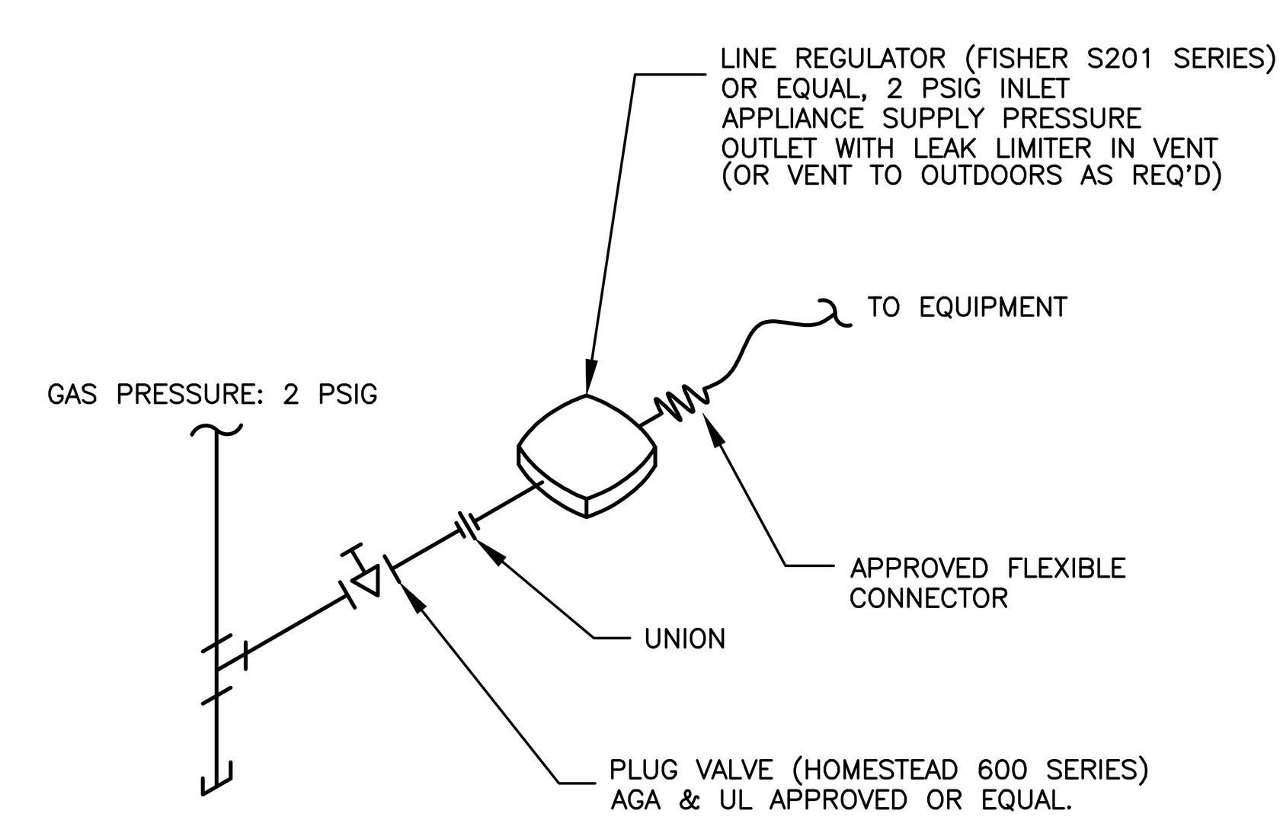
UNIT HEATER SCHEDULE

MARK	UH-1, 2, 3, & 8	UH-4 THRU 7
FUEL	NATURAL GAS	NATURAL GAS
COMBUSTION	SEPARATED COMBUSTION	SEPARATED COMBUSTION
IGNITION	INTERMITENT PILOT	INTERMITENT PILOT
INPUT (MBH)	300	250
OUTPUT (MBH)	240	200
FAN TYPE	PROPELLER	PROPELLER
BLOWER DRIVE	DIRECT	DIRECT
MOTOR HORSEPOWER	(2) @ 1/4	1/2
AIRFLOW (CFM)	4400	3100
EXTERNAL SP (IN WC)	0.0	0.0
ELECTRICAL (VOLTS/Ph/Hz)	115/1/60	115/1/60
ACCESSORIES	REMOTE LOW VOLTAGE THERMOSTAT, WALL VENT KIT	REMOTE LOW VOLTAGE THERMOSTAT, WALL VENT KIT
MANUFACTURER	TRANE	TRANE
MODEL	GAND030	GAND025



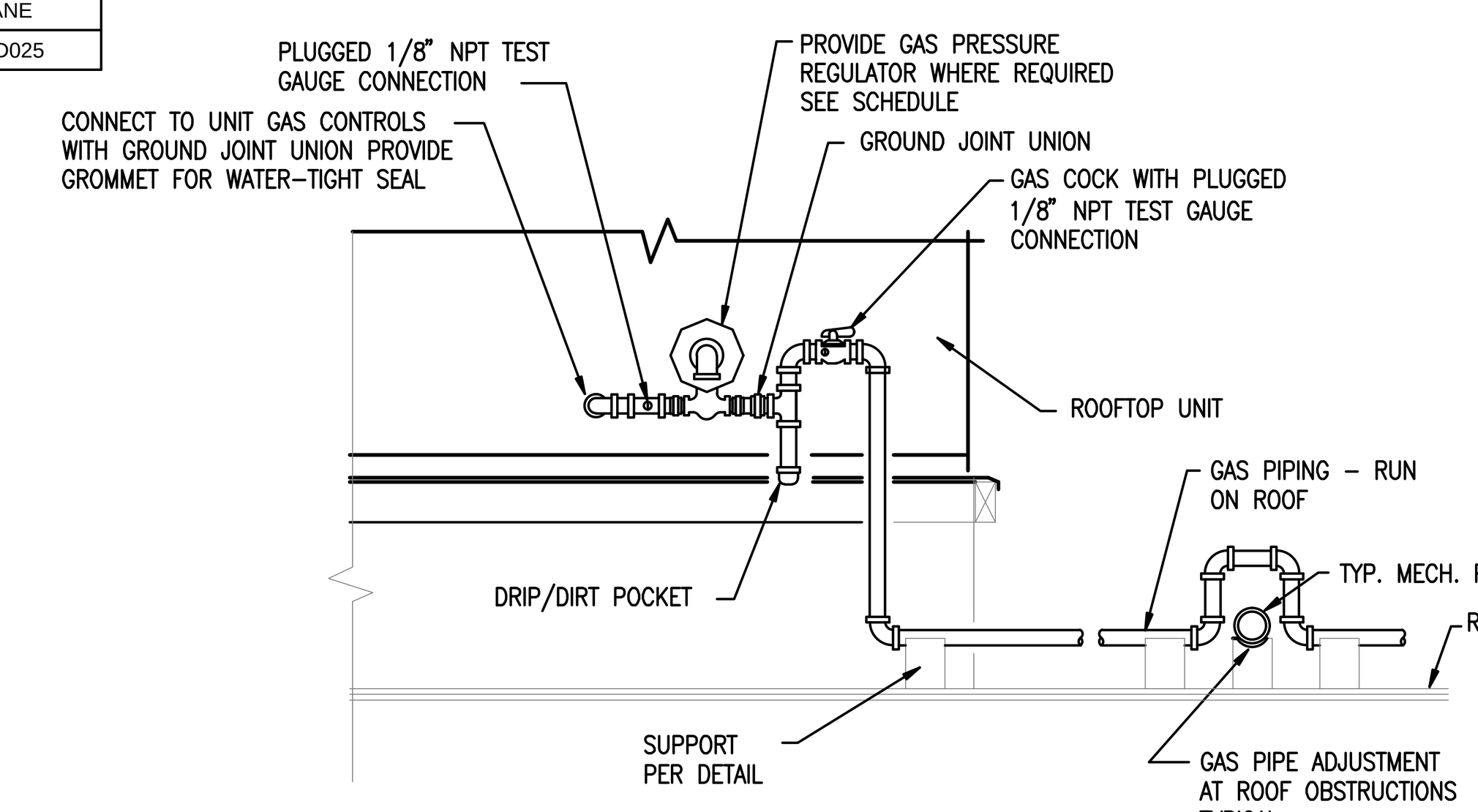
REFRIG. LINE THRU ROOF DETAIL

NTS



TYPICAL 2 PSI GAS CONNECTION

NTS

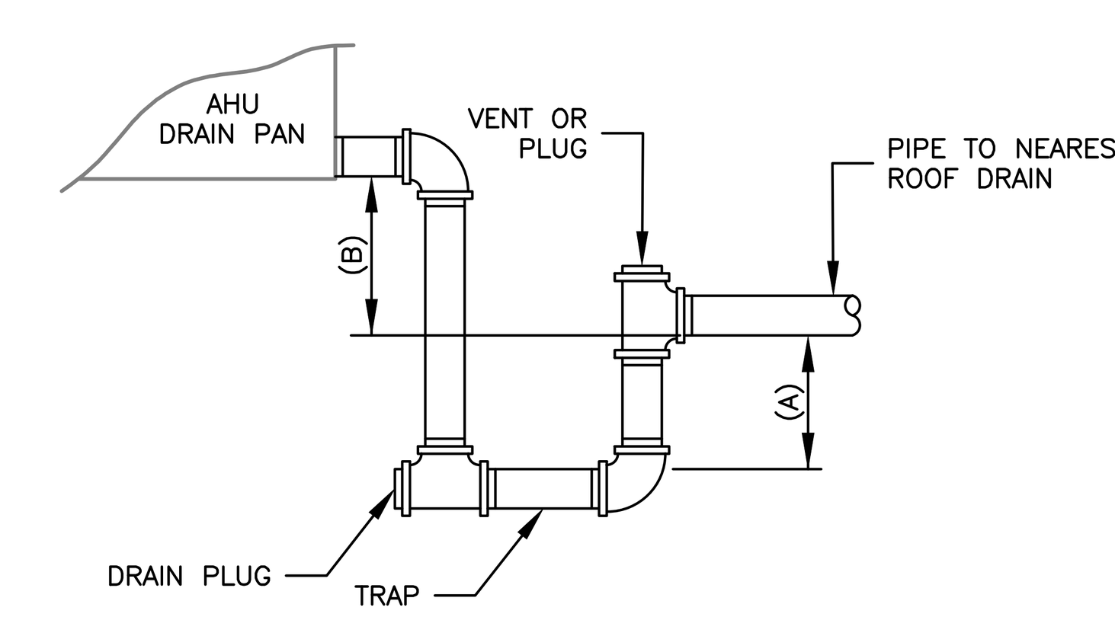


NOTE: COORDINATE PIPING SUPPORTS WITH LANDLORDS ROOFING CONTRACTOR.

NOTE: CONTRACTOR SHALL VERIFY ALL MECHANICAL GAS FIRED EQUIPMENT CONNECTION LOCATIONS IN THE FIELD PRIOR TO INSTALLING ANY GAS PIPE MAINS OR BRANCHES.

ROOFTOP UNIT GAS PIPING DETAIL

NTS



BLOW THRU UNITS:

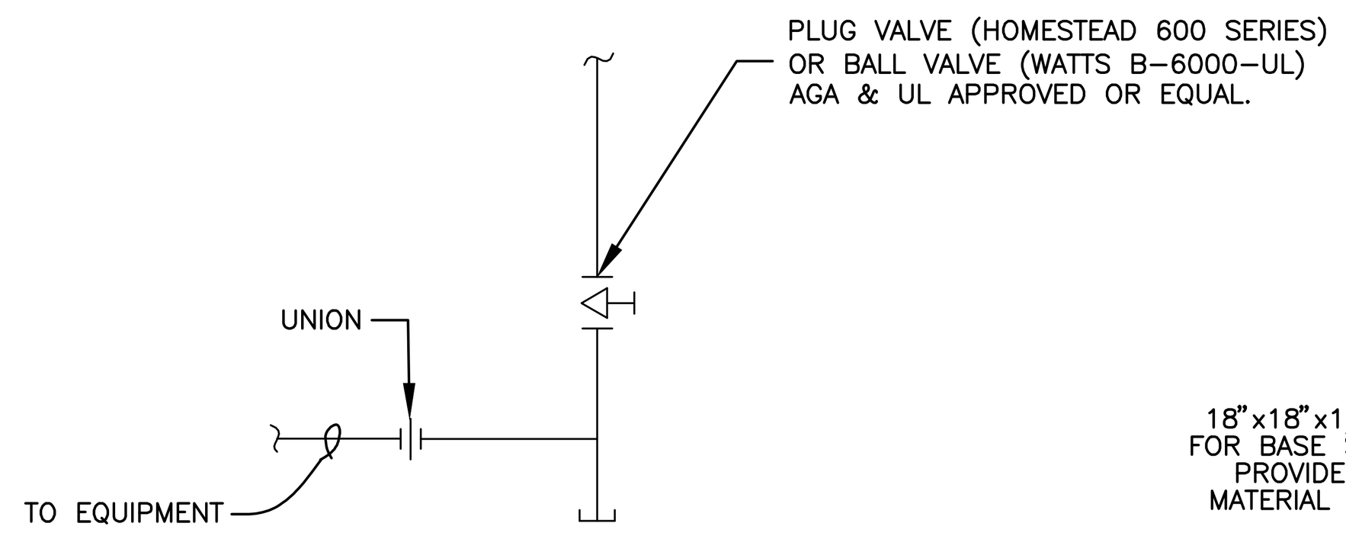
1. ALL CONDENSATE DRAIN LINES SHALL BE FULL SIZE OF DRAIN PAN OUTLET
2. A = 1/2" + T.S.P.
3. B = MIN. 1/2"

DRAW THRU UNITS:

1. ALL CONDENSATE DRAIN LINES SHALL BE FULL SIZE OF DRAIN PAN OUTLET
2. A = 1/2 OF (B)
3. B = T.S.P. + 1"

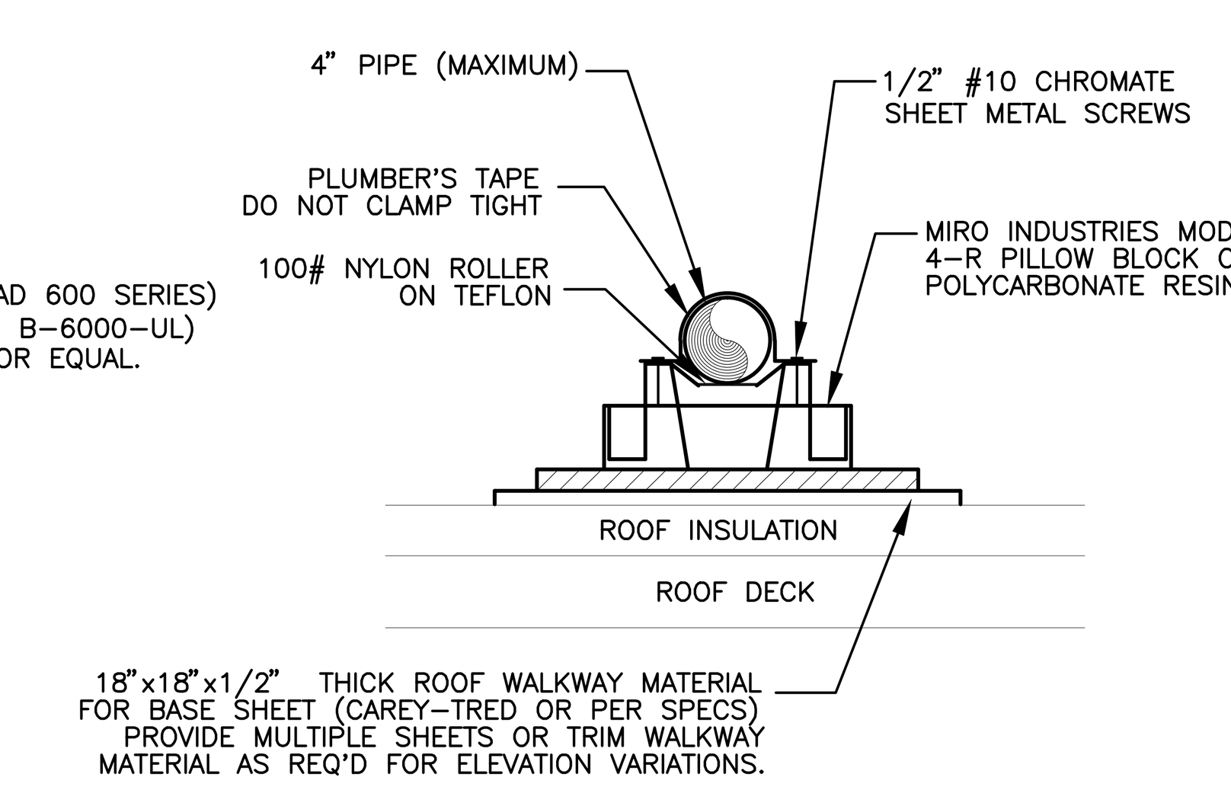
AHU CONDENSATE DRAIN DETAIL

NTS



GAS DROP DETAIL

NTS



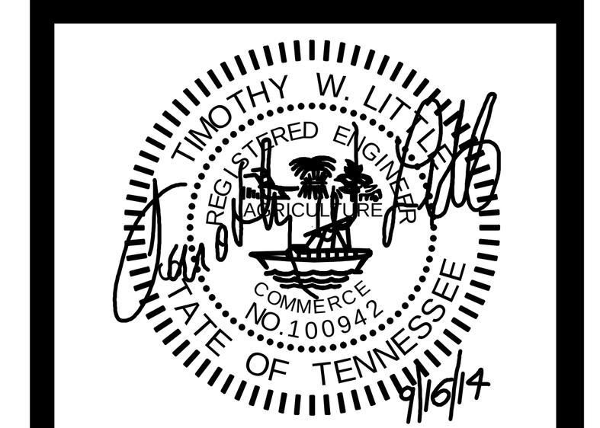
PIPE SIZE	SUPPORT SPACING
3/4"	6'-0"
1"	6'-0"
1-1/4"	6'-0"
1-1/2"	10'-0'
2"	10'-0"
2-1/2"	10'-0"
3"	12'-0"
4"	12'-0"
PLASTIC PIPE	4'-0"

ROOF PIPING SUPPORT DETAIL

NTS

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.9940 ~ Fax: 931.454.2338
www.olgengineering.com



Schedules & Details

Portland Vocational Building

Portland, Tennessee

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

M2.1

MECHANICAL LEGEND

- DEMOLITION – TO BE REMOVED
- INDICATES FLAG NOTE
- FULL RADIUS ELBOW
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- FIRE DAMPER (PROVIDE ACCESS DOOR)
- SMOKE DAMPER (PROVIDE ACCESS DOOR)
- COMBINATION FIRE/SMOKE DAMPER (PROVIDE ACCESS DOOR)
- MANUAL VOLUME DAMPER
- VARIABLE AIR VOLUME (VAV) DAMPER
- MOTORIZED DAMPER
- 45° ENTRY TAKEOFF FITTING
- MITERED ELBOW W/TURNING VANES
- SD — DUCT SMOKE DETECTOR
- INSULATED FLEX DUCT W/DAMPERED ROUND TAKEOFF FITTING WITH SCOOP
- 24x12 — DUCT SIZE IN INCHES (CLEAR INSIDE DIMENSIONS)
- RECTANGULAR–TO–ROUND (OR OVAL) TRANSITION
- 90° BRANCH FITTINGS
- 45° BRANCH FITTINGS
- CONCENTRIC REDUCER
- ELBOW DOWN
- EXISTING
- NEW
- SUPPLY AIR DEVICE
- RETURN/EXHAUST AIR DEVICE
- SUPPLY AIR DUCT, UP, DOWN
- RETURN/EXHAUST DUCT UP, DOWN
- AIR PATTERN (3–WAY SHOWN, ASSUME 4–WAY IF NOT OTHERWISE INDICATED.)
- 1½" — UNDERCUT DOOR 1–1/2" FOR RETURN AIR
- CONNECT TO EXISTING
- A 100 — AIR DEVICE CALLOUT AND CFM
- EF 1 — EQUIPMENT NUMBER TAG
- T 1 — ROOM THERMOSTAT WITH ASSOCIATED EQUIPMENT NUMBER (5'± AFF)
- TS 1 — ROOM SENSOR WITH ASSOCIATED EQUIPMENT NUMBER (5'± AFF)
- T 1 — HANDICAPPED ROOM THERMOSTAT WITH ASSOCIATED EQUIPMENT NUMBER (4'± AFF)
- H 1 — ROOM HUMIDISTAT WITH ASSOCIATED EQUIPMENT NUMBER (5'± AFF)
- CO2 2 — CARBON DIOXIDE SENSOR WITH EQUIPMENT NUMBER (5'± AFF)

AC	AIR CONDITIONER
AFF	ABOVE FINISHED FLOOR
CD	COIL CONDENSATE DRAIN
CU	CONDENSING UNIT OR COPPER
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
FD	FLOOR DRAIN
FLR	FLOOR
GALV	GALVANIZED
H	HEATER
MFR	MANUFACTURER
NG	NATURAL GAS
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OA	OUTSIDE AIR
PT	PRESSURE TREATED
RA	RETURN AIR
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
SA	SUPPLY AIR
SS	STAINLESS STEEL
STL	STEEL
TYP	TYPICAL
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
V	VARIABLE VOLUME BOX

MECHANICAL NOTES

1. THESE DRAWINGS HAVE BEEN DEVELOPED FROM THE BEST AVAILABLE INFORMATION. CONTRACTOR SHALL FIELD VERIFY ALL FIELD CONDITIONS, DIMENSIONS, CLEARANCES, LOCATION OF EXISTING UTILITIES, ETC. PRIOR TO BIDDING, FABRICATION, OR INSTALLATION. DO NOT SCALE FROM THESE DRAWINGS.

2. COORDINATE INSTALLATION AMONG TRADES TO AVOID INTERFERENCES. WHERE PIPING AND DUCTWORK ARE ROUTED TOGETHER, INSTALL PIPING BELOW DUCTWORK FOR MAINTENANCE ACCESSIBILITY. INSTALL ALL MECHANICAL SYSTEM COMPONENTS TO PERMIT INSTALLATION OF CEILINGS AT HEIGHTS INDICATED ON THE ARCHITECTURAL DRAWINGS.

3. INSTALL ALL HVAC EQUIPMENT PER MANUFACTURER RECOMMENDATIONS, INCLUDING REQUIRED MAINTENANCE CLEARANCES. PIPING, DUCTWORK, AND CONDUIT ROUTING SHALL NOT BLOCK REQUIRED ACCESS TO EQUIPMENT DOORS OR PANELS.

4. DESIGN BASIS FOR HVAC SYSTEMS, INCLUDING ASSOCIATED PIPING AND ELECTRICAL WORK, IS THE SCHEDULED EQUIPMENT. SUBSTITUTION OF OTHER EQUIPMENT MAY REQUIRE CHANGES IN PIPING, ELECTRICAL POWER SUPPLY, MAINTENANCE CLEARANCES, STRUCTURAL SUPPORTS, ETC. ALL SUCH CHANGES SHALL BE COORDINATED THROUGHOUT ALL TRADES, AND SHALL BE PERFORMED WITH NO EXTENSION OF SCHEDULE, AND AT NO ADDITIONAL COST TO THE OWNER.

5. HVAC UNITS WITH MULTIPLE COMPRESSORS SHALL BE PROVIDED WITH INTERTWINED OR ROW–SPLIT EVAPORATOR COILS. FACE–SPLIT EVAPORATOR COILS SHALL NOT BE USED.

6. INSTALL ROOF MOUNTED EQUIPMENT IN ACCORDANCE WITH THE LOCAL CODE REQUIREMENTS FOR CLEARANCE TO EDGE OF BUILDING.

7. PROVIDE LOUVERED CONDENSER COIL GUARDS FOR ALL EXTERIOR MOUNTED AC EQUIPMENT.

8. FABRICATE NEW DUCTWORK FROM MILL GALVANIZED STEEL SHEET. MATERIAL GAGES, FABRICATION DETAILS, INSTALLATION AND DUCT SUPPORT SHALL BE IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS. SEAL ALL JOINTS PER SMACNA STANDARDS.

9. THE INDICATED DUCT ROUTING AND SIZES ARE DIAGRAMMATIC. DO NOT FABRICATE FROM THESE DRAWINGS. FIELD VERIFY ROUTING AND AVAILABLE CLEARANCES. WHERE REQUIRED BY FIELD CONDITIONS, DUCTWORK MAY BE RE–SIZED UTILIZING ASHRAE/SMACNA EQUIVALENT SIZES. NOTIFY ENGINEER AND OBTAIN APPROVAL FOR REQUIRED ROUTING AND SIZE CHANGES PRIOR TO BEGINNING FABRICATION.

10. SMACNA EQUIVALENT ROUND DUCT OR RECTANGULAR DUCT SIZES MAY BE SUBSTITUTED FOR THE DUCT SIZES INDICATED ON THE PLANS. RECTANGULAR SUBSTITUTIONS SHALL MAINTAIN A MAXIMUM OF 3:1 ASPECT RATIO.

11. NEW RIGID SUPPLY DUCTWORK SHALL BE EXTERNALLY INSULATED WITH 2 INCH THICK FLEXIBLE FIBERGLASS, MINIMUM R–6 INSIDE CONDITIONED BUILDING ENVELOPE. DUCTWORK OUTSIDE BUILIDNG ENVELOPE SHALL BE PROVIDED WITH 2–1/2 INCH THICK INSULATION, MINIMUM R–8. INSULATION SHALL BE PROVIDED WITH FACTORY APPLIED REINFORCED FOIL VAPOR BARRIER. INSULATION AND VAPOR BARRIER SHALL HAVE A FIRE SMOKE RATING OF 25/50. APPLY INSULATION PER SMACNA STANDARDS.

12. NEW RIGID RETURN DUCTWORK SHALL BE INTERNALLY INSULATED WITH 1–1/2 INCH THICK DUCTLINER, MINIMUM R–6 INSIDE CONDITIONED BUILDING ENVELOPE. DUCTWORK OUTSIDE BUILIDNG ENVELOPE SHALL BE PROVIDED WITH 2 INCH THICK DUCTLINER, MINIMUM R–8. INSULATION SHALL HAVE A FIRE SMOKE RATING OF 25/50. APPLY INSULATION PER SMACNA STANDARDS.

13. PROVIDE DOUBLE THICKNESS TURNING VANES IN ALL MITERED ELBOWS AND TEES.

14. INSULATED FLEXIBLE DUCT SHALL BE UL LISTED, CONSTRUCTED OF A CPE INNER LINER, COATED SPRING STEEL WIRE HELIX WITH FIBERGLASS BLANKET, AND VAPOR BARRIER EQUAL TO THERMAFLEX G–KM BY FLEXIBLE TECHNOLOGIES. INSULATION SHALL HAVE A FIRE SMOKE RATING OF 25/50.

15. MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL BE FIVE FEET, UNLESS OTHERWISE INDICATED.

16. SECURE FLEXIBLE DUCT CONNECTIONS WITH STAINLESS STEEL WORM GEAR CLAMPS AND DUCT TAPE.

17. PIPING MATERIALS AND FITTINGS SHALL BE AS FOLLOWS:

    NATURAL GAS PIPING SHALL BE SCHEDULE 40, BLACK CARBON STEEL PER ASTM A53; CLASS 150 THREADED MALLEABLE IRON FITTINGS UP TO 2 INCHES; WELDED FITTINGS FOR 2–1/2 INCHES AND LARGER PER LOCAL GAS CODE REQUIREMENTS.

    COIL CONDENSATE DRAIN PIPING SHALL BE SCHEDULE 40 PVC WITH SOLVENT WELD FITTINGS.

18. PITCH CONDENSATE PIPING TO ROOF DRAIN A MINIMUM OF 1/8th INCH PER FOOT. PROVIDE P–TRAPS PER A/C UNIT MANUFACTURER INSTALLATION MANUAL.

19. SUPPORT HORIZONTAL PIPING FROM STRUCTURE WITHIN 1 FOOT OF ELBOWS AND AT THE MAXIMUM INTERVALS SPECIFIED BELOW:

NOMINAL PIPE SIZE	DISTANCE BETWEEN SUPPORTS
1/2 TO 1–1/4 INCH	6'–0"
1–1/2 TO 2–1/2 INCH	10'–0"
3 TO 4 INCH	12'–0"
PVC	4'–0"

    SUPPORT VERTICAL PIPING WITH RISER CLAMPS WITHIN 1 FOOT OF ELBOWS AND BENDS.

20. INSTALL, INSPECT, TEST, AND PURGE NATURAL GAS PIPING PER NFPA 54, LOCAL GAS CODE, AND THE REQUIREMENTS OF THE LOCAL UTILITY.

21. PRIME AND PAINT NATURAL GAS PIPING LOCATED OUTDOORS, AND WHERE EXPOSED INDOORS IN FINISHED LOCATIONS. FINISH PAINT COLOR TO MATCH EXISTING.

22. ALL PIPING PENETRATIONS THROUGH NON–RATED CONSTRUCTION SHALL BE SLEEVED. SEAL PENETRATIONS THROUGH EXTERIOR WALL WEATHERTIGHT WITH SILICONE SEALANT. PROVIDE ESCUTCHEONS AT EXPOSED INTERIOR LOCATIONS. ALL PIPING PENETRATIONS THROUGH RATED CONSTRUCTION SHALL BE SEALED PER DETAIL. SEE ARCHITECTURAL FOR LOCATIONS OF RATED CONSTRUCTION.

23. DUCT SMOKE DETECTORS SHALL BE UL LISTED, PHOTOELECTRIC TYPE, WITH METAL SAMPLING TUBE; HONEYWELL, SYSTEM SENSOR, OR EQUAL. DETECTORS SHALL BE FURNISHED BY THE FIRE ALARM CONTRACTOR AND INSTALLED IN THE DUCTWORK BY THE MECHANICAL CONTRACTOR. COORDINATE WITH ELECTRICAL/FIRE ALARM CONTRACTOR FOR POWER AND ALARM SYSTEM CONNECTIONS.

24. NEW PROGRAMMABLE THERMOSTATS FOR RTU'S SHALL BE HONEYWELL VISION PRO 8000/TB8220 SERIES (NO SUBSTITUTIONS). THERMOSTATS FOR CLASSROOM UNITS SHALL BE AS INDICATED ON THE SCHEDULE. THERMOSTATS SHALL BE PROGRAMMED TO PERFORM THE FOLLOWING SEQUENCES OF OPERATION:

    UN–OCCUPIED MODE: SYSTEM SHALL CYCLE TO MAINTAIN SET–POINTS OF 80 DEGREES F COOLING AND 65 DEGREES F HEATING. WHERE MOTORIZED OR MODULATING OUTSIDE AIR DAMPERS ARE PROVIDED, DAMPER SHALL CLOSE.

    OCCUPIED MODE: FAN SHALL RUN CONTINUOUSLY TO PROVIDE REQUIRED VENTILATION. SYSTEM COOLING AND HEATING SHALL CYCLE AS REQUIRED TO MAINTAIN SET–POINTS OF 74 DEGREES F COOLING AND 70 DEGREES F HEATING. WHERE MOTORIZED OR MODULATING OUTSIDE AIR DAMPERS ARE PROVIDED, DAMPER SHALL MODULATE TO MINIMUM AIRFLOW POSITION OR ECONOMIZER AS EQUIPPED.

    ECONOMIZER CYCLE: UNITS WITH ECONOMIZERS SHALL ENTER ECONOMIZER MODE ON A CALL FOR COOLING, WHEN THE OUTDOOR AIR TEMPERATURE FALLS BELOW 55 DEGREES F. COMPRESSORS SHALL BE DISABLED, AND ECONOMIZER OUTDOOR AIR AND RETURN AIR DAMPERS SHALL MODULATE AS REQUIRED TO MATCH THE LOAD. IF 100 PERCENT OUTDOOR AIR CANNOT SATISFY THE THERMOSTAT, UNIT COMPRESSORS SHALL BE ENABLED TO PROVIDE SUPPLEMENTAL COOLING.

    WHERE EQUIPPED WITH DEHUMIDIFICATION: WITH UNIT IN OCCUPIED COOLING MODE, THE UNIT SHALL ENTER DEHUMIDIFICATION MODE IF THE RELATIVE HUMIDITY IN THE SPACE RISES TO 55%. THE INACTIVE COMPRESSOR SHALL START AND RUN. HOT GAS REHEAT SHALL OPERATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE SETPOINT. WHEN THE SPACE RELATIVE HUMIDITY FALLS BELOW 50%, THE UNIT SHALL RETURN TO STANDARD COOLING MODE.

    INTERLOCKS AND SAFETIES: FIRE ALARM SYSTEM AND DUCT SMOKE DETECTORS SHALL SHUT DOWN THE SYSTEM IF PRODUCTS OF COMBUSTION ARE DETECTED. CONNECT SMOKE DETECTORS TO THE BUILDING FIRE ALARM SYSTEM (COORDINATE WITH FIRE ALARM CONTRACTOR).

25. COMPLETE HVAC SYSTEMS SHALL BE BALANCED BY AN INDEPENDENT, TESTING, ADJUSTING, AND BALANCING (TAB), AABC CERTIFIED CONTRACTOR AS APPLICABLE. TAB CONTRACTOR SHALL BE CONTRACTED BY THE MECHANICAL CONTRACTOR AND SHALL REPORT TO THE ENGINEER/ARCHITECT ON BEHALF OF THE OWNER. CONTRACTOR SHALL PROVIDE AABC NATIONAL PERFORMANCE GUARANTEE.

    MECHANICAL CONTRACTOR SHALL PROVIDE AND INSTALL ADDITIONAL SHEAVES, DAMPERS, ETC. AS REQUIRED FOR TAB CONTRACTOR TO COMPLETE AND PROVIDE BALANCED SYSTEM PER SPECIFICATIONS.

26. NEW MECHANICAL EQUIPMENT SHALL NOT BE UTILIZED FOR SPACE CONDITIONING DURING CONSTRUCTION. EQUIPMENT SHALL BE OPERATED ONLY AS REQUIRED TO PROVIDE PROPER START–UP, CHECK–OUT, BALANCE, ETC. IN ORDER TO MEET 'SUBSTANTIAL COMPLETION' GOALS AND PROVIDE A COMPLETE WORKING SYSTEM TO TURN OVER TO OWNER.

27. MECHANICAL EQUIPMENT SHALL BE AS INDICATED ON THE DRAWINGS. EQUIPMENT OTHER THAN SCHEDULED BRAND AND MODEL MAY BE CONSIDERED PER FULL COMPLIANCE WITH SCHEDULE AND SPECIFICATIONS. MECHANICAL CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY CHANGES AND/OR COSTS ASSOCIATED WITH USING PRODUCTS OTHER THAN THOSE SCHEDULED. HVAC SUPPLIER SHALL HAVE AVAILABLE FACTORY SERVICE TECHNICIANS WITHIN 100 MILE RADIUS OF JOBSITE AND OFFER 24 HR/7 DAY SERVICE, MAINTENANCE AND REPAIRS.

    EQUIPMENT SUBMITTED, INCLUDING THE SPECIFIED EQUIPMENT SHALL BE FACTORY DIRECT FROM THE MANUFACTURER'S COMMERCIAL SALES OFFICE, INCLUDING FACTORY DIRECT WARRANTY AND SUPPORT. EQUIPMENT SUBMITTED FOR APPROVAL DURING THE SUBMITTAL PROCESS SHALL BE SUBMITTED COMPLETE WITH MANUFACTURER PERFORMANCE DATA AT THE DESIGN CONDITIONS. SUBMITTAL DATA SHALL BE PROVIDED FROM FACTORY AUTHORIZED REPRESENTATIVES. MANUFACTURER CATALOG STANDARD CUT SHEETS ARE NOT ACCEPTABLE. MANUFACTURERS' DESIGNATED DEALERS AND/OR WHOLESALERS ARE NOT A SUBSTITUTE FOR FACTORY SERVICE AND SUPPORT.

28. THE FOLLOWING MODIFICATION AND RE–CONDITIONING EFFORTS SHALL BE ACCOMPLISHED TO THE EXISTING HVAC COMPONENTS BEING RE–USED. VERIFY LANDLORD WARRANTY ISSUES WITH FINAL LEASE AGREEMENT PRIOR TO START OF WORK.

    DUCTWORK: EXISTING DUCTWORK TO REMAIN FOR REUSE AS INDICATED SHALL BE CLEANED PER SPECIFICATIONS. DUCTWORK INDICATED TO REMAIN FOR RE–USE SHALL BE INSPECTED AND RE–SEALED OR REPAIRED AS REQUIRED WITH INSULATED GALVANIZED SHEET. DUCTWORK NOT INDICATED FOR REUSE SHALL BE ABANDONED OR REMOVED AS REQUIRED FOR INSTALLATION OF NEW HVAC COMPONENTS.

    DIFFUSERS & GRILLES: EXISTING DIFFUSERS, GRILLES, ETC. INDICATED TO REMAIN FOR RE–USE SHALL BE CLEANED AND TOUCH–UP PAINT APPLIED AS REQUIRED. WHERE REQUIRED TO CLEAR NEW LIGHTING, GRILLES SHALL BE RELOCATED TO ADJACENT CEILING GRID AND THE DUCTWORK EXTENDED TO MATCH EXISTING.

29. CONTRACTOR SHALL DISABLE, DE–ENERGIZE, AND SAFE EXISTING BOILER AND HOT WATER UNIT HEATERS. CONTRACTOR SHALL INSTALL NEW GAS FIRED UNIT HEATERS IN THE LOCATIONS INDICATED.

30. PROVIDE AND INSTALL NEW DIFFUSER/GRILLE IN EXISTING ACT CEILING. CONNECT NEW SUPPLY DIFFUSERS TO EXISTING BRANCH DUCT. CONTRACTOR SHALL PROVIDE AND INFILL EXISTING GRID WHERE REQUIRED. CONTRACTOR SHALL RE–VERIFY EXISTING BRANCH DUCT SIZE AND NOTIFY ENGINEER OF DISCREPANCIES PRIOR TO ORDER.

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.9940 ~ Fax: 931.454.2338
www.olgengineering.com

TIMOTHY W. LITTLE
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
NO. 100942
STATE OF TENNESSEE
9/16/14

Legend & Notes

Portland Vocational Building

Portland, Tennessee

SUMNER COUNTY SCHOOLS
TENNESSEE

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TWL
CHECKED:	TWL
SCALE:	AS NOTED

M3.1

Portland Vocational Building

Portland, Tennessee

Power Plan - Part 'A'

SUMNER COUNTY SCHOOLS
TENNESSEE

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TAS
CHECKED:	ADG
SCALE:	AS NOTED

E1.1

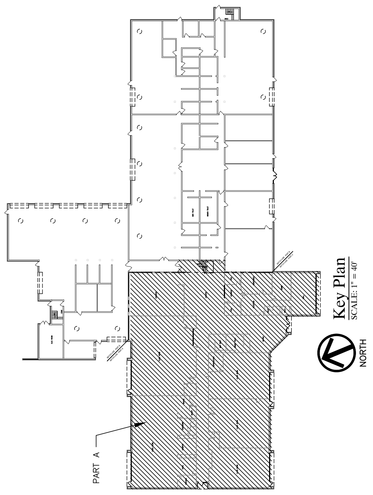
OLG Engineering, Inc.
501 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.9940 ~ Fax: 931.454.2538
www.olgengineering.com

Oliver • Little • Gipson
Engineering, Inc.

DALE GIPSON
REGISTERED ENGINEER
STATE OF TENNESSEE

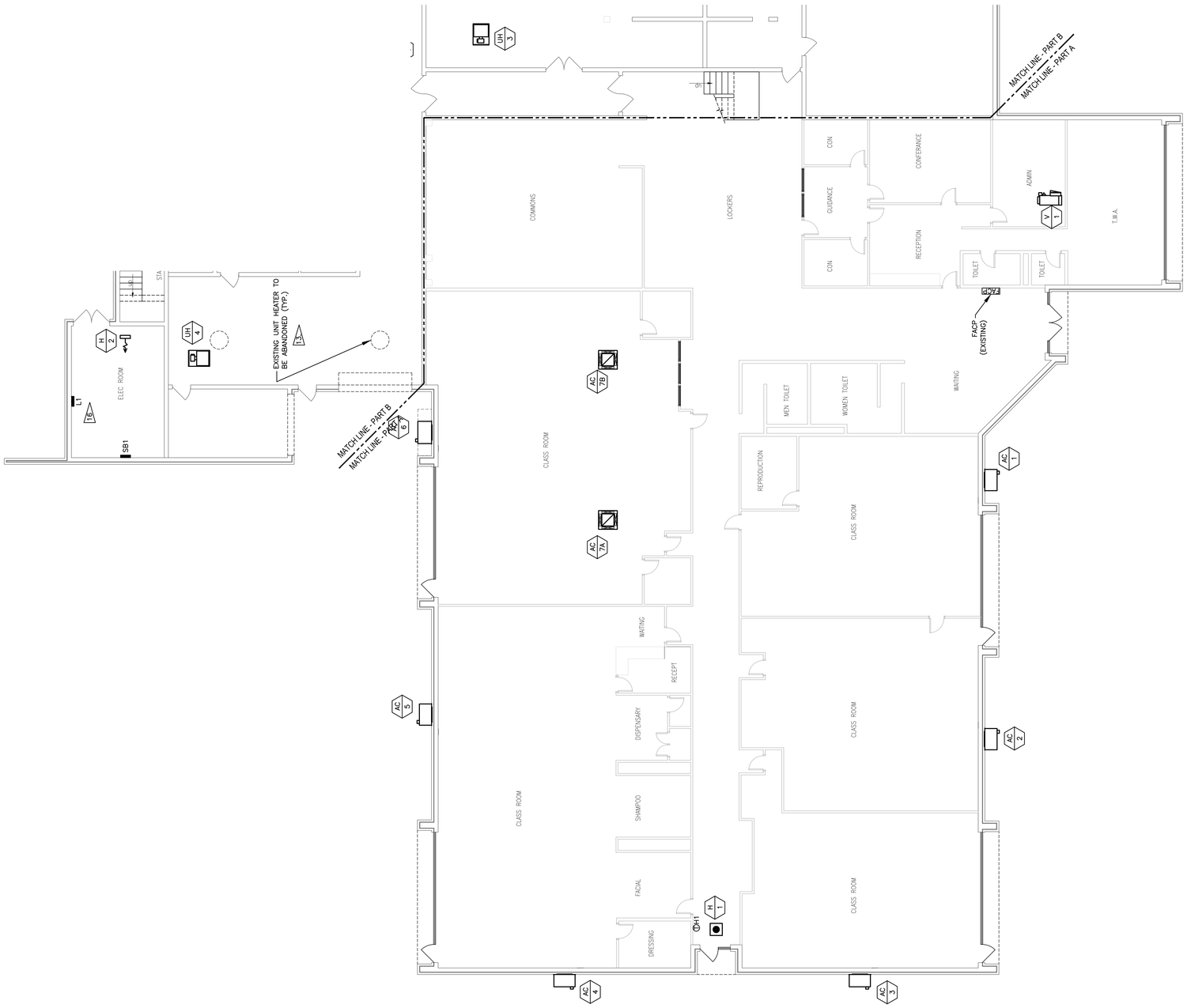
NO. DESCRIPTION

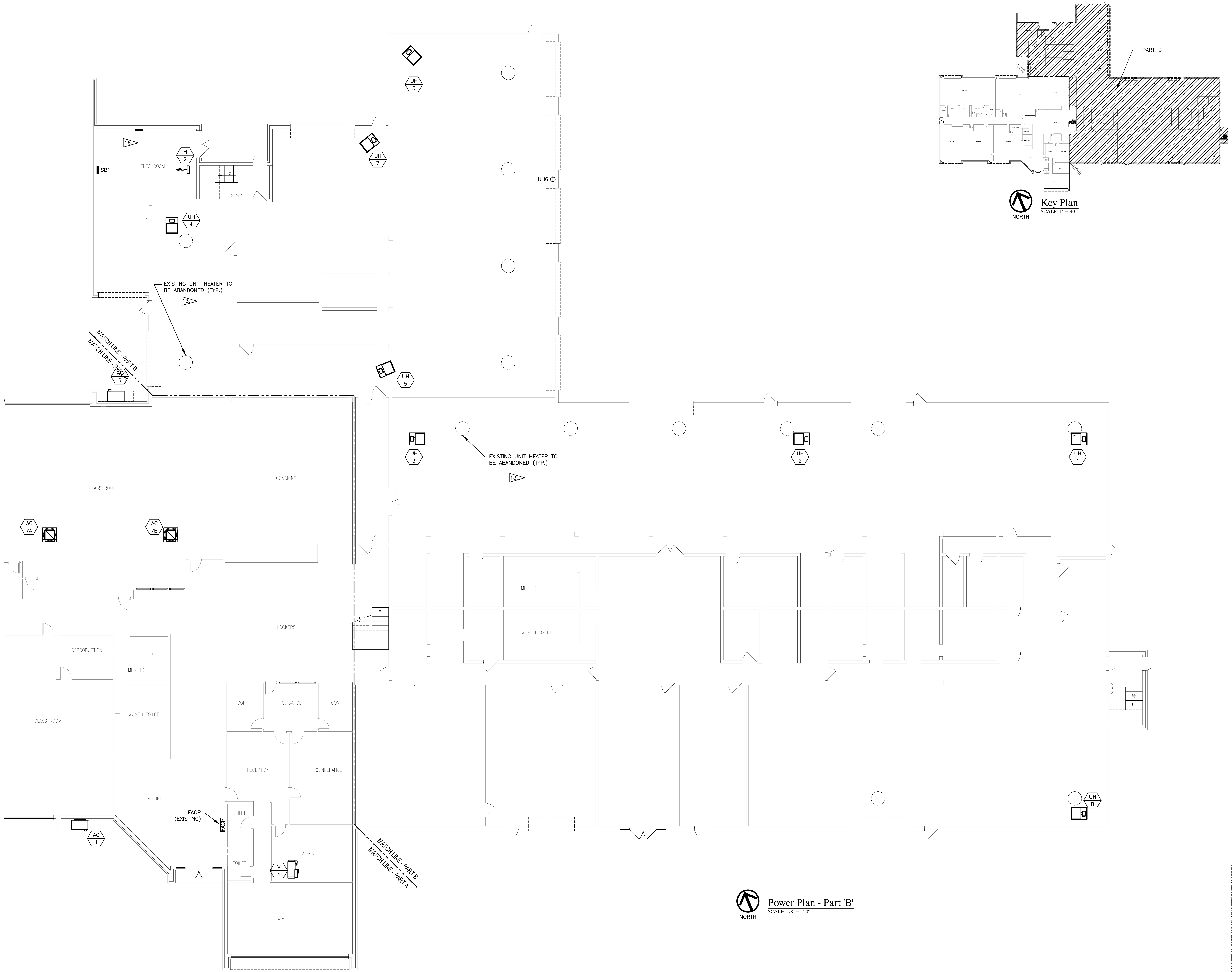
THIS INDIVIDUAL SHEET COMPRISES ONE OF MANY SHEETS ISSUED AS BIDDING AND CONTRACT DOCUMENTS. INFORMATION CONTAINED HEREIN MAY NOT BE ALL INCLUSIVE OF INFORMATION NEEDED FOR BIDDING, AWARD, CONSTRUCTION, AS WELL AS TO ENTIRE BIDDING AND CONTRACT DOCUMENTS FOR ASSOCIATED INFORMATION.



Key Plan
SCALE: 1" = 40'
NORTH

Power Plan - Part 'A'
SCALE: 1/8" = 1'-0"
NORTH





Power Plan - Part 'B'

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

NORTH

PART B

Key Plan

SCALE: 1" = 40'

NORTH

REVISIONS

Oliver • Little • Gipson

OLG Engineering, Inc.

OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.0040 Fax: 931.454.2336
www.olgengineering.com

ANTHONY DALE GIPSON — REGISTERED ENGINEER — STATE OF TENNESSEE

Power Plan - Part 'B'

Portland Vocational Building

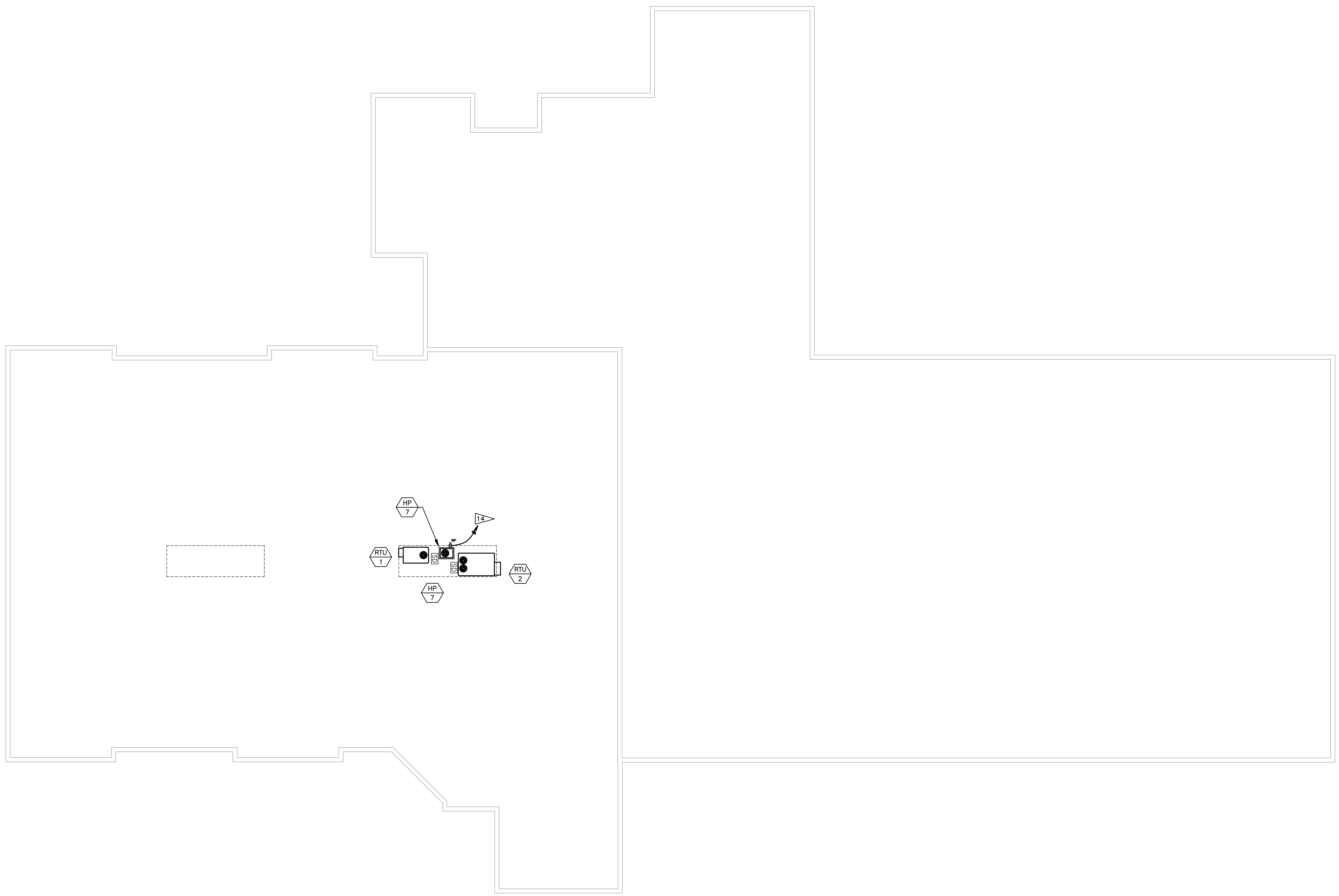
Portland, Tennessee

SUMNER COUNTY SCHOOLS TENNESSEE

THIS INDIVIDUAL SHEET COMPRISES ONE OF MANY SHEETS ISSUED AS BIDDING AND CONTRACT DOCUMENTS. INFORMATION CONTAINED HEREIN MAY NOT BE ALL INCLUSIVE OF INFORMATION NEEDED FOR BIDDING AND/OR CONSTRUCTION. REFER TO ENTIRE BIDDING AND CONTRACT DOCUMENTS FOR ASSOCIATED INFORMATION.

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TAS
CHECKED:	ADG
SCALE:	AS NOTED

E1.2



NORTH

Roof Power Plan
SCALE: 3/32" = 1'-0"

THIS INDIVIDUAL SHEET COMPRISES ONE OF MANY SHEETS ISSUED AS BIDDING AND CONTRACT DOCUMENTS. INFORMATION CONTAINED HEREIN MAY NOT BE ALL INCLUSIVE OF INFORMATION NEEDED FOR BIDDING AND/OR CONSTRUCTION. REFER TO ENTIRE BIDDING AND CONTRACT DOCUMENTS FOR ASSOCIATED INFORMATION.

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office: 931.454.0940 Fax: 931.454.2336
www.olgengineering.com

Roof Power Plan

Portland Vocational Building

Portland, Tennessee

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TAS
CHECKED:	ADG
SCALE:	AS NOTED

E1.3

POWER & WIRING INFORMATION FOR MECHANICAL EQUIPMENT					
DEVICE#	DISCONNECT SIZE	CONDUIT	WIRE SIZE	FEEDER PANEL	FEEDER BREAKER(S)
RTU-1	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	1,3,5
RTU-2	PROVIDED WITH THE UNIT	1/2"	(3)#10 & (1)#10 GND.	L1	2,4,6
H-1	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.	L1	7
V-1	600V, 30A, NON-FUSED	1/2"	(2)#10 & (1)#10 GND.	L1	8
UH-1	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-2	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-3	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-4	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-5	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-6	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-7	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
UH-8	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		14
AC-1	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	9,11,13
AC-2	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	15,17,19
AC-3	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	21,23,25
AC-4	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	27,29,31
AC-5	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	10,12,14
AC-6	PROVIDED WITH THE UNIT	1/2"	(3)#12 & (1)#12 GND.	L1	16,18,20
AC-7A/7B	RATED SWITCH	1/2"	(2)#12 & (1)#12 GND.		15
HP-7	240V, 30A, NON-FUSED,NEMA 3R	1/2"	(2)#12 & (1)#12 GND.		15
H-2	600V, 30A, NON-FUSED	1/2"	(2)#10 & (1)#10 GND.	L1	33

PANEL SCHEDULE

PANEL NUMBER: L1

LOCATION:

DIRECTORY	CKT. NO.	AMPS/POLES	kW	"A" PHASE	"B" PHASE	"C" PHASE	kW	AMPS/POLES	CKT. NO.	DIRECTORY
	1		2.24	•			4.86		2	
RTU-1	3	15/3	2.24		•		4.86	25/3	4	RTU-2
	5		2.24			•	4.86		6	
H-1	7	20/1	2.00	•			5.00	25/1	8	V-1
	9		2.88		•		2.66		10	
AC-1	11	20/3	2.88			•	2.66	15/3	12	AC-5
	13		2.88	•			2.66		14	
	15		2.88		•		3.10		16	
AC-2	17	20/3	2.88			•	3.10	20/3	18	AC-6
	19		2.88	•			3.10		20	
	21		2.66		•		0.00	20/1	22	SPARE
AC-3	23	15/3	2.66			•	0.00	20/1	24	SPARE
	25		2.66	•			0.00	20/1	26	SPARE
	27		2.66		•		0.00	20/1	28	SPARE
AC-4	29	15/3	2.66			•	0.00	20/1	30	SPARE
	31		2.66	•			0.00	20/1	32	SPARE
H-2	33	30/1	5.00		•		0.00	20/1	34	SPARE
SPARE	35	20/1	0.00			•	0.00	20/1	36	SPARE
SPARE	37	20/1	0.00	•			0.00	20/1	38	SPARE
SPARE	39	20/1	0.00		•		0.00	20/1	40	SPARE
SPARE	41	20/1	0.00			•	0.00	20/1	42	SPARE

MAIN BREAKER:	MLO	NOTES:	kW PHASE "A"	30.94
MAIN BUS:	250A		kW PHASE "B"	28.94
VOLTAGE:	480Y277V		kW PHASE "C"	23.94
AIC:	35,000		TOTAL kW	83.82
FRAME:				
TRIP:				
MOUNTING:				

LEGEND:

RECEPTACLES: (15")

- OUTLET – UNIPLEX, GENERAL PURPOSE, 120 V, 20 A
- OUTLET – DUPLEX, GENERAL PURPOSE, 120 V, 20 A
- OUTLET – DUPLEX, TAMPER PROOF
- OUTLET – DUPLEX, COUNTER HEIGHT, 120 V, 20 A (8" A.C.T.)
- OUTLET – DUPLEX, COUNTER HEIGHT, GFCI, 120 V, 20 A (8" A.C.T.)
- C: OUTLET – DUPLEX, CEILING MOUNTED, 120 V, 20 A
- WP: OUTLET – DUPLEX, WEATHER PROOF, GROUND FAULT CURRENT INTERRUPTER, 120 V, 20 A
- GFCI: OUTLET – DUPLEX, GROUND FAULT CURRENT INTERRUPTER, 120 V, 20 A
- P: OUTLET – DUPLEX, 120 V, 20 A, PLUGMOLD
- S: OUTLET – DUPLEX, SWITCHED, 120 V, 20 A
- IG: OUTLET – DUPLEX, 120 V, 20 A, ISOLATED GROUND
- AFCI: OUTLET – DUPLEX, GENERAL PURPOSE, 120V, 20A ON ARC FAULT CURRENT INTERRUPTING CIRCUIT BREAKER
- OUTLET – QUADRUPLEX, GENERAL PURPOSE, 120 V, 20 A
- OUTLET – DUPLEX, FLOOR, GENERAL PURPOSE, 120 V, 20 A
- OUTLET – QUADRUPLEX, FLOOR, GENERAL PURPOSE, 120 V, 20 A
- O: OUTLET – OVEN, 240 V, 60 A
- P: OUTLET – DRYER, 240 V, 30 A
- HARD–WIRE CONNECTION POINT
- WIREMOLD SERIES 4000 RACEWAY WITH DEVICES AS INDICATED
- WALL MOUNTED P.I.R. OCCUPANCY SENSOR
- C: CEILING MOUNTED, DUAL SENSING OCCUPANCY SENSOR
- OUTLET – TRIPLEX, RETRACTABLE DROP CABLE, GENERAL PURPOSE, 120 V, 20 A

OTHER:

- PANELBOARD – SURFACE MOUNT
- PANELBOARD – FLUSH MOUNT
- PE: PHOTOELECTRIC CELL
- DCS: DIMMER CONTROL SYSTEM WITH HAND–HELD REMOTE, 120V, MULTIPLE ZONE
- MANUAL STARTER, SIZED FOR EQUIPMENT SERVED
- T: DRY TYPE TRANSFORMER
- DISCONNECT, SIZE AS INDICATED (60")
- O: OVERHEAD DOOR CONTROL
- M: OVERHEAD DOOR MOTOR
- LC: LIGHTING CONTACTOR
- J: JUNCTION BOX
- EWH: ELECTRIC WALL OR BASEBOARD HEATER
- EXHAUST FAN
- T: THERMOSTAT (60")
- ETR: EXISTING TO REMAIN
- E.C: INTERCEPT EXISTING CIRCUIT
- TV: TELEVISION OUTLET AND RECEPTACLE FIELD COORDINATE HEIGHT WITH OWNER
- DS: DURESS SWITCH
- M: UTILITY METER
- EXIT: EXIT SIGN (ARROW INDICATES ILLUMINATED FACE) (96")
- TWIN HEAD EMERGENCY BATTERY UNIT
- SWL: SWITCH WITH LIGHTS (FOR EXHAUST FANS)

SOUND/INTERCOM/PHONE SYSTEM:

- SOUND SPHERE
- A: AMPLIFIER
- M: MICROPHONE OUTLET, FLOOR MOUNTED, FLUSH
- —A—: GYMNASIUM SOUND SYSTEM WIRING TO AMPLIFIER
- S: SPEAKER
- V: VOLUME CONTROLS
- SSC: SOUND SYSTEM CONTROLLER
- PA: PUBLIC ADDRESS SYSTEM
- TELEPHONE OUTLET
- 3: GANG OF THREE DATA OUTLETS
- W: WALL PHONE, 60" A.F.F
- PHONE & DATA COMBINATION OUTLET
- S: CLASSROOM SPEAKER
- S GP: GENERAL PAGE SPEAKER
- S GP: SPEAKER/PAGING
- TIC: TELEPHONE/INTERCOM CABINET
- —TI—: TELEPHONE/INTERCOM WIRING TO CABINETS

SWITCHES: (44" – UNLESS OTHERWISE NOTED)

- S: SWITCH – SNAP, 120 V, 20 A, SINGLE POLE
- S_3: SWITCH – SNAP, 120 V, 20 A, 3–WAY OPERATION
- S_4: SWITCH – SNAP, 120 V, 20 A, 4–WAY OPERATION
- S_K: SWITCH – KEY, 277 V, 20 A, SINGLE POLE, HUBBELL 1221L
- S_D: DIMMER CONTROL SWITCH, 120V, 20A
- S_T: SWITCH – WITH TIMER, 0–60 MIN. WITH HOLD TORK #A560MH
- WALL MOUNTED P.I.R. OCCUPANCY SENSOR
- C: CEILING MOUNTED, DUAL SENSING OCCUPANCY SENSOR

FIRE ALARM SYSTEM:

- F: PULL STATION (48")
- HORN/STROBE (80")
- T: HORN/STROBE (80" – "T" TAMPER PROOF)
- STROBE ONLY (80")
- S: CEILING MOUNTED SMOKE DETECTOR
- S–T: CEILING MOUNTED SMOKE DETECTOR ("T" TAMPER PROOF)
- H: HEAT DETECTOR
- D: DUCT SMOKE DETECTOR
- DOOR HOLDER (78")
- S G: SPEAKER/LIGHT WITH GUARD (90")
- FACP: FIRE ALARM CONTROL PANEL
- FAA: FIRE ALARM ANNUNCIATOR (48")
- VP: VOICE FIRE ALARM PANEL WITH STROBE
- —FA—: FIRE ALARM SYSTEM AND CONDUIT WIRING
- T: "T" DESIGNATES "TAMPER PROOF" OPTION
- SD: DUCT SMOKE DETECTOR

SECURITY SYSTEM:

- PIR C: CEILING MOUNTED MOTION DETECTOR
- PIR W: WALL MOUNTED MOTION DETECTOR
- DS: MAGNETIC DOOR SWITCH
- CR: CARD READER
- STC: SECURITY TERMINAL CONTROLLER
- SMP: SECURITY MAIN PROCESSOR
- —S—: SECURITY SYSTEM AND CONDUIT WIRING

CLOCK/BELL SYSTEM:

- BELL (96")
- CLOCK (96")
- CBC: CLOCK BELL CONTROLLER

NOTE:
ALL OF THE SYMBOLS AND ABBREVIATIONS INCLUDED ON THIS SHEET MAY OR MAY NOT BE USED IN THIS SET OF DRAWINGS.

GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 70, NATIONAL ELECTRICAL CODE. ALL ITEMS ARE ON AN EQUAL BASIS.
2. ALL SINGLE PHASE BRANCH CIRCUITS (RECEPTACLES, LIGHTING, ETC.) ARE 1/2" CONDUIT OR EMT WITH (3)#12 BLACK/WHITE/GREEN, THHN, 90°C WIRING. ALL OTHER CONDUIT AND WIRING SHALL BE AS INDICATED ON THE PLANS. ACTUAL ROUTING AND HOMERUN GROUPINGS ARE TO BE DETERMINED IN THE FIELD.
3. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC EXCEPT FOR DETAILS AND ELEVATIONS. DO NOT SCALE FROM DIAGRAMMATIC DRAWINGS. EXACT LOCATIONS OF DEVICES AND PANELS ARE TO BE DETERMINED AND ROUGHED–IN DURING CONSTRUCTION TO AVOID INTERFERENCE, TO MEET USER REQUIREMENTS, TO PROVIDE ADEQUATE MOUNTING, AND TO MEET NEC LINEAR ACCESS AND CLEARANCE REQUIREMENTS.
4. VERIFY EXACT LOCATION OF ALL MOTORS AND EQUIPMENT BEFORE ROUGHING IN.
5. FINAL CONNECTIONS TO ALL AIR–HANDLERS, CONDENSING UNITS, EXHAUST FANS, AND OTHER EQUIPMENT DEVICES WHICH VIBRATE, SHALL BE MADE WITH FLEXIBLE SEALTITE AND APPROPRIATE WIRING.
6. PROVIDE A LAMICOID NAMEPLATE (WHITE LETTERS ON BLACK BACKGROUND) ON EACH PANELBOARD, MOTOR STARTER, CONTACTOR, TRANSFORMER, ETC. LETTERS SHALL BE 0.75 INCH MINIMUM.
7. CIRCUIT BREAKERS FOR HVAC EQUIPMENT SHALL BE HACR RATED.
8. CONTRACTOR SHALL CUT AS REQUIRED TO INSTALL ELECTRICAL EQUIPMENT. REPAIR OF FLOOR OR WALLS SHALL BE COORDINATED WITH GENERAL CONTRACTOR. CONTRACTOR SHALL ALSO REPAIR ALL OPENINGS LEFT DUE TO EQUIPMENT REMOVAL.
9. CONDUCTORS ARE AWG#12 COPPER UNLESS OTHERWISE SHOWN. ALL CONDUCTORS LARGER THAN #10 SHALL BE STRANDED. RUNS IN EXCESS OF 90'–0" (ONE WAY) SHALL BE SIZED PER THE NATIONAL ELECTRICAL CODE MAXIMUM 2% VOLTAGE DROP.
10. PANELBOARDS SHALL CONTAIN A TYPEWRITTEN DIRECTORY WITH A PLASTIC COVER AFFIXED TO THE INSIDE DOOR. UPDATE PANEL SCHEDULES TO REFLECT NEW CONDITIONS.
11. ALL FIXTURES, DEVICES, CONDUIT, AND EQUIPMENT SHALL BE SECURED WITH APPROVED HANGERS AND ANCHORS AND IN ACCORDANCE WITH APPROVED STANDARDS OF INSTALLATION.
12. ALL BREAKERS SHOWN IN THE PANELBOARD SCHEDULE SHALL BE RATED AS SHOWN FOR BOTH CIRCUIT CAPACITY AND FAULT CURRENT INTERRUPTING CAPACITY.
13. REMOVE WIRING AND CONDUIT TO EXISTING UNIT HEATERS TO BE REMOVED BACK TO THE SOURCE UNLESS THEY CAN BE RE–USED TO POWER THE NEW UNIT HEATERS.
14. RE–USE CLOSEST DEDICATED CIRCUIT FROM THE CLOSEST ABANDONED UNIT HEATER. EXTEND CONDUIT AND WIRE.
15. ROUTE TO NEAREST 208/120V PANEL. INSTALL NEW 15/2 BREAKER FOR AC–7A/7B AND A 20/2 BREAKER FOR HP–7. RUN 1/2"C, (2)#12 & (1)#12G.
16. INSTALL NEW 150/3 BREAKER IN SB1 TO FEED PANEL L1. RUN 2"C, (4)#1/0 & (1)#6G.
17. ALL PANELBOARDS, DISCONNECT SWITCHES, MOTOR STARTERS, AND CONTACTORS SHALL BE NEMA 1 UNLESS OTHERWISE NOTED.

REVISIONS

Oliver • Little • Gipson
OLG Engineering, Inc.
OLG Engineering, Inc.
301 Industrial Blvd., Tullahoma TN 37388
Office 931.454.9940 Fax 931.454.2338
www.olgengineering.com

Schedules, Legend & Notes

Portland Vocational Building

Portland, Tennessee

JOB NO.:	50414.2
DATE:	16 SEP 14
DRAWN:	TAS
CHECKED:	ADG
SCALE:	AS NOTED

E2.1

ATTACHMENT 501414.2-A

SECTION 00 01 10

TABLE OF CONTENTS

END OF TABLE OF CONTENTS

SECTION 00 01 15
LIST OF DRAWING SHEETS

DRAWING	TITLE
CS	COVER SHEET
G0.1	UL DETAILS
M0.1	HVAC DEMOLITION PLANS
M1.1	FIRST FLOOR HVAC PLAN
M1.2	SECOND FLOOR HVAC PLAN
M1.3	THIRD FLOOR & PENTHOUSE HVAC PLANS
M2.1	HVAC SCHEDULES
M3.1	HVAC DETAILS
M4.1	HVAC LEGEND & NOTES
E0.1	ELECTRICAL DEMOLITION PLANS
E1.1	FIRST FLOOR POWER PLAN
E1.2	SECOND FLOOR POWER PLAN
E1.3	THIRD FLOOR & PENTHOUSE HVAC PLANS
E2.1	ELECTRICAL SCHEDULES
E3.1	LEGEND & NOTES

END OF LIST OF DRAWINGS

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 REFERENCE STANDARDS

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

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

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

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

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

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

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

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Comply with ASME A13.1.

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

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

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape with metallic strip, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.
   3. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

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

B. Equipment designations on the drawings are for design purposes only. Request that the Owner's facility operations department provide a list of new designations which conform to their current equipment numbering scheme. Use their designations on all equipment tags.

C. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install plastic 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. Apply stencil painting in accordance with Section 09 90 00.

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

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

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify rooftop units, exhaust fans, air handling units, variable volume boxes, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

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

J. Identify air terminal units and radiator valves with numbered tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. 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.

M. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

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

END OF SECTION

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; The American Society of Mechanical Engineers.

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

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

D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; The American Society of Mechanical Engineers.

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

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

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

H. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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.

1.04 QUALITY ASSURANCE

A. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

B. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

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

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Tennessee, and Local plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

1.06 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.

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 54, threaded or welded to ASME B31.1.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2 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 2-1/2 Inch and over:
   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.

2.04 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.

B. Plumbing Piping - Gas:
   1. Conform to ASME B31.9.

2.05 BALL VALVES

A. Construction, 2 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats, blow-out proof stem, lever handle, threaded ends.
   1. UL Rated for Gas Service.

2.06 PLUG VALVES

A. Construction: MSS SP-78, 175 psi CWP, semi-steel body and plug, pressure lubricated, teflon or Buna N packing, screwed ends. Provide removable lever operator with set screw.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 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.

3.03 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. Refer to Section 22 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

H. Provide access where valves and fittings are not exposed.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; Coordinate with Arhcitetural.

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

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.

L. Install bell and spigot pipe with bell end upstream.

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

N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

O. Sleeve pipes passing through partitions, walls and floors.

P. 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. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.
   8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   9. Support cast iron drainage piping at every joint.

3.04 APPLICATION

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

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

C. Provide UL listed plug valves in natural gas systems for shut-off service.

3.05 SERVICE CONNECTIONS

A. Provide natural gas piping from existing as indicated. Contractor shall verify delivery pressure to buidling prior to ordering regulators for assumed 2 PSI system.

3.06 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
    a. Pipe size: 1/2 inches to 1-1/4 inches:
        1) Maximum hanger spacing: 6.5 ft.
        2) Hanger rod diameter: 3/8 inches.
    b. Pipe size: 1-1/2 inches to 2 inches:
        1) Maximum hanger spacing: 10 ft.
        2) Hanger rod diameter: 3/8 inch.
    c. Pipe size: 2-1/2 inches to 3 inches:
        1) Maximum hanger spacing: 10 ft.
        2) Hanger rod diameter: 1/2 inch.
    d. Pipe size: 4 inches to 6 inches:
        1) Maximum hanger spacing: 10 ft.
        2) Hanger rod diameter: 5/8 inch.
    e. Pipe size: 8 inches to 12 inches:
        1) Maximum hanger spacing: 14 ft.
        2) Hanger rod diameter: 7/8 inch.
2. Plastic Piping:
    a. All Sizes:
        1) Maximum hanger spacing: 6 ft.
        2) Hanger rod diameter: 3/8 inch.

END OF SECTION

SECTION 23 01 30.51
HVAC AIR DUCT CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of existing HVAC duct systems, equipment, and related components.

1.02 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the existing heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.
   1. Above-ceiling plenum for supply air is required to be cleaned.
   2. Above-ceiling plenum for return air is required to be cleaned.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

D. UL 181A - Standard for Closure Systems for Use with Rigid Air Ducts.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Qualifications Statement: Submit qualifications of proposed cleaning contractor for approval.

C. Project Cleanliness Evaluation and Cleaning Plan, as specified.

D. Product Data: Manufacturer's data sheets on each product to be used.

E. Material Safety Data Sheets (MSDS): For all chemical products proposed to be used in the cleaning process; submit directly to Owner.

F. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.05 QUALITY ASSURANCE

A. Information Available to Contractor: Upon request, Owner will provide the following:
   1. One copy of project record drawings of HVAC system.

B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
   1. Certified by one of the following:
      a. NADCA, National Air Duct Cleaners Association: www.nadca.com
   2. Having minimum of three years documented experience.
   3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

B. Surface Coating for Fibrous Glass Materials: Water-based, zero VOC; flame spread index less that 25, smoke developed index less than 450, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Take precautions to prevent introduction of additional hazards into occupied spaces.

E. Obtain Owner's approval of proposed temporary locations for large equipment.

F. Designate a decontamination area and obtain Owner's approval.

G. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

H. If unforeseen mold or other biological contamination is encountered, notify Design Prof immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Prior to the commencement of any cleaning work, prepare and submit to Design Prof a project evaluation and plan for this project, including considerations recommended in NADCA ACR.

B. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

C. Start of cleaning work constitutes acceptance of existing conditions.

D. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

E. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Design Prof when cleaned components are ready for inspection.

E. When directed, re-clean components until they pass.

F. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ANTI-MICROBIAL TREATMENT

A. When directed, apply anti-microbial treatment to internal surfaces.

B. Apply anti-microbial agent after removal of surface deposits and debris.

C. Apply anti-microbial treatments and coatings in strict accordance with the manufacturer's written recommendations and EPA registration listing.

D. Spray coatings directly onto interior ductwork surfaces; do not "fog" into air stream.

3.08 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.09 WASTE MANAGEMENT

A. Double-bag all waste and debris in 0.24 inch polyethylene bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.
   1. Complete HVAC system shall be balanced by an independent, licensed Testing, Adjusting, and Balancing (TAB) Contractor. TAB contractor shall be contracted by the General Contractor and shall report to the Engineer/Architect on behalf of the owner.

B. Testing, adjustment, and balancing of air, refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

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

B. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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 Design Prof.
   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 Design Prof 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. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Expected problems and solutions, etc.
      f. 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.
      g. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
      h. Confirmation of understanding of the outside air ventilation criteria under all conditions.
      i. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
      j. Method of checking building static and exhaust fan and/or relief damper capacity.

k. Proposed selection points for sound measurements and sound measurement methods.
l. Methods for making coil or other system plant capacity measurements, if specified.
m. False loading of systems to complete TAB work, if specified.
n. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
o. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
p. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least once a week to Commissioning Authority and Construction Manager.

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. 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. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Design Prof and for inclusion in operating and maintenance manuals.
4. 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.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
8. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
9. 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 Design Prof.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

G. Project Record Documents: Record actual locations of balancing valves and rough setting.

1.04 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

C. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the Tennessee.

1.05 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.06 WARRANTY

A. Furnish AABC National Performance Guaranty for this project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

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

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. 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.

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

3.02 TESTING, ADJUSTING, AND BALANCING AGENCIES

A. Suggested Source: United Testing and Balancing, Nashville, TN; Contact - Mr. Tony Kennedy.

3.03 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.

3.04 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Design Prof to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.05 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. Balance outside air to within plus 10 percent of design.

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.

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

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

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

3.07 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 extent 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.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. Air Cooled Refrigerant Condensers
   2. Classroom Air Conditioning Units
   3. Rooftop Air Conditioners
   4. Air Coils
   5. Electric Unit Heaters
   6. Air Handling Units
   7. Fans
   8. Air Filters
   9. Air Inlets and Outlets

3.09 MINIMUM DATA TO BE REPORTED

A. Report:
   1. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence
      d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
      e. Nomenclature used throughout report
      f. Test conditions
   2. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date

B. 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

C. 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

D. Air Cooled Condensers:
    1. Identification/number
    2. Location
    3. Manufacturer
    4. Model number
    5. Serial number
    6. Number of compressors

E. Cooling Coils:
    1. Identification/number
    2. Location
    3. Service
    4. Manufacturer
    5. Air flow, design and actual
    6. Entering air DB temperature, design and actual
    7. Entering air WB temperature, design and actual
    8. Leaving air DB temperature, design and actual
    9. Leaving air WB temperature, design and actual
    10. Air pressure drop, design and actual

F. Heating Coils:
    1. Identification/number
    2. Location
    3. Service
    4. Manufacturer
    5. Air flow, design and actual
    6. Entering air temperature, design and actual
    7. Leaving air temperature, design and actual
    8. Air pressure drop, design and actual

G. 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
        a. Where equipped with integral Energy Recovery Ventilator, verify outside air and exhaust per schedule
    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

H. 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
      a. Where equipped with integral Energy Recovery Ventilator, verify outside air and exhaust per schedule
   8. Return air temperature
   9. Outside air temperature
   10. Actual mixed air temperature
   11. Design outside/return air ratio
   12. Actual outside/return air ratio

I. 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

J. 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

K. Duct Leak Tests:
   1. Description of ductwork under test
   2. Duct design operating pressure
   3. Duct design test static pressure
   4. Duct capacity, air flow
   5. Maximum allowable leakage duct capacity times leak factor
   6. Test apparatus
      a. Blower
      b. Orifice, tube size
      c. Orifice size
      d. Calibrated

7. Test static pressure
8. Test orifice differential pressure
9. Leakage

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

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

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

D. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

F. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

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

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

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

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

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

1.04 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 three years of experience and approved by manufacturer.

1.05 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.

1.06 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

2.01 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 E 84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. Minimum R-6 inside building envelope, R-8 minimum outside building envelope.
   2. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   3. Maximum service temperature: 250 degrees F.
   4. Maximum Water Vapor Sorption: 5.0 percent by weight.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture vapor transmission: ASTM E 96; 0.02 perm.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

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

2.04 JACKETS

A. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

B. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.05 DUCT LINER

A. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with poly vinyl acetate polymer or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
   1. Minimum R-6 inside building envelope, R-8 minimum outside building envelope.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   3. Service Temperature: Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch Thickness: 0.30.

B. Adhesive: Waterproof, fire-retardant type, ASTM C916.

C. Liner Fasteners: Galvanized steel, self-adhesive pad or impact applied with integral or press-on head.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

3.02 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. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

E. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. Duct Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA HVAC Duct Construction Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings: Wrap Insulation

B. Supply Ducts: Wrap Insulation

C. Return Ducts: Liner Insulation

D. Ducts Exposed to Outdoors: Rigid wrap insulation with jacket.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

1.02 REFERENCE STANDARDS

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

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

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

D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

1.04 DELIVERY, STORAGE, AND HANDLING

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

1.05 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

2.01 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.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. 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.

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

E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

3.03 SCHEDULE

A. Cooling Systems:
   1. Condensate Drains from Cooling Coils:
      a. Flexible Elastomeric Foam
         1) Thickness: 1/2 inch
   2. Refrigerant Suction:
      a. Flexible Elastomeric Foam
         1) Thickness: 1/2 inch
         2) Provide UV Coating for insulation installed exterior of buidling

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Pipe hangers and supports.

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

1.02 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; The American Society of Mechanical Engineers.

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

C. ASTM B32 - Standard Specification for Solder Metal.

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

E. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

F. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

G. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

H. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

I. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

J. AWWA C606 - Grooved and Shouldered Joints (ANSI/AWWA C606).

K. 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..

1.03 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Use non-conducting dielectric connections whenever jointing dissimilar metals.

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

1.04 SUBMITTALS

A. See Section 01 30 00 - 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. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 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.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1.06 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.07 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.

1.08 FIELD CONDITIONS

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

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube (Exterior): ASTM B 88 (ASTM B 88M), Type M (C), drawn.
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. PVC Pipe (Interior): ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466 or D2467, PVC.
   2. Joints: Solvent welded in accordance with ASTM D2855.

2.02 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. Conform to ASME B31.9.

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

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

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

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

G. Vertical Support: Steel riser clamp.

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

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

J. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

PART 3 EXECUTION

3.01 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 using jointing system specified.

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

E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

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. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every 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. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.

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

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

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

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Plastic Piping.
   1. 1/2 inch: Maximum span, 42 inches; minimum rod size, 1/4 inch.
   2. 3/4 inch: Maximum span, 45 inches; minimum rod size, 1/4 inch.
   3. 1 inch: Maximum span, 51 inches; minimum rod size, 1/4 inch.
   4. 1-1/4 inches: Maximum span, 57 inches; minimum rod size, 3/8 inch.
   5. 1-1/2 inches: Maximum span, 63 inches; minimum rod size, 3/8 inch.
   6. 2 inches: Maximum span, 69 inches; minimum rod size, 3/8 inch.
   7. 3 inches: Maximum span, 7 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

1.02 REFERENCE STANDARDS

A. AHRI 750 - Standard for Thermostatic Refrigerant Expansion Valves; Air-Conditioning, Heating, and Refrigeration Institute.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ANSI/ASHRAE Std 15).

C. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

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

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

F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

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

H. 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..

1.03 SYSTEM DESCRIPTION

A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

B. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.

C. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.05 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   2. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

2.02 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

B. Refrigerant: R-134a, tetrafluoroethane as defined in ASHRAE Std 34.

2.03 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 EXPANSION VALVES

A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

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

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

3.02 INSTALLATION

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

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

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

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Provide copper plated hangers and supports for copper piping.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Flood piping system with nitrogen when brazing.

I. Insulate piping; refer to Section .

J. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

K. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Duct cleaning.

1.02 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.

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

C. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association.

D. SMACNA (DCS) - HVAC Duct Construction Standards.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for kitchen hood exhaust systems.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

E. Manufacturer's Installation Instructions: Indicate special procedures for fabric ducts.

1.04 REGULATORY REQUIREMENTS

A. Construct ductwork to SMACNA , NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.05 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

2.01 DUCT ASSEMBLIES

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Fabric Air Dispersion Ductwork: UL classified as an air distribution device, and shall meet flammability requirements of NFPA 90A. Duct fabric shall be woven filament/spun polyester twill, 6.75 oz/sq. yd, with a porosity of 2 CFM/sf at 0.50 inches of water static pressure.
   1. Fabric duct shall be rated for a minimum static pressure of +2 inches of water gage at 150 degrees F. Design static pressure for this project is 0.50 inch of water gage.
   2. Fabric and vent colors shall be selected by the architect from the manufacturer's color samples.
   3. Fabric ducts shall have linear mesh vents, finished seams, inlet collars with cover sleeves, and zippered connections for fittings and straight lengths.

C. Insulated Flexible Ducts:

1. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
    a. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
    b. Maximum Velocity: 4000 fpm.
    c. Temperature Range: -20 degrees F to 175 degrees F.

D. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

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

C. T's, bends, and elbows: Construct according to SMACNA (DCS).

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

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

F. 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.

G. Fabric Air Dispersion Ductwork:
1. The duct manufacturer shall furnish all duct suspension hardware including steel aircraft cable, eye bolts, thimbles, cable clamps, turnbuckles, grommets, and snap hooks required for a single cable suspension system as indicated on the drawings. The manufacturer shall also provide all grommets, cinch belts, and other hardware required to connect the fabric duct inlet to the rigid duct outlet fitting.
2. Prior to fabrication of fabric duct, the manufacturer shall review the design drawings to evaluate proper application of the specified product. Duct sizes indicated on the drawings are approximate. Actual duct sizes, as well as the size, number, and orientation of air dispersion vents shall be determined by the manufacturer, based on the information on the design drawings. Building plan and section will be made available to the duct manufacturer in electronic format upon request.
3. The duct manufacturer shall submit installation shop drawings and information on all products to the Engineer for approval.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Install in accordance with manufacturer's instructions.

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

D. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

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 crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

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

I. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

J. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

K. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.

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

M. Installation of fabric air dispersion duct shall be in accordance with the design drawings, and the manufacturer's shop drawings and installation instructions.

N. At exterior wall louvers, seal duct to louver frame .

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.03 SCHEDULES

A. Ductwork Pressure Class:
   1. Supply (System with Cooling Coils): 1 inch.
   2. Return and Relief: 1 inch.
   3. General Exhaust: 1 inch.
   4. Dishwasher Exhaust: 1 inch.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers.

B. Duct access doors.

C. Duct test holes.

D. Flexible duct connections.

E. Volume control dampers.

1.02 REFERENCE STANDARDS

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

B. SMACNA (DCS) - HVAC Duct Construction Standards.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

1.04 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.

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide two of each size and type of fusible link.

PART 2 PRODUCTS

2.01 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

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.

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

2.02 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.

2.03 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. 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. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.04 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

C. 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.

D. 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.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

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

D. Demonstrate re-setting of fire dampers to Owner's representative.

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

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

G. 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

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable volume terminal units.

1.02 REFERENCE STANDARDS

A. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc..

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

D. Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

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

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE DUCT VARIABLE VOLUME UNITS

A. Basic Assembly:
   1. Casings: Minimum 22 gage, 0.0299 inch galvanized steel.
   2. Lining: Minimum 1 inch thick foil face fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements.
   3. Plenum Air Inlets: Round stub connections for duct attachment.
   4. Plenum Air Outlets: S slip and drive connections.

B. Basic Unit:
   1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
   2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.

C. Electric Heating Coil:
   1. Construction: UL listed, slip-in type, open coil design, integral control box factory wired and installed, with:
      a. Primary and secondary over-temperature protection.
      b. Minimum airflow switch.

D. Automatic Damper Operator:
   1. Electric Actuator: 24 volt with high limit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Connect to ductwork in accordance with Section 23 31 00.

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

3.02 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 30 percent full flow or as otherwise indicated.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.02 REFERENCE STANDARDS

A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council.

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

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc..

1.03 SUBMITTALS

A. See Section 01 30 00 - 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.

1.04 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.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Aire.

B. Price Industries: www.price-hvac.com.

C. Titus: www.titus-hvac.com.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, stamped, multi-core diffuser to discharge air in four way pattern .

B. Frame: Inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with baked enamel off-white finish.

D. Accessories: Radial opposed blade damper with damper adjustable from diffuser face. Fire rated where indicated.

2.03 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch louvers.

B. Fabrication: Aluminum with factory off-white enamel finish.

C. Frame: 1-1/4 inch margin with countersunk screw mounting.

D. Frame: Channel lay-in frame for suspended grid ceilings.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

PART 3 EXECUTION

3.01 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. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 90 00.

END OF SECTION

SECTION 23 55 33

FUEL-FIRED UNIT HEATERS

PART 1 GENERAL

1.01 BUILDING SYSTEMS COMMISSIONING

A. Section 01815 requires the engagement of a Commissioning Aent to document the completion of the Mechanical, Electrical, Plumbing, and Buildng Automation Systems for teh project. Section 01815 defines the role of each member of teh Commissioning Team. Comply with teh requirements of Section 01815 for the commissioning of the various building systems.

1.02 SECTION INCLUDES

A. Gas fired unit heaters.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ANSI/ASHRAE/IES Std 90.1).

B. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

C. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

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

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

F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 REGULATORY REQUIREMENTS

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

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 TRANE COMPANY COMPANY: WWW.TRANE.COM.

2.02 GAS FIRED UNIT HEATERS

A. Units: Separated combustion (where indicated), self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
   1. Heating: Natural gas fired.
   2. Discharge Louvers: Individually adjustable horizontal louvers to match cabinet finish.

B. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

C. Supply Fan: Propeller type with direct drive, variable pitch motor pulley.

D. Heat Exchanger: Type E-3 stainless steel (for separated combustion) welded construction.

E. Gas Burner:
   1. Sealed combustion type with adjustable combustion air supply,
   2. Gas valve provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
   3. Electronic pilot ignition, with electric spark igniter.

F. Gas Burner Safety Controls:
   1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
   2. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

G. Operating Controls
   1. Room Thermostat: Cycles burner to maintain room temperature setting with BMS remote interface contact.

H. Performance:
   1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1; seasonal efficiency to ASHRAE Std 103.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install gas fired units in accordance with NFPA 54 and applicable codes.

C. Provide vent connections in accordance with NFPA 211.

D. Install unit heaters with vibration isolation.

E. Provide connection to electrical power systems; refer to Section 26 27 17.

END OF SECTION

SECTION 23 74 13

PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged Rooftop unit.

B. Unit controls.

C. Roof Curb.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

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

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation; _____: www.carrier.com.

B. Trane Inc; _____: www.trane.com.

C. JCI: www.jci.com.

2.02 ROOFTOP UNITS

A. General: Roof mounted units having gas burner as indicated.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, roof curb, air filters, refrigerant cooling coil , compressor, condenser, hot gas reheat (where scheduled), energy recovery ventilator (where scheduled).

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

2.03 FABRICATION

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, 0.0478 inch, with access doors or panels of minimum 20 gage, 0.0359 inch.

B. Insulation: one inch thick neoprene coated glass fiber with edges protected from erosion.

C. Heat Exchangers: Stainless steel, of welded construction.

D. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated. Isolate complete fan assembly. Refer to Section 22 05 48.

E. Air Filters: 2 inch thick glass fiber disposable media in metal frames.

F. Roof Mounting Curb or Adapter Curb: 14 inches (or as required to provide 8 inches minimum clearance for roof flashing - field verify) high galvanized steel, vibration isolation rails as indicated, channel frame with gaskets, nailer strips and ERV supports as required.

G. Adapter Curb: Provide custom adapter curb for installation of new RTU where existing multi-zone RTU is removed. Conractor shall provide single adapter curb with structural supports to install both new units on exisitng curb along with installing condensing unit for ductless split system.

2.04 BURNER

A. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.05 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.06 COMPRESSOR

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.

B. Provide hot gas reheat with humidy controller where scheduled.

2.07 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

2.08 OPERATING CONTROLS - SINGLE ZONE UNITS

A. Electric solid state microcomputer based 7-day programmable thermostats, Honeywell Vision Pro 8000 series with locking metal cover..

B. Room thermostat shall incorporate:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from set point.
   3. Set-up for four separate temperatures per day.
   4. Instant override of set point for continuous or timed period from one hour to 31 days.
   5. Short cycle protection.
   6. Programming based on weekdays, Saturday and Sunday.

C. Room thermostat display shall include:
   1. Time of day.
   2. Actual room temperature.
   3. Programmed temperature.
   4. Day of week.
   5. System model indication: heating, cooling, auto, off, fan auto, fan on.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as illustrated by the manufacturer.

B. Verify that proper power supply and gas is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and mechanical code.

B. Install in accordance with NFPA 90A.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate operation to Owner's maintenance personnel.

END OF SECTION

SECTION 23 81 01
TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric heaters.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   3. Indicate mechanical and electrical service locations and requirements.,

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

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.

1.03 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

2.01 ELECTRIC HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
   2. Trane Inc: www.trane.com.
   3. Markel, Inc. .

B. Assembly: UL listed and labelled assembly with terminal box and cover, and built-in controls.

C. Heating Elements: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

PART 3 EXECUTION

3.01 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. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Section 26 27 17.

3.02 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.

END OF SECTION

SECTION 23 81 13

PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unitary air conditioners.

B. Controls.

1.02 REFERENCE STANDARDS

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

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

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

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bard (Base Bid):

B. Marv-Aire (Alternate)

2.02 AIR CONDITIONING UNITS

A. Description: Packaged, air-cooled, self-contained, factory assembled, prewired unit, consisting of cabinet, compressor, condensing coil, evaporator fan, evaporator coil, discharge plenum, outside air connection, gas heat, air filters, and controls; hot-gas re-heat, fully charged with refrigerant and filled with oil, energy recovery wheel.

B. Assembly: Up flow air delivery, in draw-through configuration as indicated.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.03 CABINET

A. Frame and Panels: Galvanized steel with baked enamel finish, easily removed access doors or panels with quick fasteners.

B. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.

C. Drain Pan: Galvanized steel with corrosion-resistant coating.

2.04 EVAPORATOR FAN

A. Fan: V-Belt driven, with permanently lubricated bearings, double width, double inlet, forward curved centrifugal fan, statically and dynamically balanced, resiliently mounted.

B. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

2.05 COMPRESSOR

A. Hermetically sealed, 3600 rpm maximum, resiliently mounted with positive lubrication and internal motor protection.

2.06 EVAPORATOR COIL

A. Direct expansion coiling coil of seamless copper tubes expanded into aluminum fins.

B. Refrigeration circuit with externally equalized thermal expansion valve, filter-drier, and charging valves.

2.07 CONDENSER

A. Air cooled.

B. Terminate suction and liquid refrigerant piping with service valves within unit.

2.08 AIR FILTERS

A. Easily removed 2 inch thick disposable glass fiber panel filters.

2.09 CONTROLS

A. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.

B. Provide low voltage, programmable, room thermostat/humidistat to control heater stages in sequence with delay between stages, compressor, condenser, and supply fan to maintain temperature setting. Include system selector switch (off-heat-auto-cool), and fan control switch (auto-on).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with requirements of NFPA 90A.

C. Provide shut-off valves for gas supply to unit.

D. Pipe refrigerant from unit to condenser; refer to section 23 23 00.

E. Pipe condensate from drain pan to condensate drainage system.

END OF SECTION

SECTION 23 81 27

SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Forced air furnaces.

C. Air cooled condensing units.

D. Indoor air handler (fan & coil) units for duct connection.

E. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ANSI/ASHRAE Std 15).

D. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

E. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

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

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

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
   1. Design Data: Indicate refrigerant pipe sizing.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Project Record Documents: Record actual locations of components and connections.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.04 QUALITY ASSURANCE

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

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Trane Inc: www.trane.com.

C. JCI : www.jci.com.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric refrigeration located in outdoor unit with evaporator coil in central ducted indoor unit.
   2. Heating: Heat pump Electric resistance heating.
   3. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
   4. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.
   1. Efficiency: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1; seasonal efficiency to ASHRAE Std 103.

2.03 INDOOR UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Horizontal.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm multiple speed, permanently lubricated, hinge mounted.

C. Air Filters: 2 inch thick pleated media, 30-35% dust spot efficiency.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Compressor: ARI 520; hermetic, 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling .

C. Air Cooled Condenser: ARI 520; Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.

E. Operating Controls:
   1. Control by unit mounted thermostat to maintain room temperature setting with BMS high and low limit alarm.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.05 ELECTRIC FURNACE COMPONENTS

A. Electric Heater: Helix wound bare nichrome wire heating elements arranged in incremental stages, with porcelain insulators.

B. Operating Controls:
   1. Heater stages energized in sequence with pre-determined delay between heating stages.
   2. High limit temperature control to de-energize heating elements, with automatic reset.
   3. Supply fan started before electric elements are energized and continues operating after thermostat is satisfied until bonnet temperature reaches minimum setting. Include manual switch for continuous fan operation.

2.06 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Set-up for four separate temperatures per day.
   4. Short cycle protection.
   5. Programming based on weekdays, Saturday and Sunday.
   6. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
   7. Battery replacement without program loss.
   8. Thermostat display:
      a. Actual room temperature.
      b. Programmed temperature.
      c. Day of week.
      d. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.
   9. Manufacturers:
      a. Honeywell Vision Pro 8000 series - No Substitutions

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION

SECTION 26 05 01

MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

C. Existing Electrical Service: Maintain existing system in service. Do not disable any system without prior approval of the owner. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 48 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

D. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner before partially or completely disabling system.
   2. Notify local fire service.
   3. Make notifications at least 48 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 01 - Minor Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 28 31 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS

A. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

B. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

C. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

E. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association (ANSI/NEMA WC 70/ICEA S-95-658).

F. NFPA 70 - National Electrical Code; National Fire Protection Association.

G. UL 44 - Thermoset-Insulated Wires and Cables.

H. UL 83 - Thermoplastic-Insulated Wires and Cables.

I. UL 486A-486B - Wire Connectors.

J. UL 486C - Splicing Wire Connectors.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Design Prof and obtain direction before proceeding with work.

B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Concealed Dry Interior Locations: Use only building wire with Type THHN/THWN/XHHW/XHHN insulation in raceway.

D. Exposed Dry Interior Locations: Use only building wire with Type THHN/THWN insulation in raceway.

E. Above Accessible Ceilings: Use only building wire with Type THHN/THWN insulation in raceway.

F. Wet or Damp Interior Locations: Use only building wire with Type XHHW/THWN insulation in raceway.

G. Exterior Locations: Use only building wire with Type XHHW/THWN insulation in raceway or service-entrance cable.

H. Underground Installations: Use only building wire with Type XHHW insulation in raceway or service-entrance cable.

I. Use stranded conductors for control circuits.

J. Use conductor not smaller than 12 AWG for power and lighting circuits.

K. Use conductor not smaller than 16 AWG for control circuits.

L. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

M. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

N. Conductor sizes are based on copper.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:
   1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
   2. Tinned Copper Conductors: Comply with ASTM B33.

H. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
   3. Color Code:
      a. Equipment Ground, All Systems: Green.

2.03 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

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

B. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

C. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

D. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

E. Install conductors with a minimum of 12 inches of slack at each outlet.

F. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

G. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

H. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

I. Insulate ends of spare conductors using vinyl insulating electrical tape.

J. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

L. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
   3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

M. Install wire and cable in accordance with the NECA "Standard of Installation."

N. Protect exposed cable from damage.

O. Support low voltage cables above accessible ceiling, using cable tray and plastic cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels. Where low voltage cable is run exposed, it must be run in conduit. Line voltage conductors are to be run in conduit.

P. Use suitable cable fittings and connectors.

3.04 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.

B. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.

C. Conduit and equipment supports.

D. Anchors and fasteners.

1.03 REFERENCE STANDARDS

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

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

D. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

F. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2.02 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
1. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
2. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
4. Solid Masonry Walls: Use expansion anchors or preset inserts.
5. Sheet Metal: Use sheet metal screws.
6. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Design Prof, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Design Prof, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 05 34.

I. Box Support and Attachment: Also comply with Section 26 05 37.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.
   1. Do not drill or cut structural members.

END OF SECTION

SECTION 26 05 34
CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible metal conduit (FMC).

B. Liquidtight flexible metal conduit (LFMC).

C. Electrical metallic tubing (EMT).

D. Conduit fittings.

E. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 35 - Surface Raceways.

D. Section 26 05 37 - Boxes.

1.03 REFERENCE STANDARDS

A. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

C. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association (ANSI/NEMA FB 1).

E. NFPA 70 - National Electrical Code; National Fire Protection Association.

F. UL 1 - Flexible Metal Conduit.

G. UL 360 - Liquid-Tight Flexible Steel Conduit.

H. UL 514B - Conduit, Tubing, and Cable Fittings.

I. UL 797 - Electrical Metallic Tubing-Steel.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction.

D. Fittings: NEMA FB 1.

2.03 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction with PVC jacket.

2.04 ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      c. Thomas & Betts Corporation: www.tnb.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
   5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

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

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
      d. Storage rooms.
   5. Arrange conduit to maintain adequate headroom, clearances, and access.
   6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   7. Arrange conduit to provide no more than 150 feet between pull points.
   8. Route conduits above water and drain piping where possible.
   9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   12. Group parallel conduits in the same area together on a common rack.

D. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
   6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.

E. Connections and Terminations:
   1. Use suitable adapters where required to transition from one type of conduit to another.
   2. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
   3. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   4. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

F. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

G. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

H. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

I. Provide grounding and bonding in accordance with Section 26 05 26.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective conduits.

3.04 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.

C. Install steel conduit as specified in NECA 101.

D. Arrange supports to prevent misalignment during wiring installation.

E. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.
K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
L. Route conduit in and under slab from point-to-point.
M. Maintain adequate clearance between conduit and piping.
N. Cut conduit square using saw or pipecutter; de-burr cut ends.
O. Bring conduit to shoulder of fittings; fasten securely.
P. Provide suitable pull string in each empty conduit except sleeves and nipples.
Q. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
R. Ground and bond conduit under provisions of Section 26 05 26.
S. Identify conduit under provisions of Section 26 05 53.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
B. Route conduit through roof openings for piping and ductwork wherever possible. .

END OF SECTION

SECTION 26 05 37
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 34 - Conduit:
   1. Conduit bodies and other fittings.

F. Section 26 27 26 - Wiring Devices:
   1. Wall plates.

G. Section 26 27 26 - Wiring Devices: Wall plates in finished areas.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association (ANSI/NEMA FB 1).

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

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.

F. NFPA 70 - National Electrical Code; National Fire Protection Association.

G. UL 514A - Metallic Outlet Boxes.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use raised covers suitable for the type of wall construction and device configuration where required.
   4. Do not use "through-wall" boxes designed for access from both sides of wall.
   5. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   6. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   7. Wall Plates: Comply with Section 26 27 26.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

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

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes so that wall plates do not cross masonry joints.

E. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

F. Install boxes plumb and level.

G. Install boxes as required to preserve insulation integrity.

H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

J. Close unused box openings.

K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

L. Provide grounding and bonding in accordance with Section 26 05 26.

M. Coordinate installation of outlet boxes for equipment connected under Section 26 27 17.

N. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

O. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

P. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

Q. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

R. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes with the architectural drawings.

S. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

T. Use cast outlet box in exterior locations exposed to the weather and wet locations.

U. Set floor boxes level.

3.03 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. UL 969 - Marking and Labeling Systems.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
   4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
   5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Locations:
1. Each electrical distribution and control equipment enclosure.

2.03 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Interior Components: Legible from the point of access.
6. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches; National Electrical Manufacturers Association.

F. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association.

G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association (ANSI/NEMA PB 1.1).

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).

I. NFPA 70 - National Electrical Code; National Fire Protection Association.

J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

L. UL 67 - Panelboards.

M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Design Prof of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: The electrical contractor shall provide a coordination drawing showing the layout for the main electrical room. This drawing shall be created using the dimensions of the equipment to actually be used, including panelboards, transformers, and transfer switches. For the device shop drawing submittals, indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Electric Company: www.geindustrial.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us.

C. Siemens.

2.02 ALL PANELBOARDS

A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.

F. Manufacturers:Square-D, G.E. Industrial, Siemens
   1. Substitutions: See Section 01 60 00 - Product Requirements.

G. Description: NEMA PB 1, circuit breaker type.

H. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

I. Minimum integrated short circuit rating: As indicated.

J. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

K. Cabinet Front: Surface type, fastened with hinge and latch, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel. All panelboards shall be provided with hinged front panels.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Provide clear plastic circuit directory holder mounted on inside of door.

F. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

G. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

H. Minimum Integrated Short Circuit Rating: As indicated.

I. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Do not use tandem circuit breakers.

J. Enclosure: NEMA PB 1, Type 1.

K. Cabinet Front: Surface cabinet front. To include door with concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. All panelboards shall be provided with hinged front panels.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Lug Material: Copper, suitable for terminating copper conductors only.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install panelboards plumb.

F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

I. Provide grounding and bonding in accordance with Section 26 05 26.

J. Install all field-installed branch devices, components, and accessories.

K. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

L. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

M. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

N. Provide filler plates to cover unused spaces in panelboards.

O. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

P. Provide identification nameplate for each panelboard in accordance with Section 26 05 53.

Q. Ground and bond panelboard enclosure according to Section 26 05 26.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Perform field inspection and testing in accordance with Section 01 40 00.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

E. Test GFCI circuit breakers to verify proper operation.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

G. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 17
EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 26 05 37 - Boxes.

D. Section 26 27 26 - Wiring Devices.

E. Section 26 28 18 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

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

1.05 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections. Electrical contractor shall make all final connections to mechanical, plumbing, and medical equipment included in this design package.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches: As specified on drawings and in individual equipment sections.

B. Wiring Devices: As specified in Section 26 27 26.

C. Flexible Conduit: As specified in Section 26 05 34.

D. Wire and Cable: As specified in Section 26 05 19.

E. Boxes: As specified in Section 26 05 37.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.

1.02 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables : Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors .

B. Section 26 05 35 - Surface Raceways: Surface raceway systems, including multioutlet assemblies.

C. Section 26 05 37 - Boxes.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 27 17 - Equipment Wiring: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association.

C. NEMA WD 6 - Wiring Device -- Dimensional Specifications; National Electrical Manufacturers Association.

D. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 RECEPTACLES

A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:
   1. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, GFCI,, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

2.03 WALL PLATES

A. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

B. Weatherproof Cover Plates: Gasketed in-use type with hinged covers .

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.

B. Install wiring devices in accordance with manufacturer's instructions.

C. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

D. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

F. Install wiring devices plumb and level with mounting yoke held rigidly in place.

G. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.

H. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect each wiring device for damage and defects.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 18
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonfusible switches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.

B. NECA (INST) - NECA Standard of Installation; National Electrical Contractors Association.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); National Electrical Manufacturers Association.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association (ANSI/NETA ATS).

E. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.06 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Electric Company: www.geindustrial.com.

B. Schneider Electric; Square D Products: www.schneider-electric.us.

C. Siemens.

2.02 COMPONENTS

A. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle lockable in OFF position.

B. Enclosures: NEMA KS 1.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm devices.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 23 33 00 - Air Duct Accessories: Duct smoke detectors monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

B. NFPA 72 - National Fire Alarm and Signaling Code.

C. NFPA 101 - Life Safety Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Drawings must be prepared using AutoCAD Release 10 or higher.

C. Evidence of installer qualifications.

D. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

E. Project Record Documents: Have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
   4. Contract maintenance office located within 200 miles of project site.
   5. Certified in Tennessee as fire alarm installer.

1.06 WARRANTY

A. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Initiating Devices, and Notification Appliances:
   1. Honeywell Security & Fire Solutions/Gamewell-FCI: www.gamewell-fci.com.
   2. Provide all initiating devices and notification appliances made by the same manufacturer and compatible with the existing system.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system: NFPA 72, manual and automatic local fire alarm system with connections to central monitoring system. Do not disable existing fire alarm until all components have been transfered to the new panel. Provide new components as shown on the drawings.
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.

B. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.04 COMPONENTS

A. Initiating Devices:
   1. Duct Smoke Detectors: Provided by the mechanical contractor and installed by the fire alarm contractor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

END OF SECTION