

ADDENDUM ONE

Addendum One to the drawings and specifications prepared by Myszak + Palmer for **Loogootee Elementary School Renovations** for **Loogootee Community Schools**, Loogootee, Indiana.

All Contractors bidding on this project shall read all of the items covered below and shall comply with all of the requirements as set forth, including any necessary refinements or additions generated by this Addendum and required by the intent of the original contract documents. All Contractors shall acknowledge on their bid form that they have received this Addendum, Subsequent Addenda, and include the appropriate content of same within their bid proposal

ADDENDUM ONE

SPECIFICATIONS

1. Meeting Minutes

PRE-BID MEETING MINUTES

- A. Minutes from the Pre-Bid Meeting held Tuesday, October 30, 2018 at the project site shall be distributed in Addendum 1 to all plan holders and those in attendance. See the attached minutes.

2. Section 002113

INSTRUCTIONS TO BIDDERS SPECIFICATION

- A. paragraph E, Liquidated Damages for the project shall be \$1000/per day for each consecutive calendar day after the completion date of August 9, 2019
- B. Owner shall be willing to extend completion date up to 60 days if needed and within reason.
- C. Owner shall make available the corridors, office, and kitchen area to all contractors on April 1, 2019.
- D. Each contractor shall provide and pass background checks
- E. Each contractor shall wear badges while school is in session.
- F. Lead Based Paint and Asbestos Abatement is outside of all scopes. Abatement shall be a separate project and completed before construction starts.

3. Section 002213 SPECIFICATION

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

- A. paragraph 2.1, The contractor shall provide and maintain Builders Risk Completed Value Insurance covering all risks of physical loss.

4. Section 033000

CAST-IN-PLACE CONCRETE SPECIFICATION

- A. paragraph M. Vapor Retarder, ASTM E 1745, Class A not less than 15 mils. Maintain permeance of less than 0.01 perms as tested in accordance with mandatory conditioning tests per ASTM E 1745 Section 7.1
 - 1. Vapor Barrier Products:
 - a. Basis of Design: Stego Wrap Vapor Barrier (15 mil) by Stego Industries
 - b. Vaporguard by Reef Industries
 - c. Moistop Ultra 15 by Fortifiber

5. Section 054000

COLD-FORMED METAL FRAMING SPECIFICATION

- A. All bulkhead and miscellaneous metal framing shall be braced with diagonal bracing at 48"o.c.

6. Section 098433 SOUND ABSORBING WALL UNITS SPECIFICATION

- A. Acceptable Manufacturer of Sound Absorbing Wall Units
 - a. G&S Acoustics, Acousti-Panels (AP)
 - b. Local Supplier: RAN Sales & Associates
9419 Magnolia Ridge Drive
Louisville, KY 40291
Voice: (502) 231-4978

7. Section 099100 PAINTING SPECIFICATION

- A. All door frames shown to remain on plans and shall be prepped accordingly and repainted. The painting contractor shall remove all delaminating coatings as needed to get to a sound surface. Repainted door frames shall pass industry standard adhesion testing. Paint door frames with Sherwin Williams Pro Industrial Water Based Alkyd Urethane or equal.

8. Section 101100 MARKER BOARDS SPECIFICATION

- A. Acceptable Manufacturer of Visual Display Boards
 - a. Claridge Products Series 4 Visual Display Boards & Horizontal Sliding Units
 - b. Local Supplier: Lee Company, Inc.
27 S 12th Street
Terre Haute, IN 47807
Voice: (812) 235-8155

9. Section 107300 CANOPIES SPECIFICATION

- A. Delete all reference to standing seam metal roofing at the front canopy location. Roof material is integral within the specified canopy system.
- B. The following structural loads shall be used on the canopy system:
 - a. Live Load – 20
 - b. Snow Load – 30
 - c. Wind Load – 20
 - d. Drift Load – 0
- C. 10 year standard finish warranty shall be provided
- D. Face sheet finishes shall be crystal on the upside and white on the downside
- E. Panel Construction
 - a. Thickness: 2-3/4"
 - b. Light Transmission – 37%
 - c. SHGC – N/A
 - d. Panel U-Factor - .53
 - e. Grid Pattern – 12x24 shoji
- F. Basis of Design Manufacturer of Canopies
 - a. Structures Unlimited
 - b. Local Supplier: Shaffner Heaney Associates (John Owens)
Voice: (502) 693-4590
- G. Acceptable Manufacturer of Canopies
 - a. Major Industries
 - b. Local Supplier: Spohn Associates (Eric Spohn)
7150 Winton Drive Suite 100
Indianapolis, IN 46268
Voice: (317) 921-0021

10. Section 116623 GYMNASIUM EQUIPMENT SPECIFICATION

- A. Basketball goal on west end (stage end), existing frame shall remain and new AFRG42 72x42 Glass Back Board, 2000+ Break Away Goal, 1131 Manual Height

- Adjuster, and PMCE Bolt On Edge Padding, or equal shall be installed. All adapters necessary shall be installed to install new equipment on the existing frame.
- B. Existing basketball goal and frame on east end (kitchen end) shall be demolished and replaced with the following, or equal:
- a. 2300-4064A Four Point Wall Mount with 3'-4" extension with AFRG42 72x42 Glass Back Board, 2000+ Break Away Goal, 1131 Manual Height Adjuster, and PMCE Bolt On Edge Padding
 - b. Local Supplier: Lee Company, Inc.
27 S 12th Street
Terre Haute, IN 47807
Voice: (812) 235-8155
- C. Per Alternate 6, install black KidWise Fanny pad 23"x38"x1-1/2" or equal at slide base.

11. Specification 230901

TEMPERATURE CONTROL SPECIFICATION

- A. Thermostats and controller by equipment supplier. Units and controls to be stand-alone. Stand-alone controller shall include temperature, humidity, CO2, outside air, variable speed control of supply fan, and heat pump control. Controller shall include BACNet interface for future BMS.

12. Drawing A5.1

DRAWING CLARIFICATION

- A. All glazing shown in the frame elevations and window elevations shall be tempered

13. Drawing M2.2

DRAWING CLARIFICATION

- A. See attached with revised unit ventilators and heat pump schedules.

SUPPLEMENTAL INFORMATION

Pre-bid Meeting minutes

DRAWINGS

Addendum 1 Drawing A1
Addendum 1 Drawing M2.2

Pages 1 through 8 constitute the total makeup of **Addendum One** with attached drawings and other supporting data following page 3. Contractor shall notify Architect if all pages are not received.

PREBID MEETING

AGENDA

1. Tentative Construction Schedule

- A. Bids will be received by Loogootee Community Schools on Thursday, November 15, 2018 and taken under advisement. Per discussion with Myszak+Palmer, Inc. and Loogootee Community School's Legal Counsel, award will be made within the following month.

2. Phasing and Staging

- A. Staging areas can be provided in parking lot. However, if a large portion of the parking area will be required, the architect's office should be notified at least 3 working days in advance.

3. Critical Work Sequencing/Long Lead Time Items

- A. Contractor shall provide adequate allowances in time for sufficient delivery of all materials in order to meet August 9, 2019 schedule.
- B. It shall be the responsibility of the General Contractor to plan and execute work via subcontractors (and any other concurrent work) so as not to delay progress or the overall schedule.

4. Designation of Key Personnel

- A. Main point of contact: Alan L. Knepp, Project Manager; Andrew P. Myszak, Architect
Myszak+Palmer, Inc.
903 Broadway Street
Vincennes, Indiana 47591
812-886-0350
Fax: 812-886-0790
Email: aknepp@myszakpalmer.com
amyszak@myszakpalmer.com

Owner Contact: Chris Baugh, Maintenance Director
Loogootee Community Schools
Loogootee, IN 47553
812-709-0850

- B. Architect will coordinate items with owner as informed so as not to delay the project.

5. Procedures for processing field decisions and Change Orders

- A. As noted in specifications. Submit on appropriate paperwork for processing.

6. Procedures for RFI's

- A. As noted in specifications. Submit on appropriate paperwork for processing.
- B. RFI's submitted via email or fax during bidding will be addressed in addendum format.

7. Procedures for Application for Payment

- A. As noted in specifications. Contractor shall submit G702/3 and Architect will process.

8. Submittal Procedures

- A. As noted in specifications.

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- A. Owner will occupy the facility until May 24, 2019 and re-occupy on August 12, 2019. The schools plan to have some areas (Elementary corridors, Elementary Office area, High School corridors, and High School Science Labs) available to the contractor by March 28, 2019. If necessary, evening and weekend work hours can and will be accommodated and recommended. Any staging, storage areas necessary shall be coordinated with the architect so that he may forward to the owner.

10. Fall Protection

- A. Prepare/Present Fall Protection Plan as required by work.

11. Procedures for disruptions/shutdowns

- A. Notify architect immediately and proper forms will be provided. Must be due to emergency or forced shut-down.

12. Construction Waste Management

- A. As noted in specifications.

13. Restroom Facilities

- A. Contractor shall provide proper restroom facilities

14. Parking Availability

- A. Contractor/s may use owner's existing parking lot.

15. First Aid

- A. Provide first aid supplies as required.

16. Security

- A. All Contractors shall be responsible for all his/her equipment.

17. Final Cleaning

- A. General Contractor shall provide final cleaning acceptable to owner/architect prior to substantial completion.

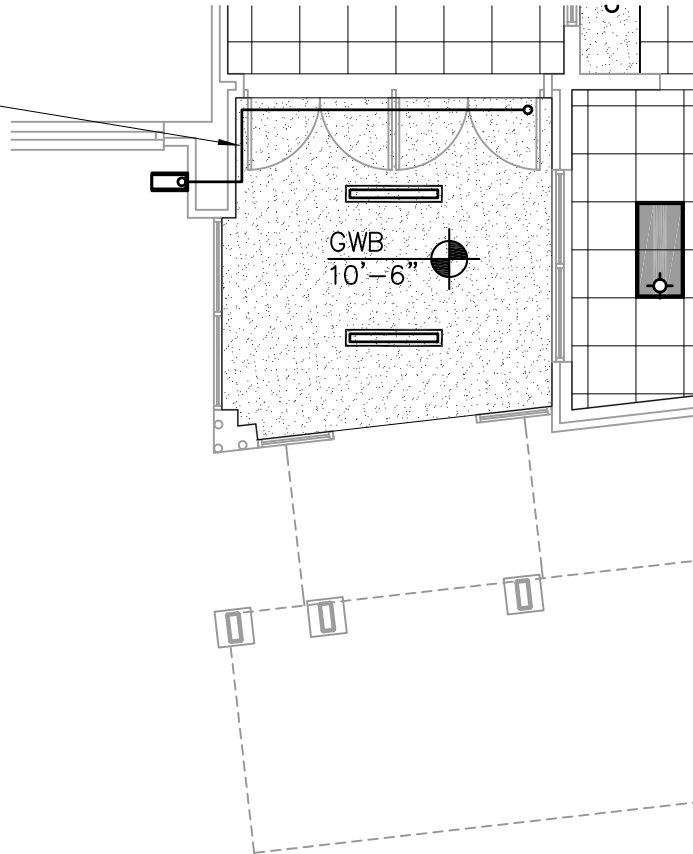
LOOGOOTEE ELEMENTARY & MIDDLE/HIGH SCHOOL RENOVATION PROJECTS

Pre-Bid Meeting Tuesday, October 30, 2018 3:30 p.m. EDT

Bids Due: 11/15/18 @ 2 p.m. EDT

Name	Company	Phone	e-mail
1 Mike Cull	Boynter	812-729-6198	mike.cull@boyntersheermetal.com
2 BRAND LAWYER	HARREL-FISH	812-537-2579	d.carter@harrell-fish.com
3 Duke Junod	Junod Painting	810-890-6805	junodpainting@gmail.com
4 Alan Wagoner	Wagoner & Sons	812-295-6944	Mano Wagoner, Hot Mail, Com
5 Logan Messmer	Messmer Mechanical	812-482-6766	logan@messmermechanical.com
6 PAUL WEYER	WEYER ELEC	812-630-4012	paul@weyer-electric.com
7 Neil Weyer	Weyer Electric	812-367-1650	neil@weyer-electric.com
8 MIKE FISH	WOLFE CAST.	812-882-7260	wolfe@wolfeconstruction.co
9 GEORGE HOFFMANN	DANON CONST	812-479-7000	ghoffmann@deno-constr.com
10 MARTY WELP	SEUFERT CONSTRUCTION	812-630-8523	m.welp@seufertconstruction.com
11 Kyle Giesler	Jasper Lumber Co.	812-492-1125	kgiesler@jasperlumberonline.com
12 Mason Stumph	ARC	812-426-0481	mstumph@arc-construction.com
13			
14			
15			
16			
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18			
19			

REMOVE AND
REPLACE EXISTING
ROOF DRAIN PIPE.
RE-ROUTE AS
SHOWN, MOUNTED
TIGHT TO CEILING
AND THROUGH
WALL. INSTALL 4"
DOWNSPOUT WITH
SPLASH PAD.



FIRST LEVEL PLAN PART 'C' REFLECTED CEILING PLAN

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

ADDENDUM 1 DRAWING A1 - REFERENCE A7.1C

ROOF DRAIN CLARIFICATION

myszak + palmer
ARCHITECTURE • DEVELOPMENT

903 Broadway Street
Vincennes, Indiana 47591
Voice: 812.886.0350
Fax: 812.886.0790
web: www.myszakpalmer.com

FACILITY RENOVATIONS FOR:

LOOGOOTEE ELEMENTARY SCHOOL

LOOGOOTEE, IN

DATE: 11/9/18

DRAWN: STAFF

CHECKED: APM

PROJECT ID: 17-18

SCHEDULE OF UNIT VENTILATOR UNITS

SYMBOL	MANUFACTURER	TYPE	MODEL	CFM	E.S.P.	HP	DX HEAT PUMP COIL	ROWS	TONS	REFRIGERANT	HEATING ②						VOLTAGE	REMARKS
											GPM	TOTAL BTU/HR	ENTERING WATER TEMP	LEAVING WATER TEMP	ENTERING AIR TEMP	LEAVING AIR TEMP		
UV-003	CHANGEAIR	FRESHMAN HRA 7' CABINET	HVRF 48 1600 B	1500	0.25	3/4	VPCOL237	4	4	R410A	8.0	119,700	180	149.2	45	111.8	208	③ 2-ROW HEATING
UV-151																		③
UV-152		FRESHMAN HRA 7' CABINET	HVRF 60 2000 C	1875		1			5		10.0	141,300		150.9		108.1		③

① ● 78/63° F RETURN AIR

② ● 70° F RETURN AIR

③ MERV 8 FILTER, DBL WALL CONSTRUCTION, O.A MODULATING DAMPER

SCHEDULE OF HEAT PUMP UNITS

SYMBOL	MANUFACTURER	MODEL	CFM	① COOLING		HEATING		KW	VOLTAGE	REMARKS
				SENSIBLE BTU/HR	TOTAL BTU/HR	TOTAL BTU/HR 47° F	TOTAL BTU/HR 17° F			
HP-1	CARRIER	38GJQD36		31,920	36,980	42,500		3.34	208	②③
HP-2										②③
HP-IDF		38GVQ012			12,000	12,000	6,800			②③

① ● 80/67/95

② EQUIP W/HAIL GUARDS

③ LOW AMBIENT COOLING

ADDENDUM 1 DRAWING M2.2

REVISED UNIT VENT. AND HEAT PUMP SCHEDULES

myszak + palmer
ARCHITECTURE • DEVELOPMENT

903 Broadway Street
Vincennes, Indiana 47591
Voice: 812.886.0350
Fax: 812.886.0790
web: www.myszakpalmer.com

FACILITY RENOVATIONS FOR:

LOOGOOTEE ELEMENTARY SCHOOL

LOOGOOTEE, IN

DATE: 11/9/18

DRAWN: KEH

CHECKED: KEH

PROJECT ID: 17-18

ADDENDUM ONE

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2. Section 002113

INSTRUCTIONS TO BIDDERS SPECIFICATION

- A. paragraph E, Liquidated Damages for the project shall be \$1000/per day for each consecutive calendar day after the completion date of August 9, 2019
- B. Owner shall be willing to extend completion date up to 60 days if needed and within reason.
- C. Owner shall make available the corridors and rooms A421, A422, A423, A425, A426, A427, A428, and A429 to all contractors on April 1, 2019.
- D. Each contractor shall provide and pass background checks
- E. Each contractor shall wear badges while school is in session.
- F. Lead Based Paint and Asbestos Abatement is outside of all scopes. Abatement shall be a separate project and completed before construction starts.

3. Section 002213 SPECIFICATION

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

- A. paragraph 2.1, The contractor shall provide and maintain Builders Risk Completed Value Insurance covering all risks of physical loss.

4. Section 004323

ALTERNATES FORM SPECIFICATION

- A. See the attached revised 004323 Alternates Form

5. Section 011200

MULTIPLE CONTRACT SUMMARY SPECIFICATION

- A. The plumbing contractor shall be responsible for any demolition, excavation and concrete patching for any required plumbing installation.

6. Section 033000

CAST-IN-PLACE CONCRETE SPECIFICATION

- A. paragraph M. Vapor Retarder, ASTM E 1745, Class A not less than 15 mils. Maintain permeance of less than 0.01 perms as tested in accordance with mandatory conditioning tests per ASTM E 1745 Section 7.1
 - 1. Vapor Barrier Products:
 - a. Basis of Design: Stego Wrap Vapor Barrier (15 mil) by Stego

Industries

- b. Vaporguard by Reef Industries
- c. Moistop Ultra 15 by Fortifiber

7. Section 054000 COLD-FORMED METAL FRAMING SPECIFICATION

- A. All bulkhead and miscellaneous metal framing shall be braced with diagonal bracing at 48"o.c.

8. Section 055000 METAL FABRICATIONS SPECIFICATION

- A. If Alternate 6 is accepted, the contractor shall install 16"x30" flat metal panel to cover existing clock/intercom opening at each clock/intercom location.

9. Section 064116 PLASTIC LAMINATE FACED ARCHITECTURAL CABINETS SPECIFICATION

- A. All sinks in all areas where epoxy resin tops are shown shall be Durcon, or equal, epoxy resin sinks. Sinks and water saver fixtures in labs shall be included in general construction contract. Plumbing contractor shall provide final hook-up.
- B. AWI QCP labels shall not be required.
- C. AWI Premium grade shall not be required.
- D. VGS Laminate shall be used on vertical surfaces.
- E. HGS edges shall be 3mm pvc edges.

10. Section 081416 FLUSH WOOD DOORS SPECIFICATION

- A. Doors and frames at openings A412 and A414 shall be replaced only in Alternate 4.

11. Section 096513 RESILIENT BASE AND ACCESSORIES SPECIFICATION

- A. 6" vinyl base shall be installed in the corridors where new walls and doors are being installed. At all other corridor locations, the existing terrazzo cove base shall remain.

12. Section 099100 PAINTING SPECIFICATION

- A. All door frames shown to remain on plans and shall be prepped accordingly and repainted. The painting contractor shall remove all delaminating coatings as needed to get to a sound surface. Repainted door frames shall pass industry standard adhesion testing. Paint door frames with Sherwin Williams Pro Industrial Water Based Alkyd Urethane or equal.

13. Section 101100 MARKER BOARDS SPECIFICATION

- A. Acceptable Manufacturer of Visual Display Boards
 - a. Claridge Products Series 4 Visual Display Boards & Horizontal Sliding Units
 - b. Local Supplier: Lee Company, Inc.
27 S 12th Street
Terre Haute, IN 47807
Voice: (812) 235-8155

14. Section 102226 OPERABLE PARTITION (GLASS WALL) SPECIFICATION

- A. Acceptable Manufacturer of Operable Partition (Glass Wall)
 - a. Kwik-Wall KWV-tec Glass Wall
 - b. Local Supplier: Lee Company, Inc.
27 S 12th Street
Terre Haute, IN 47807
Voice: (812) 235-8155
- B. Acceptable Manufacturer of Operable Partition (Glass Wall)
 - a. Hufcor GlassWall Operable Partition
 - b. Local Supplier: U.S. Specialties
2205 River Road
Louisville, KY 40206
Voice: (502) 587-9000

15. Section 102226.13 ACCORDION FOLDING PARTITION SPECIFICATION

- A. Acceptable Manufacturer of Accordion Folding Partition
 - a. Kwik-Wall VL-8 Accordion Folding Partition
 - b. Local Supplier: Lee Company, Inc.
27 S 12th Street
Terre Haute, IN 47807
Voice: (812) 235-8155

16. Section 105113 METAL LOCKERS SPECIFICATION

- A. In the base bid, paint only the outside face of the existing lockers.
- B. In Alternate 2, the contractor shall replace the lockers and install new lockers per interior elevations.

17. Section 105113 METAL SHELVING SPECIFICATION

- A. Basis of design Lab Prep A422 metal shelving – ASI Storage Solutions, Closed Type Shelving 36"x24"x87" Model #10362487CC-25

18. Section 111513 FUME HOODS SPECIFICATION

- A. Basis of Design includes 20 bench top hoods. Bench top hood basis of design – Labonco 2' Protector XVS Ventilation System with carbon filter. All Bench Top Hoods shall be Alternate #9. See the attached revised 004323 Alternates Form.

19. Specification 230901 TEMPERATURE CONTROL SPECIFICATION

- A. See attached revised specification.
- B. Temperature control is under mechanical contract. Mechanical contractor is responsible for complete operating system.
- C. Provide for new Tridium N4 BMS, sized for new equipment and future tie-in of existing equipment. All 120V circuits by temperature control contractor.
- D. Provide for remote alarm annunciation for unit ventilator and fan coil operation, high/low chilled water and hot water temperature in supply mains, discharge air, room air temperature, humidity, CO₂, supply air fan speed, and outside air damper position. System shall be open system, non-proprietary. License, hardware, software, and graphics to be owned by School Corporation.
- E. Provide (4) 4 hour training sessions for minimum 2 school corporation employees.
- F. New JACE to be sized for minimum 2000 points.
- G. Provide BACNet interface on all new equipment.
- H. Thermostats to be Allure EC-Smart-View Sensor. Thermostats by equipment supplier.

I. Control valves by temperature control contractor.

20. Drawing A5.1 DRAWING CLARIFICATION

A. All glazing shown in the frame elevations and window elevations shall be tempered

21. Drawing A6.1 DRAWING CLARIFICATION

- A. All terrazzo repair and replacement shall be in Alternate 1
- B. Replace areas as shown on A6.1. Pricing shall be included in Alternate 1
- C. Stripping and resealing of the terrazzo cove base shall be acceptable. Pricing shall be included in Alternate 1.
- D. Plumbing connections shown in corridors shall not require cutting and patching of existing terrazzo. Plumbing connections shall be made in basement level or into existing plumbing to avoid cutting of existing terrazzo.

22. Drawing E2.1 DRAWING CLARIFICATION

A. Note #2: Provide for custom color for all raceway.

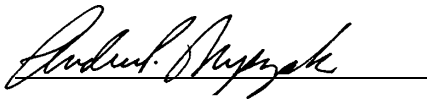
SUPPLEMENTAL INFORMATION

Pre-bid Meeting minutes
004323 Alternates Form
230901 Temperature Controls

DRAWINGS

Addendum 1 Drawing A1

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- A. Main point of contact: Alan L. Knepp, Project Manager; Andrew P. Myszak, Architect
Myszak+Palmer, Inc.
903 Broadway Street
Vincennes, Indiana 47591
812-886-0350
Fax: 812-886-0790
Email: aknepp@myszakpalmer.com
amyszak@myszakpalmer.com

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LOOGOOTEE ELEMENTARY & MIDDLE/HIGH SCHOOL RENOVATION PROJECTS

Pre-Bid Meeting

Tuesday, October 30, 2018

3:30 p.m. EDT

Bids Due: 11/15/18 @ 2 p.m. EDT

Name	Company	Phone	e-mail
1 Mike Cull	Boynter	812-729-6198	mike.cull@boyntersheermetal.com
2 BRAND LAWYER	HARRELL-FISH	812-537-2579	d.carter@harrell-fish.com
3 Duke Junod	Junod Painting	810-890-6805	junodpainting@gmail.com
4 Alan Wagoner	Wagoner & Sons	812-295-6944	Mano Wagoner, Hot Mail, Com
5 Logan Messmer	Messmer Mechanical	812-482-6766	logan@messmermechanical.com
6 PAUL WEYER	WEYER ELEC	812-630-4012	paul@weyer-electric.com
7 Neil Weyer	Weyer Electric	812-367-1650	neil@weyer-electric.com
8 MIKE FISH	WOLFE CAST.	812-882-2260	wolfe@wolfeconstruction.co
9 GEORGE HOFFMANN	DANCO CONST	812-479-7000	ghoffmann@denco-const.com
10 MARTY WELP	SEUFERT CONSTRUCTION	812-630-8523	m.welp@seufertconstruction.com
11 Kyle Giesler	Jasper Lumber Co.	812-492-1125	kgiesler@jasperlumberonline.com
12 Mason Stumph	ARC	812-426-0481	mstumph@arc-construction.com
13			
14			
15			
16			
17			
18			
19			

DOCUMENT 004323 - ALTERNATES FORM

I.1 BID INFORMATION

- A. Bidder: _____.
- B. Prime Contract: _____.
- C. Project Name: Loogootee Middle/High School Renovations
- D. Project Location: Loogootee Middle/High School, 201 Brooks Avenue, Loogootee, IN 47553
- E. Owner: Loogootee Community Schools
- F. Architect: Myszak + Palmer Architects
- G. Architect Project Number: 17-18

I.2 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.

I.3 DESCRIPTION

- A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.
- B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."
- C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."
- D. The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.
- E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within 60 days of the Notice of Award unless otherwise indicated in the Contract Documents.
- F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time.

I.4 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Vitrification and repair of existing corridor terrazzo
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- B. Alternate No. 2: Replace corridor lockers
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- C. Alternate No. 3: Install glass partition between library and classroom 451
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- D. Alternate No. 4: Renovate main lobby restrooms
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- E. Alternate No. 5: Install Electronic interior door hardware Schlage AD-400 & Software (Base bid LE Series with mortise locks and all associated hardware and software for complete operating system)
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- F. Alternate No. 6: Update intercom/clock system
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- G. Alternate No. 7: Install additional data drops as shown on drawings
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- H. Alternate No. 8: Install new switchgear
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).
- I. Alternate No. 9: Install (20) Labonco 2' Protector XVS Ventilation System with carbon filter fume hoods in Chemistry Lab A421
1. ADD ___ DEDUCT ___ NO CHANGE ___ NOT APPLICABLE _____.
2. _____ Dollars (\$_____).

I.5 SUBMISSION OF BID SUPPLEMENT

Respectfully submitted this ____ day of _____, 2018.

Submitted By: _____
(Name of bidding firm or corporation)

Authorized
Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

END OF DOCUMENT 004323

SECTION 230901 – TEMPERATURE CONTROLS

PART I - GENERAL

I.1 SECTION INCLUDES

- A. New Building Automation System (BAS) including:
 - 1. Central Operating Stations.
 - 2. Remote Terminal Stations.
 - 3. Building Automation Communication Network.
 - 4. Central Operators Station Software.
 - 5. DDC Terminal Unit Controls.
 - 6. Building Automation System Software.
 - 7. Final adjustments and technical checkout.
 - 8. Network documentation.
 - 9. Graphics software.
 - 10. System license.
- B. All required interface and coordination with building automation system and mechanical equipment supplied by other contracts.
- C. Terminal unit controls for VUV's, heat pumps, fan coils, fans, heaters, etc. unless indicated otherwise.
- D. All wiring, piping, labor and installation to complete all temperature control and automation functions.
- E. All automated dampers, damper motors, and valve operators.
- F. System Start-up and Checkout.
- G. Instructions for Owner.
- H. Owner Training

I.2 RELATED SECTIONS

- A. Section 23 05 00 - General Mechanical Requirements.
- B. Section 23 05 49 - Vibration Isolation.
- C. Section 22 30 00 - Plumbing Equipment.
- D. Section 23 23 00 - Refrigerant Piping and Specialties.

- E. Section 23 73 00 – Packaged Air Handling Units with Coils.
- F. Section 23 09 63 - Instrument Devices.
- G. Section 23 09 93 - Sequence of Operations.
- H. Section 23 05 93 - Testing, Adjusting and Balancing.
- I. Division 26 - Electrical Work.

I.3 REFERENCES

- A. ASTM D1693 - Environmental Stress-Cracking of Ethylene Plastics.

I.4 SUBMITTALS

- A. Submit shop drawings and product submittal under provisions of Division I.
- B. Provide job-tailored shop drawings as detailed herein, individual catalog cut-sheets detailing manufacturer's data for each major control system component, general catalog for all other minor control components and descriptive sequences detailing all BAS/TCS work.
- C. Generalized, standard catalog shop drawings shall not be used. This contractor shall develop a complete set of new shop drawings showing the entire BAS/TCS.
- D. Each mechanical system shall be represented by a line diagram showing each mechanical component as well as any other mechanical system components present but not necessarily affected by the BAS/TCS (filters, etc.).
- E. A line diagram representation of the respective mechanical system shall show all valves as they are intended to be connected to their respective mechanical component for proper operation.
- F. A line diagram representation of the respective mechanical system shall also show all field-mounted BAS/TCS sensing and control components (sensors, transmitters, etc.) and all controlled devices (pressure-electric switches, electric-pressure solenoids, valve actuators, etc.).
- G. All panel-mounted control components shall be shown within a separate section of the shop drawing designated for representation of the individual local control panel and its face layout; interconnecting pneumatic piping between panel-mounted components shall be shown within the panel layout and interconnecting electrical wiring shall be shown on a one-line diagram (complete with terminal designations) on the same drawing.
- H. All electrical wiring for starters of mechanical system components affected by the BAS/TCS (chillers, cooling towers, pumps, etc.) shall be represented as one-line diagrams showing all interlocks between the BAS/TCS, the respective starter and any other interlocks not necessarily provided as part of the BAS/TCS (fire alarm, smoke alarm, etc.).

- I. Each shop drawing shall be accompanied by a type-written listing identifying each BAS/TCS component shown on that drawing; each component shall be identified by the name used to designate the component on the shop drawings, the component's actual catalog description and designation (to be used when purchasing repair parts), the component's operating range, the component's fail-safe position, the component's setpoint (where applicable) and any other pertinent information.
- J. Each shop drawing shall be accompanied by a type-written sequence of operation identifying the designated function of each control component shown on that drawing; each control component shall be identified in the sequence of operation by the name used to designate the component on the shop drawings.
- K. For each system controlled by a field programmed direct digital control, provide the software program listing and the configuration data for each input and output point including hardware name, software name, range and fail condition. Software program listing shall include complete list of all program variables with software name and program function.
- L. Submit on one drawing a complete system architectural drawing indicating physical location, system addresses, and communication technique for all system components including DDC controllers, central operator station, remote terminals, modems, and other communication devices connected to the system network.
- M. Submit complete electrical wiring diagrams showing all communication and electrical wiring for all components attached to the system network.
- N. Submittals shall be provided to and approved by the Owner's authorized representative before any jobsite installation work is performed.
- O. For each system, submit a detailed checkout procedure. Identify step-by-step procedures to fully test and simulate system normal, alarm, and failure sequences. Include for each system a listing of all hardware point addresses, corresponding software point names, alarm setpoints, totalization point names, and all associated graphics and reports where point data occurs.

I.5 PROJECT RECORD DOCUMENTS

- A. Submit record documents under provisions of Division I.
- B. Accurately record actual location of control component, including panels, thermostats, and sensors.
- C. Revise shop drawings to reflect actual installation and operating sequences.
- D. Maintain at the jobsite, marked-up shop drawings showing actual job progress and installations.

I.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division I.

- B. Provide after all installation, calibration and start-up work has been completed. Include submittal shop drawings of the BAS/TCS, revised to reflect the system in its as-built condition, along with all information previously included in the first phase submittals.
- C. Include a type-written set of operating instructions identifying the procedures to be employed to perform such BAS/TCS operations as overriding the system, adjusting setpoints, displaying current values of system parameters, displaying trend logs, etc.
- D. Include information detailing preventative maintenance procedures to be performed on a regular basis and the Subcontractor's system guarantee and system component warranties. Submit a Schedule of Maintenance Inspections to be performed under this Contract.
- E. Provide submittals in a binder labeled with the title of the project.

I.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five (5) years experience.
- B. Installer: Company specializing in installing the work of this Section with minimum five (5) years experience and approved by manufacturer.

I.8 SEQUENCING AND SCHEDULING

- A. Sequence work under the provisions of Division I.
- B. Schedule work under provisions of Division I.
- C. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- D. Coordinate work under provisions of Division I, and ensure system is completed and commissioned by Date of Substantial Completion.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

I.9 REGULATORY REQUIREMENTS

- A. Standard Specifications and Codes: In addition to the requirements shown or specified, comply with the following latest current applicable standard specifications, codes or ordinances.
 - 1. NFPA - National Fire Protection Association.
 - 2. UL - Underwriters' Laboratories.
 - 3. IMC - Indiana Mechanical Code.
 - 4. Rules and Regulations of the Indiana Department of Fire Prevention and Safety.

- B. Include all items of labor and material required to comply with such standards, codes or ordinances in accordance with the contract documents. Where quantities, sizes, or other requirements indicated on Drawings or herein specified are in excess of the standard or code requirements, the specifications and drawings shall govern.

I.10 WARRANTY

- A. Provide two (2) years parts and labor warranty under provisions of Division I from date of Owner acceptance (Final Payment) of system operation.
- B. Date of Owner acceptance of system operation shall be determined by the Owner's representative. Written confirmation of system acceptance shall be provided to the contractor.
- C. Provide twenty-four (24) hour on site response to service request calls from the time of initial customer contact, including weekends and holidays.
- D. Provide software upgrades for all DDC, auxiliary devices, and system components to the manufactures current revision level for the full warranty period.
- E. Provide upgraded and revised system documentation for all modifications and additions for the full warranty period.
- F. Warranty: Include coverage for control air compressors, all system terminals, all portable devices and miscellaneous devices supplied by this contractor.

I.11 MAINTENANCE SERVICE

- A. Furnish complete service and preventative maintenance of automatic controls system for two (2) years from Date of final acceptance/final payment. Provide twenty-four (24) hour on site response to service request calls from the time of initial customer contact, including weekends and holidays.
- B. A preventive maintenance and support agreement shall be included at no additional cost to the Owner. This agreement shall begin at acceptance of the Building Automation System by the Owner and conclude at the end of the warranty period. This agreement shall include the following for each piece of equipment listed that applies to the building.
 - 1. Remote polling and review of trends. Trends shall include but not be limited to the points listed on Drawings. These trends will be polled on a monthly basis for review and sent to the Owner for their review.
 - 2. Technician will consult with Owner or Owner's Representative to address any desired changes to the system. Technician will also advise or recommend to customer ways to enhance operation of the current system, if applicable.
- C. Make minimum of six complete normal inspections per year in addition to normal and emergency service calls to inspect, calibrate and adjust controls and verify software operation. Submit written reports.

I.12 CUSTOMER TRAINING

- A. Provide (4) 4 hour training sessions for minimum 2 school corporation employees at the Owner's convenience. .

I.13 SCOPE OF WORK

- A. Provide new Tridium N4 BMS. System to be sized for future tie-in of existing equipment.
- B. Provide for tie-in of new equipment to new temperature control system.
- C. Provide for new controllers, network cabling, sensors, dampers, actuators, software, etc. required for DDC control of new equipment.
- D. Provide and install the most current updates at the time of installation. Contractor shall include costs for providing and installing all updates for two years beyond the date of substantial completion.
- E. Submit for approval critical vs. common alarms list for each location. List shall be reviewed with additions/subtractions by Owner's Representative.
- F. System shall be open protocol. All software, hardware, and license shall be owned and in possession of Owner at completion of project.

I.14 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. MS/TP: Master slave/token passing.
- D. PC: Laptop computer.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.

I.15 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.

3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
 - e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
 - f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
 - g. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
 - h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
 - i. Relative Humidity: Plus or minus 5 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - l. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
 - o. Carbon Monoxide: Plus or minus 5 percent of reading.
 - p. Carbon Dioxide: Plus or minus 50 ppm.
 - q. Electrical: Plus or minus 5 percent of reading.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Tridium, w/ Niagra 4 WEB supervisor (which utilizes the HTML5 platform), open protocol.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed

to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.2 ACCEPTABLE MANUFACTURERS

- A. Honeywell.
- B. Siemens Building Technologies, Inc.
- C. Trane.

2.3 ACCEPTABLE CONTROL CONTRACTORS

- A. Commercial Service
- B. Open Systems
- C. Alpha Mechanical
- D. ECT Services
- E. Others as approved.

2.4 DDC EQUIPMENT

- A. Operator Workstation: One laptop with minimum configuration as follows:
 - 1. Motherboard: With (3) integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
 - 2. Processor: Dual Intel Pentium 4.
 - 3. Random-Access Memory: 3 GB.
 - 4. Graphics: Video adapter, minimum 1280 x 1024 pixels, 64 MB video memory, with TV out.
 - 5. Keyboard: QWERTY, 105 keys in ergonomic shape.
 - 6. Hard-Disk Drive: 80 GB
 - 7. CD-ROM Read/Write Drive: 48x24x48
 - 8. Operating System: Microsoft Windows 10 with high-speed Internet access.
 - a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 - 9. Application Software:
 - a. I/O capability from operator station.
 - b. System security for each operator via software password and access levels.
 - c. Automatic system diagnostics; monitor system and report failures.
 - d. Database creation and support.

- e. Automatic and manual database save and restore.
- f. Dynamic color graphic displays with up to 10 screen displays at once.
- g. Custom graphics generation and graphics library of HVAC equipment and symbols.
- h. Alarm processing, messages, and reactions.
- i. Trend logs retrievable in spreadsheets and database programs.
- j. Alarm and event processing.
- k. Object and property status and control.
- l. Automatic restart of field equipment on restoration of power.
- m. Data collection, reports, and logs. Include standard reports for the following:
 - 1) Current values of all objects.
 - 2) Current alarm summary.
 - 3) Disabled objects.
 - 4) Alarm lockout objects.
 - 5) Logs.
- n. Custom report development.
- o. Utility and weather reports.
- p. Workstation application editors for controllers and schedules.
- q. Maintenance management.
- r. Provide any and all program usernames, keys, passwords. Owner shall be granted ALL permissions, rights and licenses and have the capability of full and complete control to revise, adjust, review, etc. any and all programs. Provide and install the most current software program/upgrade to the Owner's existing Tridium system.

10. Custom Application Software:

- a. English language oriented.
 - b. Full-screen character editor/programming environment.
 - c. Allow development of independently executing program modules with debugging/simulation capability.
 - d. Support conditional statements.
 - e. Support floating-point arithmetic with mathematic functions.
 - f. Contains predefined time variables.
- B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random access memory; local operator access and display panel; integral interface equipment; and backup power source.
- 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.

- e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
3. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
 - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
 - d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - e. Remote communications.
 - f. Maintenance management.
 - g. Units of Measure: Inch-pound and SI (metric).
 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 6. BacNet Compliance: Control units shall use BacNet protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 5. BacNet Compliance: Control units shall use BacNet protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
5. Analog Outputs: Provide modulating signal, either low voltage 0- to 10-V dc or current 4 to 20 mA.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
- E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
 1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
 2. Proportional band shall extend from 2 to 20 percent for 5 psig.
 3. Authority shall be 20 to 200 percent.
 4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
 5. Gages: [1-1/2 inches] [2-1/2 inches] [3-1/2 inches] in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.6 TIME CLOCKS

- A. Manufacturers:

1. ATC-Diversified Electronics.
 2. Paragon Electric Co., Inc.
 3. Precision Multiple Controls, Inc.
 4. SSAC Inc.; ABB USA.
 5. TCS/Basys Controls.
 6. Time Mark Corporation.
- B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
- C. Solid-state, programmable time control with 4 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.7 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting.
- B. Thermistor Temperature Sensors and Transmitters:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.
 - f. RDF Corporation.
 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
 5. Averaging Elements in Ducts: use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Thermometer: Concealed.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. MAMAC Systems, Inc.
 - c. RDF Corporation.
 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 5. Averaging Elements in Ducts: 24 feet long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length.
 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Thermometer: Concealed.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- D. Humidity Sensors: Bulk polymer sensor element.
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 2. Accuracy: 5 percent full range with linear output.
 3. Room Sensor Range: 20 to 80 percent relative humidity.
 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.

6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

I. Manufacturers:

- a. BEC Controls Corporation.
- b. General Eastern Instruments.
- c. MAMAC Systems, Inc.
- d. ROTRONIC Instrument Corp.
- e. TCS/Basys Controls.
- f. Vaisala.

2. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.

- a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
- b. Output: 4 to 20 mA.
- c. Building Static-Pressure Range: 0- to 0.25-inch wg.
- d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.

5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

G. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.
3. Adjusting Key: For calibration and cover screws.

2.8 FLOW MEASURING STATIONS

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.

I. Manufacturers:

- a. Air Monitor Corporation.
 - b. Wetmaster Co., Ltd.
 - c. Trane
2. Casing: Galvanized-steel frame.
 3. Flow Straightener: Aluminum honeycomb, 3/4-inch parallel cell, 3 inches deep.
 4. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.

2.9 THERMOSTATS

A. Manufacturers:

1. Erie Controls.
2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
3. Heat-Timer Corporation.
4. Sauter Controls Corporation.
5. Tekmar Control Systems, Inc.
6. Theben AG - Lumilite Control Technology, Inc.

B. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

C. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

D. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual or automatic reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

E. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual or automatic reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

F. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.10 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 3. Non-spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
 5. Non-spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 3. Dampers: Size for running torque calculated as follows:
 - a. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 4. Coupling: V-bolt and V-shaped, toothed cradle.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 7. Power Requirements (Two-Position Spring Return): 24 or 120-V ac.
 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 10. Temperature Rating: 40 to 104 deg F
 11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.

2.11 CONTROL VALVES

- A. Manufacturers:
1. Danfoss Inc.; Air Conditioning & Refrigeration Div.

2. Erie Controls.
 3. Hayward Industrial Products, Inc.
 4. Magnatrol Valve Corporation.
 5. Neles-Jamesbury.
 6. Parker Hannifin Corporation; Skinner Valve Division.
 7. Pneuline Controls.
 8. Sauter Controls Corporation.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Sizing: 1-psig maximum pressure drop at design flow rate.
- D. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
 2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
- E. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
- 2.12 DAMPERS
- A. Manufacturers:
1. Air Balance Inc.
 2. TAMCO (T. A. Morrison & Co. Inc.).
 3. United Enertech Corp.
 4. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.13 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."
- B. All new wiring, control cable, etc. shall be plenum rated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Mount compressor and tank unit on spring isolators with 1-inch static deflection. Vibration isolators are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Isolate air supply with wire-braid-reinforced rubber hose. Secure and anchor according to manufacturer's written instructions and seismic-control requirements.
 1. Pipe manual and automatic drains to nearest floor drain.
 2. Supply instrument air from compressor units through filter, pressure-reducing valve, and pressure relief valve, with pressure gages and shutoff and bypass valves.
- D. Verify location of thermostats, humidistats, CO₂ sensors and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor or as indicated on drawings.
 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- E. Install guards on thermostats in the following locations:

1. Entrances.
 2. Public areas.
 3. Where indicated.
- F. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
- G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- H. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
- I. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- J. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."
- K. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
- L. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 2. Install exposed cable in raceway.
 3. Install concealed cable in raceway.
 4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test proper shut-down initiation by smoke detector activation.
 - 4. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 5. Pressure test control air piping at 30 psig or 1.5 times the operating pressure for 24 hours, with maximum 5-psig loss.
 - 6. Pressure test high-pressure control air piping at 150 psig and low-pressure control air piping at 30 psig for 2 hours, with maximum 1-psig loss.
 - 7. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 8. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 9. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 10. Test each system for compliance with sequence of operation.
 - 11. Test software and hardware interlocks.
- C. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check installation of air supply for each instrument.
 - 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 - 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 8. Check temperature instruments and material and length of sensing elements.
 - 9. Check control valves. Verify that they are in correct direction.
 - 10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 - 11. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.

- b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

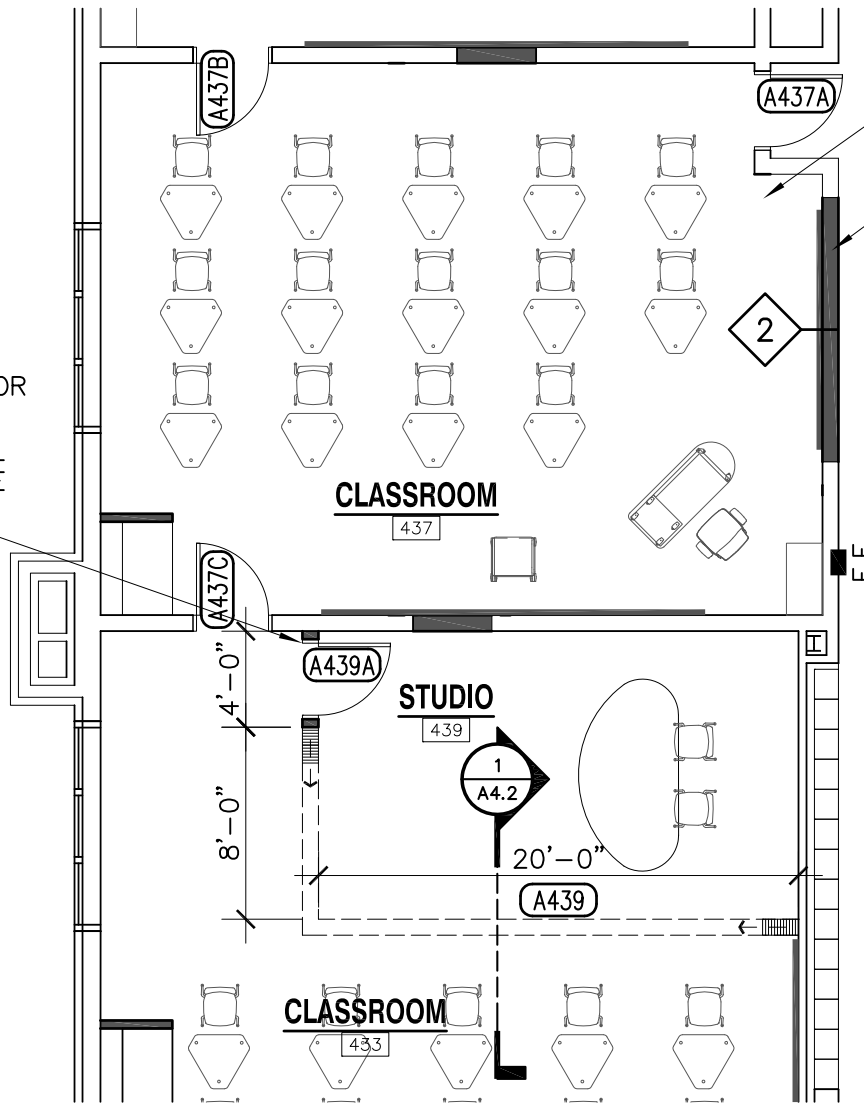
1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.

- I0. Provide diagnostic and test instruments for calibration and adjustment of system.
 - II. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: When requested within 24 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

END OF SECTION 230913

NEW 8" METAL
FRAMED WALL
WITH NEW
3'-0"x7'-0" DOOR
(TYPE 6) AND
FRAME. INSTALL
DOOR HARDWARE
SET #17.

REMOVE EXISTING
WALL BEHIND
DISPLAY CASE
REMOVE EXISTING
DISPLAY CASE
AND INFILL WITH
CMU.



FIRST LEVEL PLAN

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



INDICATES NEW WALL AREAS

ADDENDUM 1 DRAWING A1 - REFERENCE A1.1

CLASSROOM A437 & STUDIO A439 CLARIFICATION

myszak + palmer
ARCHITECTURE • DEVELOPMENT

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FACILITY RENOVATIONS FOR:

LOOGOOTEE HIGH/MIDDLE SCHOOL

LOOGOOTEE, IN

DATE: 11/9/18

DRAWN: STAFF

CHECKED: APM

PROJECT ID: 17-18