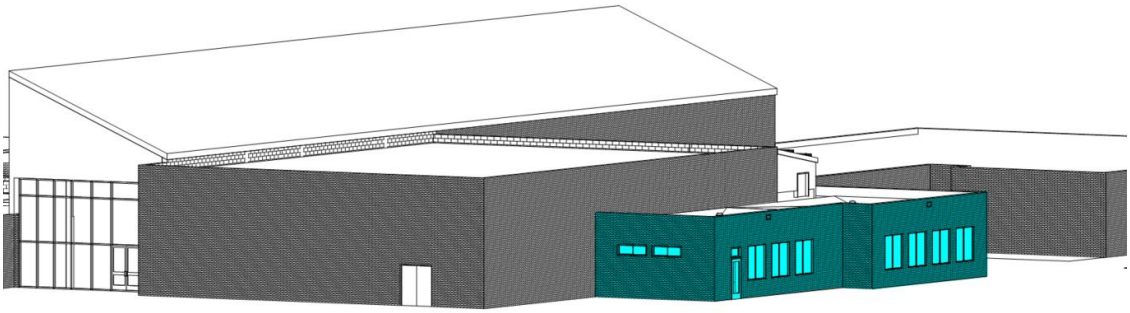
Final Commissioning Report

Strawberry Park Elementary School
Steamboat Springs, CO



Submitted To:

Steamboat Springs School District RE-2 and DPM

Submitted By:

PCD Engineering

323 3rd Avenue, Suite 100
Longmont, Colorado 80501
(303) 678-1108
pcdengineering.com

PCD Project Number: 20004

March 11, 2021

This Report Prepared For:	This Report Prepared By:
Steamboat Springs School District RE-2 325 7th Street Steamboat Springs, CO 80487 Project Address: 220 39620 Amethyst Drive, Steamboat Springs, CO 80487 Steamboat Springs School District RE-2 Pascal Ginesta, Facilities Manager 325 7th Street Steamboat Springs, CO 80487 Phone: 970-871-3188 pginesta@ssk12.org Dynamic Project Management Eagle, CO 81631 Reilly O'Brien, Project Manager Colleen Kaneda, Project Director Todd Raper, Project Manager Sarah Lara, Sr. Project Manager Reilly: (303) 775-5051 Colleen: (970) 390-0312 Todd: (970) 986-2274 Sarah: (303) 552-4995 Reilly.OBrien@dynamicpm.co Colleen.Kaneda@dynamicpm.co Todd.Raper@dynamicpm.co Sarah.Lara@dynamicpm.co	PCD Engineering 323 3rd Avenue, Suite 100 Longmont, Colorado 80501 303-678-1108 Alan Niemeyer PCD Engineering Project Manager Cell: 303-910-1193 Office: 303-678-1108 ext. 702 alan@pcdengineering.com Peter D'Antonio PCD Engineering President Office: 303-678-1108 ext. 707 peter@pcdengineering.com

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Abbreviations/Acronyms

AC/ACU	Air conditioning / Air conditioning unit	HW	Hot water
AH/AHU	Air handler / Air handling unit	HWS/ HWR	Hot water supply/Hot water return
BAS	Building automation system	kBtu	Thousand British thermal units
BTU	British thermal unit	kW	Thousand watts
CU	Condensing Unit	kWh	Kilowatt hour
DA/ DAT	Discharge air / Discharge air temperature	MAU	Make-up Air Unit
DDC	Direct digital control	MA/ MAT	Mixed air / Mixed air temperature
DHW	Domestic hot water	MBH	Thousand British thermal units
DOAS	Dedicated Outside Air System	MMBtu	Million British thermal units
DX	Direct expansion	OA/OSA	Outside air
EA/ EAT	Exhaust air / Exhaust air temperature	OAT	Outside air temperature
EUH	Electric unit heater	PCD	PCD Engineering Services
EF	Exhaust fan	RA/ RAT	Return air / Return air temperature
F	Fahrenheit	RCx	Recommissioning
FCU	Fan coil unit	RTU	Rooftop (packaged HVAC) unit
GPM	Gallons per minute	SA/ SAT	Supply air / Supply air temperature
HP	Horsepower	SF	Supply fan
HP	Heat Pump	SF	Square Foot
HVAC	Heating, ventilating, and air-conditioning	VFD	Variable Frequency Drive
HV/ HVU	Heating ventilating unit		

Steamboat Springs School District – Strawberry Park Elementary School

FINAL COMMISSIONING REPORT

1 OVERVIEW OF COMMISSIONING TASKS

1.1 Systems-Equipment Commissioned

PCD Engineering Services, Inc. (PCD) served as the Commissioning Agent for this project. This report summarizes the commissioning activities and consulting for completion of the new classroom addition and cafeteria / pre-K classroom renovations.

PCD Engineering provided commissioning for the following systems, which includes design, construction, and warranty phase commissioning to meet Steamboat Springs School District requirements. The specific equipment and systems commissioned are included under the following bullet list and are presented in Tab 5 – Functional Performance Tests.

- HVAC systems / controls and lighting control systems that were commissioned included:
  - Air Handling Unit with DX cooling and HW heating;
  - VAV Air Terminal Units with HW Reheat Coils;
  - Restroom Exhaust Fan;
  - Dishwasher Hood Exhaust Fan;
  - Kitchen Hood Exhaust Fan;
  - Kiln Room Exhaust Fan;
  - (E) Snowmelt Systems with New Snowmelt Zones;
  - Lighting Occupancy Sensor Controls;
  - Daylight Dimming System Controls; and
  - Exterior Lighting Photocell Control.

1.2 Scope of Commissioning

The scope of the HVAC systems / controls and lighting control systems commissioning activities are included the following major tasks:

- Lead an Owner's Project Requirements (OPR) charrette with the Ownership to define and develop the OPR.
- Coordinate the commissioning work during design.
- Develop and incorporate full commissioning specifications/requirements into the construction documents.
- Perform focused reviews of the design, drawings and specifications at Schematic Design, 50% & 100% Design Development, and 100% Construction Documents. Communicate the results of the design reviews.
- Update the OPR as needed after each design review submission.

- Coordinate a controls integration meeting to discuss integration issues between equipment, systems, and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications.
- Coordinate and direct the commissioning activities. Work with the general contractor and project manager to ensure that commissioning activities are being scheduled.
- Prepare construction-phase commissioning plan. Conduct a kick-off meeting to present the commissioning plan.
- Review contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
- Prepare pre-functional checklists (PFCs) and final functional performance tests (FPTs) tailored specifically to the installed equipment and systems.
- Perform site visits to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.
- Attend selected planning and job-site meetings to obtain information on construction progress and manage the commissioning process.
- Review and provide oversight and verification of the Test and Balance procedures / process.
- Witness HVAC air and water piping pressure testing, sufficient to be confident that proper procedures were followed.
- Witness and document functional performance tests performed by the Construction Contractor for all commissioned systems and assemblies.
- Monitor system operation and performance for selected data points. Analyze monitored data to verify systems operation and performance; provide a summary report.
- Maintain a master issues log and a separate record of functional testing. Report all issues through the Construction Manager as they occur, as well as written progress reports, and test results with recommended actions.
- Follow up on the corrections by retesting systems (or components) which failed the first verification test.
- Review the preparation of the O&M manuals.
- Review the training for facilities maintenance personnel and attend key training sessions.
- Provide a Final Commissioning Report.
- Coordinate and supervise required seasonal / deferred testing and deficiency corrections.
- Complete end of warranty site observations and interview with facility maintenance staff to identify building operating issues. Provide a final end-of-warranty summary report.

2 RESULTS OF COMMISSIONING

2.1 Design Phase

PCD reviewed the mechanical and lighting control design documents, and offered recommendations for cost-effective system enhancements for improving serviceability, ease of operations and maintenance, and energy-efficiency. A list of these items can be found in Tab 3 - Commissioning Reviews. The commissioning specifications were prepared by PCD and provided to the design team for integration into the project manual.

2.2 Construction Phase

The commissioning activities during construction included field observation visits, commissioning meetings with contractors, review of prefunctional checklists, creation of functional performance tests, and verification of installed equipment and systems operation.

2.3 Summary of Findings

2.3.1 Commissioning Summary

A significant part of the commissioning process for the HVAC systems and lighting control systems required preparation and implementation of functional performance tests (FPTs). The FPTs were written based on the equipment in the design documents and submittals provided by the contractor. The FPTs were provided in advance to the contractor for review.

The controls point-to-point testing and the functional testing of the equipment / system operating sequences were performed. The detailed results of the point-to-point and functional testing were documented in the FPT forms and are presented in Tab 5.

The commissioning process identified 11 deficiencies / issues. The active Cx issues were documented on Haselden's Procore online management software. The Cx issues were also tracked in the Final Commissioning Issues Log presented in Tab 4. Nine of the 11 commissioning issues were addressed and corrections were implemented. The two outstanding Cx issues are as follows:

> #1 – AHU-2 – TAB Airflow: The AHU-02 actual airflow was measured at 83% of Design Airflow, which is 1,125 CFM below design. Consult Carrier and make pulley / sheave adjustments to the air handler and other adjustments, as needed, to bring the AHU airflow up to design airflow.
>
> #2 – VAV-02 – TAB Airflow: VAV-02 actual Max Cooling airflow is 70% of design. Recheck VAV-02 Max Cooling airflow value after AHU-02 adjustments to airflow have been made to increase airflow to design CFM. Make adjustments to VAV-02, as needed, to bring actual airflow to design Max Cooling airflow.

For complete information and recommendations, refer to the Final Commissioning Issues Log dated 3/10/2021 in Tab 4.

2.4 Warranty Phase

The opposite season verification of AHU-2 cooling for the new classroom addition and cafeteria renovation will be conducted during the spring / summer when ambient temperatures are warm enough to operate the DX cooling.

In the 10th month of the warranty period, the building operations and outstanding issues related to the commissioning activities will be reviewed with the facility staff. The facility staff will also be interviewed to identify problems or concerns they have with operating the building as originally intended. A findings and recommendations report will be provided.

Tab 1:
Commissioning Plan

COMMISSIONING PLAN

Strawberry Park Elementary Addition / Renovation

Submitted To:

Steamboat Springs SD RE-2 & DPM

Submitted By:

PCD Engineering

323 3rd Avenue, Suite 100
Longmont, Colorado 80501
(303) 678-1108
pcdengineering.com

October 1, 2020

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Abbreviations/Acronyms

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AH/AHU	Air handler / Air handling unit	HWS/ HWR	Hot water supply/Hot water return
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BTU	British thermal unit	kW	Thousand watts
CCF	Hundred cubic feet (measure of natural gas usage)	kWh	Kilowatt hour
CFM	Cubic feet per minute	MA/ MAT	Mixed air / Mixed air temperature
CO_2	Carbon dioxide	MBH	Thousand British thermal units
CV	Constant volume	MMBtu	Million British thermal units
Cx	Commissioning	MS	Middle School
DA/ DAT	Discharge air / Discharge air temperature	OA/OSA	Outside air
DDC	Direct digital control	OAT	Outside air temperature
DHW	Domestic hot water	RA/ RAT	Return air / Return air temperature
DX	Direct expansion	RCx	Retro-commissioning
EA/ EAT	Exhaust air / Exhaust air temperature	RF	Return fan
EF	Exhaust fan	RH	Relative humidity
ERV	Energy recovery ventilator	RTU	Rooftop (packaged HVAC) unit
ES	Elementary School	SA / SAT	Supply air / Supply air temperature
EUI	Energy use intensity	SF	Supply fan
F	Fahrenheit	SF	Square Foot
FCU	Fan coil unit	SZ	Single zone
FY	Fiscal year	Therms	Energy equal to 100,000 British Thermal units (BTU)
GPM	Gallons per minute	TU	Terminal unit
HP	Horsepower	VAV	Variable air volume
HS	High School	VFD	Variable frequency drive
HVAC	Heating, ventilating, and air-conditioning	WC	Water Column
HV/ HVU	Heating ventilating unit		

Strawberry Park Elementary School - Commissioning Plan

1 GENERAL BUILDING INFORMATION

The general building information is included in the following table.

Table 1-1: General Building Information

Project Name	Strawberry Park Elementary School Additional / Renovation
Project Address	39620 Amethyst Drive, Steamboat Springs, CO 80487
Building Type	Elementary school
Square Footage	Existing Building: 71,098 SF New Classroom Addition: 2,480 SF Cafeteria & Pre-K Classroom Renovation: 6,090 SF
Building Description	Pre-K through 5th Grade classrooms, music and art classrooms , administration offices, library, and gymnasium
Owner Agency	Steamboat Springs School District RE-2
Scheduled Completion Date	November 19, 2020

2 OVERVIEW

2.1 Abbreviations and Definitions

The following table presents common abbreviations used in this document.

Table 2-1: Abbreviations and Definitions

A/E	Architect and Design Engineers	FPT	Functional Performance Test
BECx	Building Enclosure Commissioning	GC	General Contractor
CP	Commissioning Provider	MC	Mechanical Contractor
CC	Controls Contractor	PFC	Pre-functional Checklist
Cx	Commissioning	PM	Project Manager
EM	Energy Manager	Subs	Subcontractors to General
Cx Plan	Commissioning Plan document	TAB	Test and Balance Contractor
EC	Electrical Contractor	Staff	Maintenance Staff
MM	Maintenance Manager		

2.2 Purpose of the Commissioning Plan

The purpose of the commissioning plan is to provide direction for the commissioning process during construction, providing resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals, and coordination.

2.3 Commissioning Goals and Objectives

Commissioning is a systematic process of ensuring that the building systems perform according to the design intent and the owner's operational requirements. All equipment and systems should be installed according to manufacturer's recommendations and the best practices and standards of the industry.

Commissioning will include documenting the design intent, followed by activities in the construction, acceptance, and warranty phases of the project. The participation of the contractors in commissioning activities will follow the requirements defined in the specifications. The three main goals of the commissioning process are:

1. Facilitate the final acceptance of the project at the earliest possible date.
2. Facilitate the transfer of the project to the owner's maintenance staff.
3. Ensure that the comfort systems meet the requirements of the occupants.

Commissioning is also intended to achieve the following specific objectives:

- Document that equipment is installed and started per manufacturer's recommendations.
- Document that equipment and systems receive complete operational checkout by installing contractors.
- Document system performance with thorough functional performance testing and monitoring.
- Verify the completeness of operations and maintenance materials.
- Ensure that the owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

2.4 Commissioning Scope

The following systems / equipment will be commissioned for this project. All general references in this document refer only to systems / equipment that are to be commissioned.

Table 2-2: Systems / Equipment To Be Commissioned

System	Equipment	Sample Rate	Qty	Notes
HVAC Systems	Air Handling Unit	100%	1	AHU-2
	Air Cooled Condensing Unit	100%	1	CU-1 for AHU-2
	VAV Terminal Boxes	100%	5	VAV-01, -02, -03, -04, and -05
	Art Classroom Exhaust Fan	100%	1	EF-1
	Kiln Room Exhaust Fan	100%	1	EF-3
	Restroom Exhaust Fans	100%	2	EF-2 and -4
	Kitchen Hood Exhaust Fan	100%	1	KEF-1
	Dishwasher Hood Exhaust Fan	100%	1	KEF-2
	(E) Fan Powered VAV Box	100%	2	(E) FPB-1-9 and -1-10
	Snowmelt System Addition	100%	1	(E) Snowmelt Boiler SB-3 – Addition of New Snow-melted Area (5,015 SF) and (E) controls
	Test, Adjust, Balance (TAB)	-	-	Verification
Electrical: Interior Lighting Controls	Ceiling Occupancy Sensors	40%	9	Total of 23
	Wall Occupancy Sensors	70%	5	Total of 7
	Daylight Photocell Sensors	100%	5	Total of 5
Electrical: Exterior Lighting Controls	Photocell Sensor	100%	1	Total of 5 exterior light fixtures

3 COMMISSIONING TEAM INFORMATION

The commissioning team information is presented in the following table.

Table 3-1: Commissioning Team Information

Function	Name/Address	Contact Information
Owner	Steamboat Springs School District RE-2 Brad Meeks, Superintendent 325 7th Street Steamboat Springs, CO 80487 bmeeks@ssk12.org	Office: (970) 871-3193
Owner Facility Director	Steamboat Springs School District RE-2 Pascal Ginesta, Facilities Manager 325 7th Street Steamboat Springs, CO 80487 pginesta@ssk12.org	Office: (970) 871-3188
Owner's Representative (Project Team)	Dynamic Project Management Colleen Kaneda, Project Director Reilly O'Brien, Project Manager Eagle, CO 81631 Colleen.Kaneda@dynamicpm.co Reilly.OBrien@dynamicpm.co	Colleen: (970) 390-0312 Reilly: (303) 775-5051
Commissioning (Cx) Provider	PCD Engineering, Inc. Peter D'Antonio, President Alan Niemeyer, Project Manager 323 3rd Avenue, Suite 100 Longmont, CO 80501 peter@pcdengineering.com alan@pcdengineering.com	Phone: (303) 678-1108 Alan: (303) 910-1193
Architect	TAB Associates, Inc. Warner Hopkins, Project Manager Greg Macik, NCARB, Principal 56 Edwards Village Boulevard, Suite 210 Edwards, CO 81632 warner@tabassociates.com greg@tabassociates.com	Warner: (970) 766-1470 x111 Greg: (970) 766-1470 x107
MEP Engineer	BG Buildingworks David Lyle, Principal Marc Sacconi, 222 Chapel Pl., Unit AC-201 Avon, CO 81620 dalyle@bgbuildingworks.com masacconi@bgbuildingworks.com	Phone: (970) 949-6108

Function	Name/Address	Contact Information
General Contractor	Haselden Construction, LLC Mike Cunningham, Sr. Project Manager James Eschelbach, Project Manager Tony Soddy, Superintendent Jason Luna, Superintendent Ian Grams, Project Engineer 6950 South Potomac Street Centennial, CO 80112 mikecunningham@haselden.com jameseschelbach@haselden.com tonysoddy@haselden.com jasonluna@haselden.com iangrams@haselden.com	Mike Cunningham: (307) 275-0049 James: (303) 358-5035 Tony: (303) 990-0824 Jason: (303) 870-7118 Ian: (303) 518-0034
Mechanical - Plumbing Contractor	R&H Mechanical John Dietrich, Project Manager 1119 Chambers Ave Eagle, CO 81631 johnd@randhmechanical.com	Office: (970) 328-2699 John: (970) 401-4510
Electrical Contractor	Central Electric, LLC Jed Gibson, Project Manager 2618 Copper Ridge Circle Unit A Steamboat Springs, CO 80487 jed@cesteamboat.com	Phone: (970) 871-9611 Jed: (970) 846-8379
Controls Contractor	LONG Building Technologies Greg Custer, Controls Specialist Steve Tanner, Controls Technician 5001 South Zuni Street Littleton, CO 80120 gcuster@LONG.com stanner@LONG.com	Phone: (970) 673-5547 Greg: (970) 673-5547 Steve: (720) 799-7388
TAB Contractor	Certified Balancing and Commissioning Greg Barnes, TAB Supervisor Littleton, CO 80120 greg@certtab.com	Phone: (720) 201-6274

4 ROLES AND RESPONSIBILITIES

4.1 General Management Plan

In general, the CP coordinates the commissioning activities and reports to the owner's construction representative. The CP's responsibilities, along with all other contractors' commissioning responsibilities are detailed in the specifications. The Specifications will take precedence over this Commissioning Plan. All members work together to fulfill contracted responsibilities and meet the objectives of the Contract Documents.

4.2 General Descriptions of Roles

General descriptions of the commissioning roles are as follows:

CP: Commissioning Provider coordinates the Cx process, writes and/or reviews testing plans, directs and documents performance testing.

PM: Project Manager facilitates and supports the Cx process and gives final approval of the Cx work.

MM: Maintenance Manager coordinates maintenance staff participation in commissioning activities.

GC: General Contractor facilitates the Cx process, ensures that Subs perform their responsibilities and integrates Cx into the construction process and schedule.

Subs: Subcontractors demonstrate correct system performance.

Staff: Staff members participate in commissioning tasks and performance testing, review O&M documentation, and attend training.

A/E: Architect/Engineers perform construction observation, approve O&M manuals and assist in resolving problems.

Mfr.: Equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted startup.

4.3 General Management Plan and Protocols

The following protocols will be used on this project:

Table 4-1: Commissioning Protocols

Issue	Protocol
For requests for information (RFI) or formal documentation requests:	The CP goes first through the PM.
For minor or verbal information and clarifications:	The CP goes direct to the informed party.
For notifying contractors of deficiencies:	The CP documents deficiencies through the PM, but may discuss deficiency issues with contractors prior to notifying the PM.
For scheduling functional tests or training:	The CP provides input and coordination of testing and training. Scheduling is done through the PM.
For scheduling commissioning meetings:	The CP selects the date and schedules through the PM.
For making a request for significant changes:	The CP has no authority to issue change orders.

Issue	Protocol
For making minor changes in specified sequences of operations:	Any required changes in sequences of operations required to correct operational deficiencies must be approved and documented by the PM and A/E team. The CP may recommend to the PM changes in sequences of operation to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CP shall:	Resolve issues at the lowest level possible. First with the CP, then with the GC and PM. Some issues may require input from the A/E team.

5 COMMISSIONING PROCESS

This section provides details of the commissioning process by commissioning task or activity.

5.1 Commissioning Tasks per Project Phases

The following table presents the commissioning tasks per the design, construction, and warranty phases.

Table 5-1: Commissioning Tasks per Project Phase

Design Phase	
1	Lead a charrette to define and develop the owner's requirements (OPR). Review the basis of design (BOD). CP shall document the OPR and the design team shall develop the BOD.
2	Develop and incorporate commissioning specifications / requirements into the construction documents and review energy model inputs.
3	Coordinate the commissioning work during design.
4	Prepare a commissioning plan and update for Construction Stage.
5	Perform focused reviews of the design, drawings and specifications at Schematic Design, 50% & 100% Design Development, and 100% Construction Documents. Communicate the results of the design review(s).
6	Update the OPR as needed after each design review submission.
7	Coordinate a controls integration meeting where the electrical engineers, fire protection engineers, mechanical engineers, owner's representative, and commissioning provider discuss integration issues between equipment, systems, and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications.
8	Attend design meetings as required; participate in value engineering meetings with the project team and make recommendations for commissioning and O&M issues.
Construction Phase	
1	Coordinate and direct the commissioning activities; ensure that commissioning activities are being incorporated into the master schedule.
2	Prepare construction phase commissioning plan.
3	Review equipment submittals applicable to systems being commissioned.
4	Prepare pre-functional checklists (PFC) and final functional performance tests (FPTs) tailored specifically to the installed equipment and systems.
5	Perform site visits to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/ substitutions relating to the commissioning process. Assist in resolving any discrepancies.
6	Review and provide oversight and verification of the Test and Balance procedures / process.
7	Witness Heating Ventilating and Air Conditioning (HVAC) piping pressure test and flushing, sufficient to be confident that proper procedures were followed. Include testing documentation in the Commissioning Record.

8	Witness any ductwork testing and cleaning sufficient to be confident that proper procedures were followed. Include documentation in the Commissioning Record.
9	Document construction checklist completion by reviewing completed construction checklists and by selected site observation.
10	Document systems start-up by reviewing start-up reports and by selected site observation.
11	Approve air and water systems balancing by spot testing, by reviewing completed reports, and by selected site observation.
12	Coordinate functional testing for all commissioned systems and assemblies. Witness and document manual functional performance tests performed by the Construction Contractor for all commissioned systems and assemblies, except some smaller equipment may be tested and documented by the Construction Contractor at the Commissioning Agent's discretion.
13	Monitor system operation and performance for selected data points for up to two weeks by requesting trend logs from the Construction Contractor from the building automation system or by using temporary portable data loggers that will monitor up to 20 points. Analyze monitored data to verify operation and performance and issue a written report. The time frame and monitoring points may be modified to accurately commission the building.
14	Maintain a master issues log and a separate record of functional testing. Report all issues through the Construction Manager as they occur, as well as written progress reports, and test results with recommended actions.
15	Follow up on the corrections by retesting systems (or components) which failed the first verification test.
16	Facilitate, oversee and review the training of Owner's operating personnel. Oversee the videotaping of this training. Attend and participate in key training sessions.
17	Review the preparation of the O&M manuals for commissioned equipment, including equipment warranties to ensure responsibilities are clearly defined.
18	Prepare a final commissioning report of the project, including final issues log with outstanding non-compliance items and commissioning documents summarizing reviews, checklists, meetings, functional tests, and training.
Post-Construction Phase	
1	Coordinate and supervise required opposite season / deferred testing and deficiency corrections; provide the final testing documentation for the Final Commissioning Report and O&M manuals.
2	Conduct 10th-month warranty period site visit. Review with facility staff the current building operation and outstanding issues related to the original and seasonal commissioning. Interview facility staff and identify problems or concerns they have with operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents, and requests for services to remedy outstanding problems.
3	Assist in the development of a preventative maintenance plan, a detailed operating plan, or an energy and resource management plan.
4	Update the master deficiency and resolution log; provide final end-of-warranty commissioning report.

The following systems, including all components and controls, are to be commissioned under the project scope of work:

- HVAC systems; and
- Lighting control systems.

The following sections provide further detail for specific tasks or activities in the commissioning process. All sections do not necessarily apply to this project. Consult the tables in the preceding pages for specific tasks and activities included under the scope of services of this project.

5.2 Commissioning Scoping Meeting

The scoping meeting brings together all members of the design, construction, and operations team that will be involved in the commissioning process. Each building system to be commissioned is addressed, including commissioning requirements, and completion and start-up schedules. During the scoping meeting, all parties agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Commissioning Plan.

5.3 Final Commissioning Plan

The commissioning agent finalizes the draft Commissioning Plan using the information gathered from the scoping meeting. The initial commissioning schedule is also developed along with a detailed timeline. The timeline is fine-tuned as construction progresses.

5.4 Design Intent / Basis of Design Documentation

The design requirements, relative to the building systems selected for commissioning, must be explicitly documented in order to establish a baseline of performance expectations to which the actual installed performance is compared. The commissioning provider, with the assistance of the building owner and design team, prepares a Design Intent Summary that documents the design intent for those building systems selected for commissioning. The Design Intent Summary reflects the underlying assumptions and requirements that become represented in the construction documents.

5.5 Design Review

Constructability, maintainability, operability and functionality are the main focus of the design review. PCD reviews the design documents to facilitate commissioning during construction. Many of the features that facilitate commissioning will also enhance ease of building operation.

5.6 Submittals

The general contractor will provide the commissioning agent with a set of equipment and system submittals. This equipment data includes installation and start-up procedures, O&M data, performance data and temperature control drawings. The subcontractors, general contractor or A/E notify the commissioning agent of any new design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems.

5.7 Site Observation

The commissioning agent makes periodic site visits to witness equipment and system installations. Each site visit will have a specific agenda and will be coordinated with the general contractor site supervisor. The commissioning agent attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in commissioning. The general contractor provides the commissioning agent with information regarding substitutions or change orders that may affect commissioned equipment or the commissioning schedule.

5.8 Development of Functional Test and Verification Procedures

Functional performance testing verifies the intended operation of individual components and system interactions under various conditions and modes of operation. The systems are run through all the sequences of operation and the response of components is verified. Testing proceeds from components to subsystems to systems, and finally to interlocks and connections between systems.

The commissioning agent prepares functional performance test (FPT) plans so that the complete sequence of operations is included. The commissioning agent obtains all documentation, including an updated points list, control sequences, and setpoints. If necessary, the commissioning agent may request clarifications from contractors and the design team regarding sequences and operation. Prior to execution, the commissioning agent provides a copy of the primary equipment tests to the installing subcontractor and general contractor who can review the tests for feasibility, safety, warranty and equipment protection.

5.9 Execution of Functional Performance Tests

The commissioning agent schedules functional tests through the general contractor and subcontractors. Under the supervision of the commissioning agent, the installing subcontractor performs the hardware and/or software manipulations required for the testing. Owner maintenance staff may also be present in order to assist in system observations. The commissioning agent witnesses and records the results of functional performance testing.

Any deficiencies found from functional performance testing will be documented in a Deficiency Report. The report will include all details of the components or systems found to be non-compliant with the parameters of the functional performance test plans and design documents. The deficiency report will become part of the punch list. The report will detail the adjustments or alterations required to correct the system operation, and identify the responsible party. The deficiency report will be continuously updated. The commissioning agent schedules any required retesting through the general contractor. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between commissioning agent, sub-contractor and general contractor.

5.10 Short-Term Diagnostic Monitoring

Short-term diagnostic testing, using data acquisition equipment or building automation system trends to record system operation over a two to three week period, may be used to investigate the dynamic interactions between components in the building system. The monitoring occurs after occupancy to evaluate the building systems' performance under natural occupancy and ambient load conditions. The objectives of the monitoring are to evaluate scheduling, the interaction

between heating and cooling, and the effectiveness of the system in meeting the comfort requirements of the occupants.

5.11 Operations and Maintenance Manuals

The operation and maintenance manuals prepared by the contractors for the owner's maintenance personnel are reviewed for completeness. The contractors are encouraged to submit O&M manuals at the earliest possible date. Materials may be added, or requested from the contractors, to stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. A database of preventative maintenance information may also be created from the materials in the O&M manuals.

5.12 Training and Orientation of Owner Personnel and Occupants

Effective training of maintenance personnel is critical to the long term performance of the new building. The commissioning agent will assist the owner and general contractor in organizing the training sessions by identifying the appropriate staff for each session and creating an overall training plan.

For each training session, the contractors provide a detailed agenda for each piece of equipment or system for which training is required. The agenda describes the training scope, duration, and methods, along with the name and qualifications of the trainers. The commissioning agent develops a plan for including in the training session contractors / trainers from different disciplines, when appropriate. The trainer documents each training session (duration, general subjects covered, and attendees). The commissioning agent may witness any of the training sessions.

5.13 Warranty Period

Seasonal variation in operations or control strategies may require additional testing during peak cooling and heating seasons to verify system performance. During the warranty period, seasonal testing and other deferred testing is completed as required to fully test all sequences of operation. The commissioning agent coordinates this activity. Tests are executed and deficiencies corrected by the appropriate subcontractors, witnessed by facilities staff and the commissioning agent. Any final adjustments to the O&M manuals and as-builts due to the testing are made.

The commissioning agent will request input from the owner's operations staff and occupants about the performance of the building systems. The commissioning agent also supports the general contractor's troubleshooting process during the warranty period. The general contractor's warranty team will first try and resolve the issues before requesting assistance from the commissioning agent.

5.14 Commissioning Report

A final Commissioning Report will be compiled which summarizes all of the tasks, findings, and documentation of the commissioning process. The report will address the actual performance of the building systems in reference to the design documents. All test reports by various sub-contractors, manufacturers and controlling authorities will be incorporated into the final report.

The commissioning report includes:

- An evaluation of the operating condition of the systems at the time of functional test completion,

- Deficiencies that were discovered and the measures taken to correct them,
- Functional performance tests and results,
- Reports that document all commissioning field activities as they progressed, and
- A description and estimated schedule of required deferred testing.

6 COMMISSIONING SCHEDULE

6.1 General Issues

The commissioning requirements should be completed in the following sequence and priority:

1. Pre-functional checklist items and all manufacturers' pre-start procedures must be completed before equipment start-ups. Any moisture, dust, or other environmental and building integrity issues should also be addressed before equipment start-ups.
2. Functional performance testing will begin after the equipment pre-functional checklists and start-ups have been verified as complete. The TAB procedures must be completed for equipment and systems as specified. Any outstanding issues on engineer punch lists must be completed prior to functional performance testing.
3. The control system, and the equipment it controls, will be functionally tested after all control points have been calibrated and pre-functional checklists are verified as complete.
4. Training and O&M documentation must be completed and reviewed by all parties prior to the project substantial completion.

6.2 Project Schedule

The following table presents the preliminary commissioning schedule.

Table 6-1: Commissioning Schedule

Design Phase		Conformance with Schedule
1	Lead a charrette to define and develop the owner's requirements (OPR). Review the BOD.	Duration: 4 weeks Start: Within 4 weeks from NTP
2	Develop and incorporate commissioning specifications / requirements into the construction documents and review energy model inputs.	Duration: Commensurate with design schedule Start: Design Development
3	Coordinate the commissioning work during design.	Duration: DD – Pre-Con Start: Design Development
4	Prepare a commissioning plan and update for Construction Stage.	Duration: DD – Pre-Con Start: Design Development
5	Perform focused reviews of the design, drawings and specifications at Schematic Design, 50% & 100% Design Development, and 100% Construction Documents. Communicate the results of the design review(s).	Duration: Commensurate with design schedule Start: Schematic Design
6	Update the OPR as needed after each design review submission.	Duration: Commensurate with design schedule Start: Schematic Design
7	Coordinate a controls integration meeting to discuss integration issues between equipment, systems, and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications.	Duration: Commensurate with design schedule. Start: 3 weeks prior to 100% CDs.

8	Attend design meetings as required; participate in value engineering meetings with the project team and make recommendations for commissioning and O&M issues.	Duration: Commensurate with design schedule. Start: Pre-design through 100% CDs.
Construction Phase		**Conformance with Schedule**
1	Coordinate and direct the commissioning activities.	Duration: Pre-Con - Completion Start: Pre-Con
2	Prepare construction phase commissioning plan.	
3	Review equipment submittals applicable to systems being commissioned.	Duration: 1 to 2 weeks per submittal Start: Commensurate with submittal schedule
4	Prepare pre-functional checklists (PFC) and final functional performance tests (FPTs) tailored specifically to the installed equipment and systems.	Duration: 4 to 8 weeks Start: Following submittal review
5	Perform site visits to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress.	Duration: Commensurate with construction schedule Start-End: Pre-Con – Substantial completion
6	Review and provide oversight and verification of the Test and Balance procedures / process.	Duration: Commensurate with construction schedule Start-End: Equipment start-ups – Substantial completion
7	Witness Heating Ventilating and Air Conditioning (HVAC) piping pressure test and flushing, sufficient to be confident that proper procedures were followed. Include testing documentation in the Commissioning Record.	Duration: Commensurate with construction schedule Start-End: Pre-Con – Substantial completion
8	Witness any ductwork testing and cleaning sufficient to be confident that proper procedures were followed. Include documentation in the Commissioning Record.	Duration: Commensurate with construction schedule Start-End: Pre-Con – Substantial completion
9	Document construction checklist completion by reviewing completed construction checklists and by selected site observation.	Duration: Commensurate with construction schedule Start-End: Pre-Con – Substantial completion
10	Document systems start-up by reviewing start-up reports and by selected site observation.	Duration: Commensurate with construction schedule – 1 to 2 months Start-End: Following Equipment Install – Substantial completion
11	Approve air and water systems balancing by spot testing and by reviewing completed reports and by selected site observation.	Duration: Commensurate with construction schedule - 1 to 3 months

12	Coordinate functional testing for all commissioned systems and assemblies. Witness and document manual functional performance tests.	Start-End: Following TAB – Substantial completion
13	Monitor system operation and performance for selected data points for up to two weeks. Analyze monitored data to verify operation and performance and issue a written report.	
14	Maintain a master issues log and a separate record of functional testing. Report all issues as they occur, as well as written progress reports, and test results with recommended actions.	
15	Follow up on the corrections by retesting systems (or components) which failed the first verification test.	
16	Facilitate, oversee, and review the training of Owner's operating personnel. Oversee the videotaping of this training. Attend and participate in key training sessions.	Duration: 2 to 4 weeks Start: Commensurate with training schedule.
17	Review the preparation of the O&M manuals for commissioned equipment, including equipment warranties to ensure responsibilities are clearly defined.	Duration: 2 to 4 weeks Start: Commensurate with O&M Manual documents schedule.
18	Prepare a final commissioning report of the project, including final issues log with outstanding non-compliance items and commissioning documents summarizing reviews, checklists, meetings, functional tests, and training.	Duration: 1 to 2 months Start: Following Substantial completion.
Post-Construction Phase		**Conformance with Schedule**
1	Coordinate and supervise required opposite season / deferred testing and deficiency corrections; provide the final testing documentation for the Final Commissioning Report and O&M manuals.	Duration: Ongoing 12 months
2	Conduct 10th-month warranty period site visit. Review with facility staff the current building operation and outstanding issues related to the original and seasonal commissioning. Interview facility staff and identify problems or concerns they have with operating the building as originally intended. Assist facility staff in developing reports, documents, and requests for services to remedy outstanding problems.	Duration: 10th/11th month
3	Assist in the development of a preventative maintenance plan, a detailed operating plan, or an energy and resource management plan.	Duration: 10th/11th month
4	Update the master deficiency and resolution log; provide final end-of-warranty commissioning report.	Duration: 10th/11th month

Tab 2:
Owner's Project Requirements
and
Basis of Design Narrative

Owner's Project Requirements

Steamboat Springs School District RE-2 – Priority Projects

The Steamboat Springs School District (SSSD) priority projects include existing facility renovations and new building additions. The priority project schools work will be done in two phases. The work phases and schools are as follows:

Phase 1

- Soda Creek Elementary
- Strawberry Park Elementary
- Steamboat Springs Middle

Phase 2 (Spring 2021)

- Steamboat Springs High
- North Routt Community Charter

Phase 1 and 2 Overlap

- Yampa Valley High / Boys & Girls Club.

The general project information for the priority project schools is presented at the end of this Owner's Project Requirements (OPR) document. SSSD will not pursue any sustainability programs such as LEED or Green Globes. The priority projects will include a formal commissioning process.

GENERAL BUILDING STANDARDS

The Phase 1 priority projects are being built using the following standards, guidelines, and codes. In addition to meeting these requirements, the Performance Criteria section contains project specific information.

- Americans with Disabilities Act (ADA)
- ASHRAE 90.1 (current or applicable edition)
- ASHRAE Standard 62.1 (current or applicable edition)
- ASHRAE Standard 55 (current or applicable edition)
- 2015 International Building Code
- 2015 International Mechanical Code
- 2015 International Plumbing Code
- 2015 International Energy Conservation Code
- 2015 International Fuel Gas Code

DYNAMIC PROGRAM MANAGEMENT

pcd ENGINEERING

- 2015 International Fire Code
- State and local amendments to the International Codes
- National Fire Alarm Code – NFPA 72, 2013 Edition
- National Fire Protection Standards (NFPA)
- Installation of Sprinkler Systems – NFPA 13
- Life Safety Code – NFPA 101
- National Electrical Code – NFPA 70
- Illuminating Engineering Society of North America (IESNA) and applicable RP and DG publications.

The upcoming Phase 2 projects will use 2018 international codes; the updated codes and standards will be included here.

TRAINING, OPERATIONS, & MAINTENANCE

Overall, the building is intended to be operated as follows:

> The primary goal is to have a "user-friendly" system that the average person could walk in and operate without elaborate training. Once completed, the building will be operated by employees of Steamboat Springs SD who will require some training regarding the operation and maintenance (O&M) of the equipment installed in the building. The additional training for Steamboat Springs SD will expand the level of in-house technical expertise.

Steamboat Springs SD requires the training and documentation for this project as shown below:

- *Operations staff training:* video and hands-on, on-site training. This should ideally be in phases such that users have time to get familiar with the systems on their own, and then ask questions.
  - *Trainees:* Director of Facilities, O&M staff, and American Mechanical Services (AMS) HVAC contract service personnel.
  - *Responsible Party:* installing contractors.
  - *Contractual Agreement:* plans and specifications.
  - *Additional Information:* Training will be tailored to the actual knowledge level of the individuals being trained. This includes the maintenance staff and main building personnel.
  - The training documentation shall include the following and shall be stated in the plans and specifications for each project:
    - Contractor closeout submittals that include training videos and training manual(s) that have been coordinated with O&M manuals and emergency systems.
      - Draft O&M Manuals (electronic and hard copy version) shall be submitted to CxA and Architect at least 30 days prior to start of

demonstration and training for review. Final O&M manuals are due 14 days prior to commencement of demonstration and training.

- In addition to the typical normal and emergency O&M instructions, Manuals shall also contain important items such as approved submittals, system start-up/testing sheets, fan and pump curves, detailed wiring diagrams showing both factory and field wiring, spare parts lists and a summary of warranties and bonds and warranty/bond contact information for each piece of equipment or system installed for easy reference by the Owner.
- Owner requires (2) hard copies of O&M Manuals and electronic copies of O&M Manuals on USB flash drive memory sticks.

- Detailed outline for training modules shall list system design parameters, operational requirements, adjustments, troubleshooting, maintenance, and repairs. Training modules shall have learning objectives stated and a teaching outline provided for each.
- A schedule of training duration hours for equipment and systems shall be included and any requirements for manufacturer-produced demonstration and training video recordings.
- Training videos are required (either manufacturer-produced or live) and instructors and videographers must be qualified such that high-quality training is produced and recorded. Light and sound quality must be maintained.

➢ Commissioning agent will review the O&M training manual(s) including the outlines, objectives, and schedules. Thoroughness of the training by contractors will be verified along with the training attendance.

- *Minimum Warranties:* systems will have a 1-year minimum warranty for labor and roofs will have a 2-year minimum warranty for labor.
  - ➢ *Responsible Party:* installing contractors;
  - ➢ *Contractual Agreement:* plans and specifications.

Additional Information: The school district would like to ensure that they have all necessary tools and equipment for maintaining the systems in-house after the warranty period. After the warranty period, the target is to require no more than one outside contractor call per quarter. Remote access for the building automation system is expected.

The equipment and systems designed and installed during this project will match the knowledge and skills of the intended users, including operations staff and building tenants. Also, proper access will be provided for the equipment and systems designed and installed.

BUILDING SPACE SUMMARY

This project will include the building occupancies presented below. Each of these occupancies will be designed to operate according to the following criteria:

All Building Space Types - Common Requirements

Architectural Requirements: The design will achieve efficiency and sustainability using the applicable building codes, standards, and best-practices guidelines, and will include an energy efficient building envelope, appropriate daylighting, high level acoustic performance, and durable building materials.

Engineering Requirements (mechanical, electrical, plumbing): The mechanical, electrical, and plumbing systems will be designed for efficiency and sustainability. The benefits include enhanced space thermal comfort and indoor air quality, plus reduced energy use and maintenance costs.

Soda Creek ES – New Addition

Building Space Type: Administration

Approximate Square Footage: 1,200 SF

Occupancy Schedule: 7:00 am through 5:30 pm; Monday through Friday; no usage at night; open on Saturdays and Sundays as needed for scheduled activities.

Special Equipment: computer equipment, copy machine.

Building Space Type: Pre-K Classrooms

Approximate Square Footage: 2,800 SF

Occupancy Schedule: 8:00 am to 3:30 pm; Monday through Friday; no usage is expected at night.

Special Equipment: audio-visual equipment.

Building Space Type: Pre-K Kitchenette / Changing Area

Approximate Square Footage: 400 SF

Occupancy Schedule: 8:00 am through 3:30 pm; Monday through Friday; no usage is expected at night.

Special Equipment: food warming appliances, refrigerators.

Building Space Type: Classrooms / Breakout-Intervention Rooms

Approximate Square Footage: 2,800 SF

Occupancy Schedule: 8:00 am to 3:30 pm; Monday through Friday; no usage is expected at night.

Special Equipment: computers, audio-visual equipment.

Building Space Type: Commons Area

Approximate Square Footage: 800 SF

Occupancy Schedule: 7:00 am through 5:30 pm; Monday through Friday; no usage at night; open on Saturdays and Sundays as needed for scheduled activities.

Special Equipment: audio-visual equipment.

Steamboat Springs MS

Building Space Type: Cafeteria (new addition)

Approximate Square Footage: 2,400 SF

Occupancy Schedule: 7:00 am to 3:30 pm; Monday through Friday; no usage is expected at night.

Special Equipment: none.

Building Space Type: Kitchen (new addition)

Approximate Square Footage: 900 SF

Occupancy Schedule: 8:00 am to 2:30 pm; Monday through Friday; no usage at is expected at night.

Special Equipment: kitchen equipment, refrigerators, freezers.

Building Space Type: Science Classrooms (renovate two pairs of classrooms)

Approximate Square Footage: 5,100 SF

Occupancy Schedule: 8:00 am to 3:30 pm; Monday through Friday; no usage at is expected at night.

Special Equipment: lab equipment, computers, audio-visual equipment.

Strawberry Park ES

Building Space Type: Art and Music Classrooms (new addition)

Approximate Square Footage: 2,500 SF

Occupancy Schedule: 8:00 am to 3:30 pm; Monday through Friday; no usage at is expected at night.

Special Equipment: computers, audio-visual equipment.

Building Space Type: Cafeteria (existing renovation)

Approximate Square Footage: 2,900 SF

Occupancy Schedule: 7:00 am to 3:30 pm; Monday through Friday; no usage is expected at night.

Special Equipment: none.

Building Space Type: Pre-K Classrooms (renovate two existing classrooms)

Approximate Square Footage: 1,850 SF

Occupancy Schedule: 8:00 am to 3:30 pm; Monday through Friday; no usage at is expected at night.

Special Equipment: audio-visual equipment.

[Building space summaries for Steamboat Springs High, North Routt Community Charter, and Yampa Valley High / Boys & Girls Club to be added in the near future.]

BUILDING PERFORMANCE CRITERIA

Steamboat Springs SD has set the building performance criteria described below. These criteria define acceptable performance for the completed project facilities. The commissioning process will measure the facilities' systems against these criteria.

ENERGY EFFICIENCY

The energy efficiency will be achieved through the design process by using the applicable building codes, standards, and best-practices guidelines. The building will be operated in an efficient manner by scheduled operation of equipment where possible. The building systems will be properly maintained to ensure efficient operation.

The owner will participate in utility company rebate programs for design assistance and equipment upgrades. The commissioning agent will coordinate applicable rebate information with the design team to provide an opportunity to maximize rebates. Natural gas service is provided by Atmos Energy and electrical service is provided by Yampa Valley Electric Association.

MATERIALS & RESOURCES

Building Life: Steamboat Springs SD requires that new facility construction be built to last at least 50 years. As such, the building's materials and equipment must be of high quality and meet the building's required lifetime. Building materials should be low maintenance as well. Likewise, construction workmanship must exceed normal industry standards. Steamboat Springs SD requires labor warranties for all installed equipment to be a minimum of 1-year from the time of construction completion, except for roofs which require a labor warranty of 2 years.

Building Roof Color: Steamboat Springs SD prefers black for the building roof color.

HVAC Equipment Enclosures: Steamboat SD prefers roof-mounted equipment to be protected in penthouse enclosures, where applicable on a per project basis.

CONTROL SYSTEMS

Required Control System Type: The building automation system (BAS) is a LONG Building Technologies – Niagara controls management platform capable of remote login by facility operators to monitor building HVAC systems and critical alarms.

The BAS controls will be set up to trend all control points to confirm proper system operation and to identify areas for optimization. Trend points shall all record at 15 minute intervals and shall be actively trending at least 2 weeks prior to 3rd party system commissioning.

HEATING SYSTEMS

Heating systems design parameters: The hot water (HW) boiler plants with multiple boilers should be designed with redundancy where one boiler has the capacity to meet 60% of the design heating load.

The HW system design should include HW coil sizing for a maximum supply temperature in the lower 160°F's temperature range and a 30°F temperature drop to maximize condensing boiler operation for both new and remodel projects.

HW Boiler Manufacturer Preferences: The Steamboat Springs SD currently has RBI Futera Fusion, Lochinvar, and other brands of HW boilers; however, the school district prefers Lochinvar boilers.

COOLING SYSTEMS

Cooling systems design parameters: The typical schools in the Steamboat Springs locale require 400 to 600 SF per ton for sizing equipment to meet space cooling and ventilation loads.

Cooling system types include packaged rooftop units (RTUs) with direct expansion (DX) cooling and air-cooled condensers (ACCs), fan coil units (FCUs) with DX cooling and remote ACCs, and air-cooled chillers that provide chilled water to air handling units (AHUs), RTUs, and FCUs.

Cooling Systems Manufacturer Preferences: The Steamboat Springs SD currently does not have a preferred manufacturer for AHUs, RTUs, FCUs, and AC chillers.

OUTSIDE AIR DESIGN CRITERIA

Heating and Cooling Design Criteria:

- Project location is in IECC Climate Zone 7;
- Project location is 6,800 feet above sea level;
- Weather Station is Craig-Moffat, CO;
- Winter Design Dry Bulb (DB) temperature is -15°F;
- Summer Design DB temperature / Mean Coincident Wet Bulb temperature (MCWB) is 87.9°F / 57.2 °F.

ELECTRICAL AND LIGHTING SYSTEMS

Electrical Power Distribution: The electrical power to the schools is typically a 480Y/277 volt, three-phase, four-wire service connected to a main switchboard.

Lighting: The lighting fixtures and lighting control systems shall comply with 2015 IECC. The lighting design goal shall be a maximum power density of 0.8 watts per SF.

PLUMBING SYSTEMS

Domestic Water Heating Equipment: The domestic hot water (DHW) heating equipment shall be high efficiency equipment. Equipment with Energy Star certification is preferred, where applicable.

Plumbing Fixture Preferences: The Steamboat Springs SD prefers water-saving toilets and urinals with battery operated flush valves. Faucets for lavatories and sinks shall have manual activation.

INDOOR ENVIRONMENTAL QUALITY

Temperature & Humidity, regularly occupied spaces: Occupied spaces shall reflect the standard practice for air conditioning criteria and provide thermal comfort per ASHRAE 55. For nighttime occupancy, the HVAC control systems must respond to a change in space loads within 60 minutes; scheduling of events outside of normal building occupancy is implemented through BAS scheduling. The commissioning process will verify that this requirement is met.

Humidity is not controlled in the facilities, including IT closets and computer server rooms, and indoor relative humidity will track ambient humidity levels.

The following space temperature setpoints are guidelines for the school district buildings. The temperature setpoints should follow the district guidelines where current codes do not conflict.

- Occupied Space Temperature Setpoints: Summer 74°F; Winter 70°F.
- Unoccupied Space Temperature Setpoints: Summer 85°F; Winter 65°F.
- Kitchen Occupied Temperature Setpoints: Summer 74°F; Winter 68°F.
- IT Closet Setpoint: 80°F.
- Computer Server Room Setpoint: 78°F.
- Mechanical Equipment Room Setpoints: Summer 80°F; Winter 65°F.
- Electrical Equipment Room Setpoints: Summer 80°F; Winter 60°F.

Occupant Comfort, temperature: As a gauge of the facilities' indoor environmental quality, Steamboat Springs SD expects that the facilities operate such that the number of comfort complaints from occupants is less than 20% of occupants for the first year. To achieve this goal, the facilities' spaces must be designed to keep occupants comfortable and, after construction is completed, must be operated and maintained to avoid building equipment failure. For PK and kindergarten classrooms, the heating systems and heating controls shall maintain thermal comfort at or near the floor level.

Occupant Comfort, odors: The facilities will control odors by exhausting building spaces that normally produce odors. These spaces, which include restrooms, break rooms, kitchen/cafeteria spaces, locker rooms, science hoods, and janitorial storage spaces, will be maintained under negative pressurization. The systems are expected to operate such that the number of complaints due to odors is less than three per year.

Air handling systems shall have carbon-dioxide monitoring systems within the building spaces where applicable.

Temperature & Humidity, other: Areas that contain building support equipment such as telecommunications, computer networking, and elevator machine rooms will be maintained within equipment temperature and humidity requirements, rather than occupant preferences.

Air Filtration & Cleanliness: Steamboat Springs SD requires MERV 8 air filtration or better for their facilities. Equipment filters will be monitored by permanently installed devices.

Ventilation Criteria: The building will conform to all applicable codes and guidelines. Natural ventilation is acceptable means of ventilation where possible. Use of energy recovery and/or demand control ventilation strategies is encouraged. Use of self-calibrating CO2 sensors is desired.

Illumination: Interior and exterior lighting control strategies shall be used on this project. The lighting controls will comply with IECC 2015 requirements. The goal is to be as automatic as possible, but still allow flexibility for changes and adjustments.

The use of building space requires an interior lighting system that provides adequate lighting levels and also provides for good visibility and comfortable surroundings. Lighting levels for each space will be designed to conform to the Illuminance Selection Tables appearing in the Illuminating Engineering Society (IES) Lighting Handbook. Specific influences of glare, task complexity, surface reflectance characteristics, ceiling brightness and user age will be considered when specifying lighting.

Local codes will take precedence when they dictate the use of alternative procedures or require minimum lighting levels for specific areas. All lighting designs will be in keeping with the energy codes adopted locally. Lighting designs will also ensure that lighting controls are installed in locations that are readily accessible.

All interior lighting is required to be on lighting controls per the IECC. Occupancy or Vacancy sensors shall be installed in spaces where automatic shutoff of electric lighting is appropriate. Sensor time-out will be adjustable from 15 to 30 minutes.

The Steamboat Springs SD prefers manual switches for lighting controls in libraries, computer labs, and corridors. Motion sensor lighting controls are preferred in all classrooms.

The priority school projects should be designed with Dark Sky lighting goals to reduce light pollution.

GENERAL PROJECT INFORMATION

The Steamboat Springs SD priority projects include existing facility renovations and new building additions. The general project information for the priority project schools is included in the following table.

Project Facility	Existing Facility Area (SF)	New Addition Area (SF)	Facility / Improvement Description
Soda Creek Elementary	72,976	7,890	Pre-K and Classroom Addition: New Multizone VAV AHU or (7) FCUs (both options would have HW heat and DX cooling), new exhaust fans, new LED lighting, and new lighting controls. Pre-K Playground – Snowmelt System including new boiler, pump, and 2,600 SF of snowmelt area. Light renovation at new-to-existing.
Strawberry Park Elementary	71,098	3,750	Addition with new Music and Art Rooms: VAV RTU with HW heating, DX cooling, and VAV Boxes or FCUs with HW heating and DX cooling, new exhaust fans, new LED lighting, and new lighting controls. Cafeteria Renovation: VAV RTU with HW heating, DX cooling, and VAV Boxes or Single-zone RTU with HW heating and DX cooling, new exhaust fans, new LED lighting, and new lighting controls.
Steamboat Springs Middle	118,354	3,480	Addition with new Cafeteria and Kitchen: New Single-Zone 4-Pipe RTU or Upgrade existing RTU-1 to Multizone VAV System with Reheat, new exhaust fans, new LED lighting, and new lighting controls.
Steamboat Springs High	343,000	9,000	CTE addition with six classrooms. Minor renovation of classrooms
North Routt Community Charter	16,286	5,900	Addition with multi-purpose space and restroom
Yampa Valley High / Boys & Girls Club	50,934	-	Renovation of Yampa Valley HS space and restrooms; Renovation of existing PK rooms for B&G Club; security vestibule

The schools typical hours of operation are from 7:30 am through 4:00 pm, Monday through Friday. The school year is from the second week of August through the second week of June.

The SSSD facilities will be designed for energy efficiency by using the applicable building codes, standards, and best-practices guidelines. SSSD will not pursue any sustainability programs such as LEED or Green Globes.

The Phase 1 priority projects construction will begin in June 2020. The school facilities scheduled completion dates are as follows:

- Soda Creek ES: November / December 2020;
- Strawberry Park ES: October / November 2020; and
- Steamboat Springs MS: October / November 2020.

The project facility addresses are included in the following table.

Project Facility	**Facility Address**
Soda Creek Elementary	220 Park Avenue, Steamboat Springs, CO 80487
Strawberry Park Elementary	39620 Amethyst Drive, Steamboat Springs, CO 80487
Steamboat Springs Middle	39610 Amethyst Drive, Steamboat Springs, CO 80487
Steamboat Springs High	45 Maple Street, Steamboat Springs, CO 80487
North Routt Community Charter	26990 Eagle Lane, Clark, CO 80428
Yampa Valley High / Boys & Girls Club	325 7th Street, Steamboat Springs, CO 80487

SSSD Facility Design Guidelines

Revised 2/5/20

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The Facility Design Guidelines were referenced and used in the project design.

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District Design Guidelines

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STRAWBERRY PARK ELEMENTARY SCHOOL
39620 Amethyst Drive
Steamboat Springs, CO 80487

YEAR CONSTRUCTED:	1981
MAJOR RENOVATIONS / ADDITIONS:	2007
CURRENT ENROLLMENT:	510
CAPACITY:	480
BUILDING AREA:	68,688 SF + 2410 Aux
SITE AREA:	39.9 AC Total Campus

Building History and Use

Strawberry Park Elementary School is a shared campus with Steamboat Springs Middle School. The campus is located just to the northeast of central Steamboat Springs and has kindergarten through fifth grades.

The facility was originally built to be used as an elementary school and continues in the same use. The original campus was constructed in 1981 and had a mechanical renovation and building addition completed in 2007. The addition includes 11 classrooms, break out spaces, restrooms and a roof-top mechanical penthouse on the west side of the building.

The school has approximately four classes at every grade level with an average class size of 20 students and approximately 60 staff members.

The architect of record for the building is Robert Sanford Ralston Associates, Architects of Steamboat Springs and W.C. Muchow & Partners of Denver, Colorado. The architect of record for the addition is Christiansen, Reece & Partners.

Strawberry Park Exterior / entry

Foundation and Structural summary

The building structure is primarily steel frame and column construction with steel roof deck on joists. The exterior walls are composed of metal stud frames. The foundation is slab on grade. The gymnasium had load bearing masonry walls, steel roof framing and deck, and slab on grade.

The structural systems of the building are in good condition. There are no visible signs of cracking or settlement at the foundation elements, or at exterior walls or veneer. One area of potential concern is the existing therapy swing, currently supported by the existing structure. It was noted that the swing in room 109 did not appear to be adequately braced. roof structure.

Building envelope summary

Overall
The exterior envelope is generally in good condition and has been well maintained. Specific deficiencies and recommended maintenance are listed below.

Exterior Wall
The exterior wall material consists of veneer brick masonry. The brick masonry and mortar joints are in good condition, however there a few locations that repointing of the joints is recommended. All of the masonry control joints require removal and replacement of the backer rod and sealant. There are no weeps present at the base of the wall in original construction. There is no evidence of water being trapped in the cavity and then making its way to the interior, nor is there any evidence of efflorescence on the exterior face of the brick at the base of the wall. No action to add weeps to the original walls is recommended.

Wall Insulation
The original exterior wall assembly is brick veneer over steel frame. The arcade has both interior and exterior brick veneer, while the classrooms have interior gypsum board. Due to a similar construction at the middle school, it is assumed there is insulation within the masonry wall assemblies both at the arcade and the gymnasium. Wall insulation is likely also installed throughout the remaining exterior wall assemblies of the original school building, but could not be confirmed without selective demolition.

The classroom addition completed in 2007 is a steel frame with metal studs and brick veneer. This assembly has both 1” rigid insulation on the exterior face of studs and 6” batt insulation inside the stud framing. This insulation provides an approximate R-Value of 29 within the exterior wall assembly.

Windows
All of the windows were replaced recently in the existing building with new aluminum storefront type windows. The windows in the 2007 addition are also aluminum storefront type and are in good condition.

Roof

The roof is a combination of asphalt shingles, single ply EPDM membrane, and standing seam metal roofing. The metal roof is located at the sloped roof over the arcade, the EPDM membrane is at all flat roofs and the asphalt shingles are located on the modular buildings only. The EPDM membrane roof was replaced in 2000 and all roofs are well maintained. There have been roof leaks that have required patching since the 2000 roof replacement. As roofing material reaches the end of its useful life, as the original EPDM membrane has, it is recommended to replace.

At the high sloped roof, near the main entry, there is a gap between the metal fascia and the brick veneer of the exterior wall. It is recommended that gap be filled, likely through the replacement of the metal fascia.

Roof Insulation
With the roofing replacement project in the summer of 2018, code compliant rigid insulation board was installed prior to the new EPDM membrane. The code minimum R-Value for this climate zone is R-35 which equates to 6” of rigid polyisocyanurate insulation.

The roof on the 2007 addition was not replaced with the rest of the school, as that roof is still within is useful life. This addition has 6” of rigid polyisocyanurate insulation per the construction documents, providing an R-Value at R-35.

Building area vs. Capacity : Square Foot Analysis

The total building area of the school is 71,098 square feet, 2,410 of which is in temporary trailers There is one modular classroom building, housing two classroom spaces on site that are not currently used as educational classroom space. The current area of the school is not adequate to serve the current student body of the school. The school is designed for a capacity of 475 students and currently has 510 students enrolled. While the total permanent structure provides approximately 145 square feet per student total, the large central arcade at 5,650 square feet, effectively reduces this area to around 123 square feet per enrolled student.

The cafeteria and gym are a shared space which creates scheduling conflicts between the two uses, forcing additional lunch periods to accommodate the student body. The central arcade was utilized for additional eating space for a period of time, however the acoustics of the space made it difficult to manage the noisy activity. The library is adequately sized for an elementary program and includes adjacent computer lab space.

Building code / Fire code summary

The school is classified as a Type IIB construction and Occupancy Group ‘E’, permitted under the 2006 International Codes. The building is constructed of non-combustible materials including concrete, concrete masonry units, brick masonry on metal stud framing, with steel floor and roof decks. The building is not fire sprinklered and has one-hour rated corridors throughout. The building is currently not divided into fire areas and exceeds the allowable square footage per the 2015 IBC. All of the hollow metal doors and frames accessing the central arcade are on magnetic hold-open hardware. These doors automatically close in a fire alarm condition. The building can be brought into compliance with allowable area by creating two fire separation walls, therefore dividing the building into three separate fire areas all under the maximum allowable square footage. This can be accomplished by utilizing existing masonry walls, with structural modification providing independent roof framing systems. Alternatively, the incorporation of a fire sprinkler system throughout the school would also bring the building into compliance. Any proposed addition will need to be evaluated for fire separation requirements as part of the current 2015 IBC. It is recommended to add a fire sprinkler system throughout this building.

Hazardous materials

No suspect material was observed within the school.

Accessibility summary

The building is for the most part ADA accessible, largely due to the building being one story. The main building entrance is ADA-accessible which leads to the main lobby and is directly accessible from the parking area. There are accessible parking spaces and accessible routes throughout the site. The entire building door hardware has been upgraded to level sets. The majority of recessed classroom doors along the atrium do not meet the proper clearances for wheelchair accessibility. The restrooms in the original building are not fully compliant and require upgrades to accessories and reconfiguration of toilet stalls to be fully compliant. The restrooms in the 2007 addition are complaint except for vertical grab bars in the accessible toilet stall. This became a code requirement after the addition was constructed.

The playground equipment was not evaluated for current accessibility and safety standards. The playground surfacing is worn and at the end of useful life. The condition of this surfacing could impact accessible maneuverability and impact protection.

Educational Adequacy summary

The average classroom size in the school ranges between 825-850 square feet. Colorado Public School Guidelines indicate that 875 square feet is sufficient for elementary school classrooms. (25 students X 35 sf / student = 875 sf.) Therefore, the classroom sizes are slightly undersized for the original capacity intended. The classrooms do range in size, providing a suitable variety of sizes for multiple learning styles.

The Special Education programs including Severe Needs are located within this school. There are currently 12 severe needs students in addition to a high number of special education students in this school. The current spaces do not meet all of the needs of these programs, and it is recommended to add a dedicated restroom and changing room for these students.

A divisible gym doubles as school cafeteria.

Media Center Condition summary

The Library / Media Center is located near the center of the school. The interior is open and flexible, although the ceilings are relatively low. There is a lack of natural light due to the location of this space within the school. The two LMC computer labs adjacent to the Media Center are utilized for general education and testing.

Cafeteria / Gymnasium Condition summary

The cafeteria is a shared multi-purpose room, sharing functions with the gymnasium. The two spaces are separated by a ceiling mounted operable partition. With only half of the room dedicated as cafeteria, the room is crowded during multiple lunch periods spanning from 10:50 – 1:30 every day. Folding tables are stored in an adjacent storage room when not in use.

The kitchen is quite small and is difficult to serve from. Some cold food is prepared at Soda Creek, with the remainder prepared at the high school and delivered daily to the school. The equipment on site is adequate to store the prepared food and includes a mobile refrigerator, hot box, abd milk cooler. There is a full dish washing station separate from the food serving area with three-compartment sink. All stainless steel serving areas are in good condition and there are no evident sanitary issues. The flooring is VCT with visible wear due to the amount of cleaning required in the kitchen. The most significant issue with the kitchen is the lack of space to properly execute lunch service.

The gym is adequate in size and equipment for physical education. The gymnasium floor is striped for one full basketball court and two side courts, with supporting ceiling mounted backboards. There is an operable partition dividing the gym in half allowing for gym and lunch programs to happen concurrently. There are no bleachers or mat storage. There is minimal acoustic wall treatment and none at the ceiling, contributing to the high sound levels in the room. There is equipment storage adjacent to the gym, but the school is currently storing mats and other athletic equipment along the perimeter of the space, indicative that the amount of storage is inadequate. While the gym is adequate in size for physical education, it is not large enough to support the shared cafeteria function. It is recommended to separate the gym and cafeteria functions into two spaces. This will alleviate the scheduling conflicts and improve the lunch schedule.

The operable partition is worn and at the end of its life. It is recommended to replace this partition. The stage curtains are original and showing signs of wear. Same with the gym wall padding. It is recommended to replace these specialties.

Storage adequacy

There is little to no dedicated curriculum or teacher storage space other than that which is provided by the casework in each classroom. Several rooms that were originally designed as offices have been converted into educational spaces and do not provide adequate storage for educational curriculum. There is minimal general building storage as most of these spaces have been converted into occupied rooms. There is adequate storage for art and music programs and meets the needs of a typical elementary school program.

There is ample storage provided in the 2007 addition. Each classroom has base and upper cabinet storage, the shared break out areas also have extensive wall mounted storage. There are also student cubbies in the break out areas for backpacks and books. Wall mounted wood dowels are located in the corridors for student coats and boots. These areas tend to get cluttered and can impact the circulation paths. It is recommended to remove the coat hooks from the corridors and move jacket storage into the classrooms. Student cubbies are working well and should be incorporated into any new or renovated classroom spaces.

Interior finishes summary

Interior walls are highly durable and low-maintenance. The interior walls and floor of the central arcade are brick and in excellent condition. Interior walls in the classrooms are painted gypsum board on metal studs and are well maintained. Interior floors are carpet in the learning environments, brick in the common areas and dens, VCT in the art spaces and gymnasium, and quarry tile in the kitchen. The restrooms have 2x2 porcelain tile flooring. While in good condition, the grout is stained and requires significant maintenance to keep clean. The carpet in the educational spaces is well maintained, but at the end of its life and should be replaced. It is recommended to repaint the interior of the school.

The ceiling of the arcade is finished with acoustic spray-applied material. The ceiling of the gym is exposed roof deck. The majority of the remaining spaces have suspended acoustic ceiling tile and is in good condition. The acoustic spray is not able to absorb the extent of noise throughout the arcade, especially with the brick floors and hard wall surfaces. It is also original to the building and showing its age. It is recommended to find additional soft materials to help provide acoustic treatment.

The restroom finishes are porcelain tile floors, painted gypsum board walls, painted CMU walls, with the same tile at wet wall locations and wall mounted fixtures. The toilet partitions are painted metal and there are no urinal screens between the fixtures, or between the urinals and lavatories. While the restrooms appear to be holding up well, these finishes are original to the school and are showing signs of wear and dirt. It is recommended to provide new finishes in all the student restrooms including new tile floors, tile walls, toilet partitions and urinal screens. New finishes will aid in the ease of cleanability in these restrooms.

The vestibules at the exit doors have recessed aluminum walk-off mat systems. These are difficult to clean and are not ADA-compliant. It is recommended to remove these systems, float the concrete floor level and replace the mats with modular carpet squares, made specifically for entry locations.

Doors and Hardware

Exterior doors are hollow metal with hollow metal frames. Most of the exterior doors appear to be original to their respective area of the building. The exterior doors and frames are susceptible to extreme weather and are damaged and deteriorating. All door hardware has been upgraded to ADA-compliant lever hardware. Interior doors along the Arcade are hollow metal, with hollow metal frames and magnetic hold-open hardware. These hold-opens release during alarm events as well as at the end of each school day as a security measure. Panic devices in the gym and classroom pods are older hardware and need to be evaluated for accessibility compliance. All other interior doors are wood. Classroom doors have either a partial or half-door vision lite. It is recommended to replace the exterior hollow metal doors and frames.

Door hardware throughout the school has been replaced from BEST to Schlage and is now on a district-wide keying system. All classroom doors, common spaces and exterior main doors now have card access control. The current hardware and access control system meets the District's needs, no additional card readers are needed.

Furnishings Summary

The casework in general is in average condition and appears to be original to the 1981 building and 2007 addition. The casework is plastic laminate with recessed PVC pulls and edge banding. The casework is showing normal wear and tear for its age. There are several full height wardrobes for art storage. These types of cabinets are adequate for materials storage, but do not accommodate all types of student projects. A variety of types of casework, including flat storage are recommended for project storage. There is adequate storage in the general classrooms.

Security and Supervision

The building is equipped with a secure entry vestibule. However, there is no ability to check in visitors until after they are granted access into the school. There is a fixed view window from administration facing the entry vestibule that provide visual access only. A secure transaction window should replace the fixed window, relocating the check-in point into the secure vestibule. Security film can be installed on all existing glazing at the entry vestibule to provide added protection.

The existing Video Surveillance system is a Bosch Serra Detention System with a limited quantity of cameras in the building for the video surveillance system. The building exterior doors are equipped with door contacts. The main entry doors are equipped with card access. The building security alarm system extends coverage to most of the exterior doors for monitoring purposes only. The building alarm system does not extend to any of the doors at the outlying modular buildings.

The building is not equipped with an intrusion detection system. The district does not see a need for an intrusion system. The District plans to add a Blue Light system for lock down throughout the school.

Common area casework, typical.

Energy use summary

The Energy Use Intensity or EUI is the measure of total energy consumed in the cooling, heating and operation of the building. For Strawberry Park Elementary School for a three year average during 2009-2012 the EUI was 78 kBTU/sf/yr which ranks as average in energy performance for Colorado schools. The average energy use cost during this same time period was $1.22/sf/year, which is slightly below the average energy use cost of other school buildings in the district.

EUI Index for > 4,000 Colorado Schools in kBTU/sf/yr

EUI	<60	60 -73	73-87	87-100	>100
Rank	Very good	Good	Average	Poor	Very Poor

Total water use and water use intensity (WUI) in gallons per square foot vary greatly based on the type of building and to what degree irrigation is occurring.

The average WUI between 2009-2012 for Strawberry Park Elementary School was 6 gal/sf or $0.06/sf which makes it one of the least water intensive schools in the district.

Heating, Ventilation, and Air Conditioning System summary

The school's mechanical equipment consists of variable air volume (VAV) indoor air handling units and variable volume boxes with reheat coils or heating water fan coils with direct expansion cooling coils that are zoned throughout the building and provided with a two-pipe heating distribution system. The VAV boxes are a mixture throughout the building of shut-off or fan powered type boxes. Most of the mechanical equipment and controls was installed in 2008 addition and remodel of the building. The central heating plant contains two condensing boilers with boiler circulation pumps and two main heating water distribution pumps. The building has a combination of direct digital controls and pneumatic controls installed throughout the building. The school district noted that the building controls were recently over laid with Honeywell in 2014. The main corridor and central classroom pod spaces are served with infrared heating and inline fans and louvers for ventilation. The central pod spaces also have a dedicated direct expansion split system cooling unit. There is a snowmelt boiler at the southeast corner of the building exterior. The snowmelt boiler appears to be in good condition.

Heating and cooling is provided to the spaces via the terminal VAV boxes or Fan Coils and the air handling units and fan coils are equipped with heating and direct expansion cooling coils. Ventilation air is delivered to the spaces via the air handling units or fan coils. The air handling units, VAV boxes, fan coils, condensing units, space temperature sensors, ductwork, and air diffusers throughout the building all appear in good condition. The infrared heating and ventilation in the corridor or classroom pod spaces should be replaced in the near future.

The mechanical rooms need minor duct and piping insulation repair.

Plumbing System summary

The buildings plumbing systems are all original except the flush valves and faucets. Some fixtures and trim have been replaced throughout with maintenance. The fixtures are in poor condition and should be replaced throughout the building including all kitchen plumbing fixtures. The building water entry was not located and should be evaluated but was noted by the school district to be in working condition. The main domestic water heating plant or remote water heater was not located or assessed and should be evaluated. It was noted by the school district to be in working condition.

The majority of the fixtures are standard flow fixtures. 1.0 GPF urinals, 1.6 GPF water closets, and 2.2 GPM aerators on lavatories. These fixtures have been upgraded to sensor operated flush valves where a few still had manual flush valve. The lavatories have been upgraded to include sensor operated faucets. The sinks are manual faucets. The fixtures are original to the building and it is recommended to replace all the plumbing fixtures and accessories.

The sanitary piping and the domestic water piping throughout the building all appears to be in good shape.

Fire Protection System summary

The building is not sprinkled at any location.

The building is equipped with a fully addressable Simplex Fire Alarm System. The fire alarm main control panel (FACP) is located at the Admin reception area with smoke detectors in corridors, classrooms and offices. Annunciation devices are located though-out to meet local and state requirements. In general the existing system and devices appear in good condition and meets the intent of the current state codes for fire alarm. The existing FACP does not have the capacity for 'Voice Evacuation' which the state will require in the upcoming code adoption this year. Spare capacity of the system to be verified.

Electrical System summary

The original 1981 Main Electrical Service/Distribution was replaced in an addition project in 2007. It consists of a 1200A, 277/480V Main Switchboard with a Main 1200A3P GFI circuit breaker and surge protection. The Main Electrical Distribution feeds Sub-distribution panels. One is the original 1981, 1200A, 277/480V Main Service Switchboard, and a 400A, 277/480V panel installed in 2007 that distributes power to 480V-120/208V transformers, lighting, mechanical and miscellaneous types of equipment. Dry-type transformers feed power to 120/208V branch circuit panelboards that distributes power to receptacles, kitchen equipment, stage dimmer and miscellaneous equipment though-out the building. The majority of the buildings electrical equipment is located on the exterior of the building in a secured area with chain-link fence enclosures and interior electrical rooms and closets.

The Main electrical service, transformers and panelboards installed in 2007are in good condition. It appears there are spare circuit breakers and/or breaker space available for new devices in the equipment. Based on previous assessment information and existing record drawings there is minimal spare ampacity on the service to add new loads. The removal of in-floor heating could free up enough capacity to accommodate new work and will have to be confirmed. The original '1981' 1200A Switchboard and associated transformers and branch circuit panelboards are reaching their expected life expectancy of 30 to 40 years. Due to the age and the availability of parts it is recommended to replace the existing equipment.

Emergency power for the facility is provided by a 60Kw 480V-3phase Natural Gas Generator. It provides power to (2) automatic transfer switches (ATS), (1) 40A3P for essential life safety lighting and (1) 70A3P for non-essential loads. Each ATS feeds a 277/480V, transformer and 120/208V emergency panelboard. The emergency system provides power to the life safety egress lighting, IT/Data room equipment and the intercom paging system. The system appears to be in good conditions and based on record drawings has capacity to add load.

Classrooms appear to have a limited quantity of receptacles and extension cords have been used to accommodate the needed power. It is recommended to provide new outlets to eliminate the need for the extension cords. Some the receptacles located above the counters and within 6' of sinks appear to be missing GFI protection as required by the code. It is recommended to provide GFI protection to meet the intent of code.

The kitchen area appears to have a limited quantity of receptacles. Cord drops are stretched out to accommodate the needed power, and devices are in poor condition. It is recommended to replace and provide new outlets as needed. The majority of the buildings electrical equipment is located on the exterior of the building in a secured area with chain-link fence enclosures and interior electrical rooms and closets.

Lighting summary

The original exterior and interior light fixtures were replaced and/or upgraded in the summer of 2014 under a lighting performance contract. The interior light fixtures use a combination of T5 and T8 fluorescent lamps, and compact fluorescent lamps depending on the location. Overall the buildings commons area, storage, offices and gymnasiums lighting is in good condition and the lighting levels for the areas appear adequate. Classroom and office area lighting consists of recessed and suspended fluorescent direct/indirect fixtures and appear in good condition. Lighting levels are adequate. The corridors lights consist of suspended type strips and in general appear to be in good condition. Light levels are adequate.

Electrical system was replaced in 2007

The exterior lighting consists of perimeter LED wall type and pole mounted fixtures. The parking area and surrounding areas appear to be adequately lit. The courtyard between the main building and the modular classrooms is not as well-lit as it should be. It is recommended to install additional lighting for safety and security purposes.

Life Safety Egress lighting and exit signs requirements is provided by a combination of the emergency generator back-up fixtures and emergency wall packs with select light fixtures and exit signs located throughout the building that identify and illuminate the path of egress out of the building. The system is in good condition and the lighting levels appear adequate.

Controls for the exterior site, interior common areas and public space lighting is controlled by a lighting control system that provides automatic sweep of 'On/Off' of lights at specified times of day. The lighting controls for the classrooms, work rooms and office space lights are provided by individual standalone ceiling mounted type occupancy sensors for automatic shut off of lights. The lighting control devices and system appear in good condition.

SF Analysis

Site Size and Amenities

Strawberry Park shares a 39.9-acre site with Steamboat Middle School. This site size is adequate to serve the elementary school and middle school, but there is little room for growth. The elementary side of the site includes amenities recommended by the Colorado Facility Construction Guidelines including age appropriate play equipment, landscaped playfields and hard surface play areas. These amenities are open to the public and serve the community needs as well. The fenced playground provides a variety of play structures in a safe and visible location.

There were no reported or observed concerns with the existing site utilities, including the irrigation, electrical, gas and communication infrastructure. There is an existing potable water service into the building from the public main. The elementary school facility is not fire protected via sprinklers throughout but does appear to have intermittent protections in place. There are several fire hydrants within the site boundaries and adjoining neighborhood however the Fire Protection District did mention a slight concern with possibility of low flows and low pressures. The site is served by a gravity sanitary sewer service that discharges to the public main.

Traffic circulation for the middle/elementary campus needs improvement. Significant backups are reported by the City of Steamboat Springs on Amethyst as the school day starts and ends. The City has identified a need for enhanced school pedestrian upgrades with their Safe Routes to Schools program. Currently, there are trail systems in place that connect this campus with both Soda Creek and Steamboat High School. Additional coordination with the City is required to determine cooperative agreements with possible signage upgrades and one-way movements on some of the collector and local streets adjoining the school. There are easements reportedly in place for additional sidewalks to provide improved pedestrian circulation that need to be explored. The quantity of shared parking spaces is reportedly adequate however separation of bus, vehicle and pedestrian movements needs additional study. Improved site circulation between the two buildings is recommended.

The asphalt paved parking areas appear to have served their useful design life. Significant longitudinal, traverse and block cracking is evident. There are several areas of curb, gutter and sidewalk that have been modified with recent site improvements that function as intended however older infrastructure is showing signs of fatigue and failure. There are several concrete walks and plazas that exhibit cracks along with poor drainage towards the building and are in need of replacement. It is also worth noting that continuous access around the perimeter of the building is not currently achieved and is a potential concern of the City fire protection district. Tight radii around the school make truck maneuverability difficult and the close proximity to the hydrant is concerning.

Although no drainage deficiencies were reported, several areas are noted. The service area and playgrounds are in need of repair. There are several areas that have poor drainage towards the building and no adequate daylight. The pedestrian access along the north side of the building is deteriorated and in need of replacement. There are areas that have been adequately protected from water intrusion, however many areas along the existing building façade are in need of mitigation. The areas that have recently seen upgrades are functioning as intended. Snow storage areas could use improvement.

The playground surfacing is worn and at the end of life, which can affect the fall safety and accessibility of the surfacing. The play surfacing should be replaced. There is a snow melt system under the playground surfacing that must be maintained. Any alterations to the playground location or configuration must take the snow melt system into consideration. The playground equipment was not assessed for code compliance.

Technology Summary

A. Summary:
1) The building will be provided with three additions that include a new entry, cafeteria, and Kitchen. The building will also be renovated to include more pre-school and ECE areas, new small group learning areas, special education, and a clinic area. Technology systems will be integrated into the various spaces based on current district standards and additional upgrade based on future technology system programming. Existing spaces that are not included in the renovation may also need technology upgrades to keep the site consistent and to be sure that the campus wide technology systems work properly.
B. Technology Spaces:
1) The elementary school currently has one MDF/Demarc and multiple IDF locations. The rooms are NOT up to industry standards specifically related to sizing and the owner has had to be "creative" in their use of space to fit the necessary equipment and components in these spaces. Some of the technology spaces currently do not have electronic access control to enter the space and rely on key access. Also, the MDF/Server room is also used by the IT support staff as an office. Also, the air conditioning should be evaluated to verify it is appropriately sized (if required in the various spaces). The district would like all IT spaces, and in some cased the air conditioning, to be backed up by generator power (this should be verified).
2) Any renovated areas where the IT spaces are nearby should be evaluated to determine if the IT space can be brought up to the current code and standards and if possible provide additional room size for adequate access to the equipment. The local IT support staff should have an office that is not internal to the MDF/Server room space or has appropriate separation from the equipment racks. They also need appropriate storage and lab bench space for working on the IT equipment. Each technology room will need card reader access to secure the space, provide easy access for the staff, and also allow for tracking of who enters the spaces.
3) The existing typical elementary classroom contains teacher's workstation, teacher telephone with custom speaker for paging, wired student computers, a wireless system Access Point, projector based SMART Board, program audio and teacher voice reinforcement system. There is also typically a printer in the common area outside of the classroom.
4) All future rooms should be designed with typical technology components to match the current district standards with only minor device differences if required. Additionally, existing rooms that are not part of the renovation space should be evaluated to determine if the technology and infrastructure need to be upgraded to meet the requirements of the site

and technology systems. Existing modular classroom buildings that may be removed will need to be disconnected from the existing technology systems and removed from the site. If the modular classrooms are staying on site, they will need to be brought up to district technology standards.

C. Structured Cabling:

1) The site has fiber optic connectivity to the District Office that is currently leased from Century Link. The District should evaluate installation of a private fiber network to save on the lease rate of this link and determine if the ROI is worth the cost.

2) The site has adequate OM3 multi-mode fiber optic cable from the MDF/Demarc to each of the IDF closets. The original portion of the site utilizes Category 5 horizontal unshielded twisted pair (UTP) cable from the IDF closets to each of the data outlets which are located in the offices, classrooms, labs, group work area, etc. This is antiquated cable and the entire site should be evaluated to upgrade this cable to newer Category 5e, 6, or 6A cable based on final district standards.

3) The equipment racks and cabinets, wire managers, etc. are appropriate and adequate for the structured cable system and do not need to be upgraded. On the other hand, the cable raceways/conveyance system needs to be evaluated and a possible cable tray is needed to provide connection between various points in the main “atrium” and easy connection between points where there is hard cap ceiling in the corridors.

4) The classrooms and computer labs currently use computers for learning and standardized testing. The minimum horizontal cabling requirement in a classroom will be six (6) wires with two (2) to the teacher work station, two (2) to the projector, and two (2) to the AP location. Additional wiring for computer workstations in the classroom is NOT required as these computers will be wireless.

5) The computer lab standard is 30 computers per lab with wired data connectivity to each workstation. All power/data should be fed from one side wall and run to rows of desk furniture which is placed up against one side wall with the walking aisle way against the other wall (i.e. there is not a center aisle). Computer desks are adequate and do not need to be upgraded.

6) A typical classroom and computer lab will need to be upgraded to have USB charging for mobile devices with an access cart for storage and docking of room wireless devices (i.e. tables, Chromebooks, etc.) that needs to be located within the rooms. Also, all classroom should be updated so that there is (1) wireless access point per classroom.

D. Network/Telephone/Wi-Fi:

1) The network system is adequate in the facility and does not need to be upgraded. Current phones are Nortel and will be upgraded to Avaya. The building’s existing Wi-Fi coverage is adequate in most spaces, but various spaces need a few more access points (AP) installed for complete coverage. In addition, the district may be upgrading the wireless system. The district typical classroom and computer lab standard requires an AP in each room for proper coverage. The playground and outdoor spaces where students and faculty reside also needs exterior Wi-Fi connectivity added (specifically areas that may utilize wireless (Wi-Fi) phones in the future).

2) The paging/bell system is also incorporated into the telephone system and provides paging/bells through speakers connected to the telephones. These should be upgraded to newer technology from Avaya when the phone system is upgraded to provide better audio quality and enhanced functionality or be upgraded to use the Audio Enhancement system device.

3) Current overhead paging in other open spaces is done through horn speakers and a phone interconnect in the MDF room. Speakers are not currently installed for sound outdoors and are required for outdoor communication. At a minimum, these speakers will need to be installed for the outdoor playground area.

E. Security Systems:

1) The existing security system has recently been upgraded on the campus and is adequate in most locations, with minor upgrades and repairs required. The classroom doors should be verified to allow for a locked mode with the teachers and staff having a method to keep the latch in an “unlocked” state during normal operation, and then during a lock down situation be able to lock the door. If this functionality is not working properly it should be upgraded throughout the campus. The district is evaluating a new badged/key system from Schlage that may be utilized on new doors and specific existing locations that need new electronic hardware.

2) A “Blue Light” security system is desired for all exterior doors to alert of a lockdown situation. Additional lockdown buttons are desired which would include physical, virtual, and wireless buttons throughout the facility with a kickoff sequence to lockdown doors electronically, activate blue lights, and provide paging notification.

3) New cameras locations are desired at various locations throughout the facility to meet the latest district standards. This would include cameras in front of bathrooms for monitoring with view of sink area, in specific classrooms, in the computer labs, in the parking lot areas, and on the playground from the farther corners in addition to the corners of the building. In the reception area, appropriate monitoring displays should be installed for security monitoring.

a) Confirm with the District if the cameras for this school have been updated to the Verkada system.

4) A secure entry vestibule configuration is required with a pass-through window.

F. Audio/Visual Systems:

1) In a typical classroom there is a flat panel display or wall mounted projector / SMART Board with VGA connection. Audio is either to SMART speakers or an integrated audio system with speakers overhead. Most spaces also have an enhanced teacher speech reinforcement system to the overhead speakers.

2) In any new typical classroom or computer lab there shall be a SMART board with HDMI connectivity as defined in the technology standard configuration. There shall also be an Audio Enhancement system.

3) Existing classrooms that will not be impacted by the site upgrades should still be evaluated for technology upgrades to bring them up to the district standards as noted above. At a minimum, the SMART boards need to be evaluated with added HDMI connectivity and AppleTV devices.

4) There are digital signage displays throughout the facility being added which can be used for lunch menu, upcoming activities, and to honor students. Additional locations may be desired. The playground need to have external paging configured.

5) The gym contains the existing equipment to control audio and lighting. This space does need to have the projector and screen upgraded to support computer presentations within the space.

Tab 3:
Commissioning Reviews

Commissioning Design Review

PCD Engineering
323 3rd Avenue, Suite 100
Longmont, CO 80501
(303) 678-1108
(888) 840-4PCD (4723)

Project: **Steamboat Springs SD - Strawberry Park ES**
Project Number: 20004
Design Phase: 100%

No. of Open Comments: 0
No. of Closed Comments: 35
No. of Total Comments: 35

TO: Dynamic Program Management
Reilly O'Brien
-
Eagle, CO 81631
303-775-5051
reilly.obrien@dynamicpm.co

Person Completing Review: CB
Checked By: AN

Date of Previous Report: 3/24/20
Date of This Report: 4/6/20

Summary:

Drawings and specifications are reviewed only for systems being commissioned, including mechanical/HVAC, electrical service/distribution, lighting controls, service hot water, irrigation systems and building envelope systems and associated controls.
This review includes review of architectural and MEP drawings, and Division 1, 22, 23, 26 specifications with other disciplines cross-referenced for coordination.

DESIGN REVIEW - ISSUES LOG

PCD Engineering Project: **Steamboat Springs SD - Strawberry Park ES** Date of This Report: 4/6/20

Issue No.	Date Noted	Drawing No. / Spec Section No.	Review Comment	Recommendation	Installed Cost Savings Impact	Energy / Operational Savings Impact	Date Closed	Applicable Party	Applicable Party Response
1	3/5/2020	DD: Dwg M0.1	Terminal unit schedule does not include airside coil pressure drop.	Provide maximum airside pressure drop on terminal unit schedule..		x	3/24/2020	BG Buildingworks	Work in progress. PCD (4/3/20): Included on 95% CD plan.
2	3/5/2020	DD: Dwg M2.1	Sheet M2.1, note indicates barometric relief damper serving cafeteria. Why is barometric relief required in this location?	The cafeteria is being served by the new air handling unit that has variable volume control. Has building pressure monitoring and relief fan / outside air damper modulation been considered as a design option?		x	3/24/2020	BG Buildingworks	The space allocated for the air handler will not allow direct relief at the system. Separate relieve damper above kitchen area will provide relief path in full economizer and/or make-up air mode.
3	3/5/2020	DD: Dwg M2.2 - Storage C21	Sheet M2 .2 supply duct over storage C21: please provide duct size.				3/24/2020	BG Buildingworks	Work in progress. PCD (4/3/20): Included on 95% CD plan.
4	3/5/2020	DD: Dwg M2 .2 - Pre-K Plan - Area B	Exhaust duct looks like there is 300 CFM being pulled through an 8 inch duct.	The 300 CFM seems high for an 8 in. duct; recommend a 10 in. duct for the volume of airflow.		x	3/24/2020	BG Buildingworks	Work in progress, will review PCD (4/3/20): Duct size update to 10 in. on 95% CD plan.
5	3/5/2020	DD: Dwg M2.2	Supply ducts over Pre-K Classroom C22 do not show air balancing dampers.	Update supply ducts to show air balancing dampers.	x		3/24/2020	BG Buildingworks	Balance dampers to be provided per standard branch duct diagram. PCD (4/3/20): Included on 95% CD plan.
6	3/5/2020	DD: Dwg M3.1 AHU-1	AHU appears to be installed very close to the wall of penthouse on the plan south and plan east sides.	Please confirm AHU location will meet manufacturer's installation requirements.			3/24/2020	BG Buildingworks	Work in progress. Coordinating layout and clearances with team. Limited space available.
7	3/5/2020	DD: Dwg M3 1 - Mechanical Penthouse	No doors are shown on the penthouse.	Please coordinate door location and size with the unit requirements and ensure AHU-1 and it's components may be serviced / removed if required.	x		3/24/2020	BG Buildingworks	Architect to add doors for access. PCD (4/3/20): Included on 95% CD plan.
8	3/5/2020	DD: Dwg M3.1 - Penthouse AHU-1 Installation	It is unclear how AHU-1 is going to be installed in the existing penthouse.	Please provide additional information regarding this process on the sheet, i.e. are we removing the roof of the penthouse?	x		3/24/2020	BG Buildingworks	Penthoue is new. Contractor will need to set the AHU prior to closing in the penthouse, or assemble AHU in place.
9	3/5/2020	DD: Dwg M3.1 - Condensing Unit CU –1	Please confirm replacement condensing unit weight has been coordinated with structural engineer.				3/24/2020	BG Buildingworks	Information has been provided to structural for review.
10	3/5/2020	DD: Dwg MP 2.1	Main level - Area A - Plumbing Plan Gas Meter: Note indicates gas distribution pressure is unknown.	Recommend surveying gas pressure prior to completion of design.			3/24/2020	BG Buildingworks	Work in progress. PCD (4/3/20): Gas pressure noted on 95% CD plan.
11	3/5/2020	DD: Dwg MP 2.1	Note at dish washing sink indicates grease waste to connect downstream of interceptor.	Please confirm this is correct.			3/24/2020	BG Buildingworks	Indirect drains from kitchen plumbing fixutre will all connect to the grease interceptor. PCD (4/3/20): Note updated on 95% CD plan.
12	3/5/2020	DD: Dwg M2.1	Music Room - A19 is supplied with 1,100 CFM supply air; however, the space has a single 24x24 RA Grille to plenum above.	The 24x24 RA Grille to the plenum appears undersized. Plenum differential pressures are very low. Confirm the RA path will be adequate; add additional RA grilles if needed.	x		3/24/2020	BG Buildingworks	Work in progress, will review. PCD (4/3/20): Noted on 95% CD plan.
13	3/5/2020	DD: Dwg M2.1	A 18x14 transfer duct connects the plenum above Music A19 to an adjacent plenum above Hall 14. This transfer duct appears to have been sized for approximately 650 FPM.	Transfer air ducts operate under very low differential pressures; since the air is transferring between plenums, consider sizing the transfer duct for 300 FPM velocity.			3/24/2020	BG Buildingworks	Work in progres, will review. PCD (4/3/20): Noted; transfer air duct size increased on 95% CD plan.

Commissioning Design Review

PCD Engineering Project: **Steamboat Springs SD - Strawberry Park ES** Date of This Report: 4/6/20

Issue No.	Date Noted	Drawing No. / Spec Section No.	Review Comment	Recommendation	Installed Cost Savings Impact	Energy / Operational Savings Impact	Date Closed	Applicable Party	Applicable Party Response
14	3/5/2020	DD: Dwg M2.1	VAV-02 appears to be to close to the wall.	Please confirm access clearances are maintained at VAV-02.			3/24/2020	BG Buildingworks	Work in progress, will review. PCD (4/3/20): VAV location changed on 95% CD plan.
15	3/5/2020	DD: Dwg M2.1	Plenum RA Duct above Hall 14: The RA duct inlet appears to be small; the duct size is not shown on the drawings.	It may be useful to provide larger inlets / sound elbows or attenuators for the RA duct. Please coordinate acoustics of RA inlet with equipment manufacturer.			3/24/2020	BG Buildingworks	Will coordinate with acoustical consultant. PCD (4/3/20): Duct sizes provided on 95% CD plan.
16	3/5/2020	DD: Dwg M2.1	Several supply diffuser runouts do not show balancing dampers.	Please show all balancing dampers and their locations.			3/24/2020	BG Buildingworks	Branch SA ducts to have balance dampers per standard diagram.
17	3/5/2020	DD: Dwg MP 3.1	Floor drain is shown, but no slope arrows on floor – is this intentional?				3/24/2020	BG Buildingworks	Architect to provide floor slope details
18	3/5/2020	DD: Dwg M4.1	Return air grills sound boot diagram: This diagram shows "lead wool" – is this correct?				3/24/2020	BG Buildingworks	Typo - will correct. PCD (4/3/20): Note corrected on 95% CD detail.
19	3/5/2020	DD: Dwg M4.1	Typical pipe penetration diagram: Notes on this detail referred to "tenant".	Please coordinate all notes with project scope of work.			3/24/2020	BG Buildingworks	Work in progress. PCD (4/3/20): Notes have been corrected on 95% CD detail.
20	3/5/2020	DD: Dwg M4.2	Gas piping demo diagram: Note indicates "existing gas meter to remain…" This note appears to contradict sheet – that indicates existing gas meter shall be relocated.	Please coordinate diagram with plan.			3/24/2020	BG Buildingworks	Work in progress. PCD (4/3/20): Gas meter notes are updated on 95% CD plan.
21	3/5/2020	DD: Dwg M4.2	Bathroom and Art Room exhaust control schematic: Roof mounted-exhaust fan shown in diagram, while in-line fan shown on plans.	Please coordinate fan representation in control diagram with plans.			3/24/2020	BG Buildingworks	Work in progress. PCD (4/3/20): EF diagram is updated on 95% CD plan.
22	3/5/2020	DD: Dwg M4.2	Controls General Notes No. 17: Trend storage is a minimum of one-year.	Recommend the trend storage be a minimum of 18 months, instead of 12 months. Add to note that trend points shall record at 15 min. intervals.			3/24/2020	BG Buildingworks	Trend interval and storage to match existing BAS system.
23	3/5/2020	DD: Dwg M4.2	Gas piping proposed diagram: Buried gas line to generator indicated in vented conduit.	Has direct burial of polyethylene gas line been considered as a design option? Be sure to include tracer wire if this option is used.			3/24/2020	BG Buildingworks	Contractor to provide direct burial poly as a VE.
24	3/5/2020	DD: Dwg E0.1	Lighting Control Devices Note L: Drawing note indicates commissioning as required by the IECC.	Change Note L to indicate that commissioning shall be provided in accordance with school district requirements.			3/24/2020	BG Buildingworks	This note has been added. PCD (4/3/20): Detail Note has been updated on 95% CD plan.
25	3/5/2020	DD: Dwg E0.2:	Panel (E) ENR is not shown.	Recommend to include Panel (E) ENR on Dwg E0.2 for the new circuit breakers serving the existing cooling unit and existing receptacles.			3/24/2020	BG Buildingworks	Panel 'ENR' is already shown on the one-line diagram and sheet E2.2.
26	3/5/2020	DD: Dwg E0.3	Section 26 50 00 Lighting and Lighting Controls: Training for the lighting controls is not shown.	Add lighting controls training, including demonstration by factory-authorized service technicians and the minimum number of hours for training.			3/24/2020	BG Buildingworks	This spec section has been added. PCD (4/3/20): Spec section to be included in Project Manual.
27	3/5/2020	DD: Dwg E0.3	Section 26 00 10, 1.01 Project Description - The project description is not correct.	Update the project description for the Strawberry Park ES renovation at 39620 Amethyst Drive, Steamboat Springs, CO			3/24/2020	BG Buildingworks	The project description has been updated. PCD (4/3/20): Spec section information to be included in Project Manual.
28	3/5/2020	DD: Dwg E0.3	A specification section for the electrical transformer is not shown.	Provide a spec section for the electrical transformer.			3/24/2020	BG Buildingworks	This section has been added. PCD (4/3/20): Spec section to be included in Project Manual.
29	3/5/2020	DD: Dwg E2.12	Pre-K Classroom C24: (E) Exit Sign is shown next to the window.	Confirm if the (E) Exit Sign location is at the exterior door; recommend to move to this location, as applicable.			3/24/2020	BG Buildingworks	This exit sign has been shifted to new door location. PCD (4/3/20): Exit sign location has been updated on 95% CD plan.
30	3/5/2020	DD: Project Manual - Page 000110-3	Table of Contents: Indicate which spec divisions are included on the design drawings.				3/24/2020	TAB Associates	All spec sections will be included in the Project Manual for CDs
31	3/5/2020	DD: Project Manual - Page 017900-1	Part 1.3 Submittals: Revise Item A, Sub-Items 1 through 4 to indicate that all submittals to be submitted for approval.	Remove the Commissioning Authority as the submittal approver from the spec verbiage. PCD, the Commissioning Authority, will provide a 3rd-party review of submittals only, and provide comments to the design team.			3/24/2020	TAB Associates	TAB will make these changes. PCD (4/3/20): Issue has been corrected.
32	3/5/2020	DD: Project Manual - Page 017900-1	Part 1.3 Submittals: Revise Item A, Sub-item 4 - The Commissioning Authority will not prepare the overall Training Plan.	Revise the spec verbiage to indicate the Contractor will prepare the Training Plan. PCD, the Commissioning Authority, will review the Training Plan for completeness and provide comments.			3/24/2020	TAB Associates	TAB will make these changes. PCD (4/3/20): Issue has been corrected.

Commissioning Design Review

PCD Engineering Project: **Steamboat Springs SD - Strawberry Park ES** Date of This Report: 4/6/20

Issue No.	Date Noted	Drawing No. / Spec Section No.	Review Comment	Recommendation	Installed Cost Savings Impact	Energy / Operational Savings Impact	Date Closed	Applicable Party	Applicable Party Response
33	3/5/2020	DD: Project Manual - Page 017900-2	Part 1.3 Submittals: Revise Item B, Sub-Item 1: The Commissioning Authority is not the submittal approver.	Revise Item B, Sub-Item 1 to indicate that Draft Training Plans submittals to be submitted for approval and Contractor will include approved submittals in the overall training plan. Remove the Commissioning Authority as the submittal approver from the spec verbiage. PCD will provide a 3rd-party review of the Draft Training Plans.			3/24/2020	TAB Associates	TAB will make these changes. PCD (4/3/20): Issue has been corrected.
34	3/5/2020	DD: Project Manual - Page 017900-4	Part 3.2 Training General, Item A: PCD, the Commissioning Authority, will not prepare the Training Plan.	Revise Item A to show the Contractor will prepare the Training Plan based on draft plans. Remove the Commissioning Authority as the preparer of the Training Plan. PCD will provide a 3rd-party review of the Training Plan.			3/24/2020	TAB Associates	TAB will make these changes. PCD (4/3/20): Issue has been corrected.
35	4/3/2020	CD: Mechanical, Plumbing, and Electrical	The CD - Mechanical, Plumbing, and Electrical plans were reviewed and there are no additional comments beyond the comments listed above.				4/3/2020	PCD Engineering	

Commissioning Submittal Review

PCD Engineering
323 3rd Avenue, Suite 100
Longmont, Colorado 80501
(303) 678-1108
(888) 840-4PCD (4723)

Project: **Steamboat Springs SD - Strawberry Park ES**
Project Number: 20004
Design Phase: 100%
Construction Phase: 100%

No. of Open Comments: 0
No. of Closed Comments: 12
No. of Total Comments: 12

TO: Dynamic Program Management
Reilly O'Brien
-
Eagle, CO 81631
303-775-5051
reilly.obrien@dynamicpm.co

Person Completing Review: AN
Checked By: PD

Date of Previous Report: 6/11/20
Date of This Report: 8/14/20

Informational Items:

This review is only for submissions relative to commissioning issues expressed in the contract documents, not for general contract compliance with the contract documents (which is the A/E's responsibility), unless specifically directed to do so. The goal of this review as a part of the commissioning process is to provide feedback to the architect/engineer to assist in their submittal approval for this project. Recommendations are made based on items that may need clarification or that do not meet the project intent and construction documents.

Summary:

We have the following specific issues:

SUBMITTAL REVIEW - ISSUES LOG

PCD Engineering | Project: **Steamboat Springs SD - Strawberry Park ES** | Date of This Report: 8/14/20

Issue No.	Date Received	Date On Submittal	Date Noted	Submittal Number	Equipment	Review Comment	Recommendation	Date Closed	Applicable Party	Applicable Party Response
1	06/11/20	06/05/20	06/11/20	230010-1.0	Air Handling Unit - Product Information and Shop Drawings [AHU-1]	No Cx-related comments.		06/11/20		
2	06/11/20	06/05/20	06/11/20	230010-2.0	Terminal Boxes - Product Information and Shop Drawings	No Cx-related comments.		06/11/20		
3	06/11/20	06/10/20	06/11/20	230010-3.0	Exhaust Fans - Product Data	No Cx-related comments.		06/11/20		
4	06/11/20	06/05/20	06/11/20	230010-4.0	Condensing Unit - Product Information and Shop Drawings	No Cx-related comments.		06/11/20		
5	06/11/20	06/07/20	06/11/20	230923.12-1.0	Dampers and Flex Duct - Product Data	No Cx-related comments.		06/11/20		
6	06/11/20	06/06/20	06/11/20	232500-1.0	Snowmelt System - Product Data and Shop Drawings	No Cx-related comments.		06/11/20		
7	06/11/20	06/04/20	06/11/20	260923-1	Lighting Control Devices - Product Data and Shop Drawings	No Cx-related comments.		06/11/20		
8	07/31/20	07/23/20	07/31/20	230923	Direct-Digital Control System for HVAC	The SA Airflow monitoring point is not shown on the AHU graphic - Sheet TC8.1.	Verify that the SA Airflow monitoring will be required as shown on mechanical Dwg M4.3.	08/14/21	BG Buildingworks	PCD: Submittal comment sent to ME for review. Control diagram without SA flow monitoring point approved by ME on 8/14/20.

Commissioning Submittal Review

PCD Engineering Project: **Steamboat Springs SD - Strawberry Park ES** Date of This Report: 8/14/20

Issue No.	Date Received	Date On Submittal	Date Noted	Submittal Number	Equipment	Review Comment	Recommendation	Date Closed	Applicable Party	Applicable Party Response
9	07/31/20	07/23/20	07/31/20	230923	Direct-Digital Control System for HVAC	Space Pressure control sequence of operation is not shown on controls Sheet TC8.4.	The Space Pressure control sequence of operation should be included on Sheet TC8.4.	08/14/21	BG Buildingworks	PCD: Submittal comment sent to ME for review. Control sequence without space pressure control approved by ME on 8/14/20. Space pressure point is included on the AHU diagram and the space pressure control sequence will be commissioned as shown on the design drawings.
10	07/31/20	07/23/20	07/31/20	230923	Direct-Digital Control System for HVAC	Demand Control Ventilation control sequence of operation is not shown on controls Sheet TC8.4.	The Demand Control Ventilation control sequence of operation should be included on Sheet TC8.4.	08/14/21	BG Buildingworks	PCD: Submittal comment sent to ME for review. Control sequence without demand control ventilation approved by ME on 8/14/20. Space CO2 point is included for each VAV box and the AHU demand control ventilation sequence will be commissioned as shown on the design drawings.
11	07/31/20	07/23/20	07/31/20	230923	Direct-Digital Control System for HVAC	The Existing Fan Powered VAV Box with HW Reheat Control Diagram and Sequence of Control are not shown in the TC drawings set.	Provide the Fan Powered VAV Box controls diagram and sequence per mechanical Dwg M4.3.	08/14/21	BG Buildingworks	PCD: The Fan Powered VAV Boxes will be included in the Phase 2 construction.
12	07/31/20	07/23/20	07/31/20	230923	Direct-Digital Control System for HVAC	EF-3 - Kiln Room control diagram on Sheet TC11.1 does not include DDC controls as shown on mechanical Dwg M4.2.	Provide DDC controls for EF-3 per mechanical Dwg M4.2.	08/14/21	BG Buildingworks	PCD: Submittal comment sent to ME for review. EF-3 control diagram approved by ME on 8/14/20.

Tab 4:

Final Commissioning Issues Log

Commissioning Issues Log

PCD Engineering
323 3rd Avenue, Suite 100
Longmont, Colorado 80501
(303) 678-1108
(888) 840-4PCD (4723)

Project: **Steamboat Springs SD - Strawberry Park ES**
Project Number: 20004
Design Phase: 100%
Implementation Phase: 100%

No. of Open Comments: 2
No. of Closed Comments: 9
No. of Total Comments: 11

TO: Dynamic Program Management
Reilly O'Brien
-
Eagle, CO 81631
303-775-505´ reilly.obrien@dynamicpm.co

Person Completing Review: Alan Niemeyer
Checked By: -

Date of Previous Report: 12/4/2020
Date of This Report: 3/10/2021

Informational Items:

This log is only for items and issues relative to commissioning issues expressed in the contract documents, not for general contract compliance with the contract documents (which is the A/E's responsibility), unless specifically directed to do so. The goal of this log as a part of the commissioning process is to provide feedback to the architect/engineer and owner to assist in their assessment of construction completion and approval for this project.

Summary:

We have the following specific issues:

ISSUES LOG

PCD Engineering — Project: **Steamboat Springs SD - Strawberry Park ES** — Date of This Report: 3/10/2021

Issue No.	Date Noted	Contractor	Affected Equipment	Issue Description	Recommendations	Date Closed	Responding Applicable Party	Applicable Party Response
1	12/4/2020	Mechanical / TAB	AHU-02 - TAB Airflow	AHU-02 actual airflow was measured at 83% of Design Airflow, which is 1,125 CFM below design.	Recommend to contact Carrier to make pulley / sheave adjustments to the air handler and other adjustments, as needed, to bring the AHU airflow up to design airflow.		R&H Mechanical	
2	12/4/2020	Mechanical / TAB	VAV-02 TAB Airflow	VAV-02 actual Max Cooling airflow is 70% of design.	Recheck VAV-02 Max Cooling airflow value after AHU-02 adjustments to airflow have been made to increase airflow to design CFM. Make adjustments to VAV-02, as needed, to bring actual airflow to design Max Cooling airflow.		R&H Mechanical	
3	12/4/2020	Mechanical / TAB	EF-1 - Art Classroom - TAB Report	EF-1 air balance is not included in the Final TAB Report.	Provide airflow test and balance for EF-1 and include in the Final TAB Report.	1/12/2021	R&H Mechanical	TAB measurements have been completed for EF-1 and are included in the Final TAB Report.
4	12/10/2020	Controls Contractor	VAV-02 - Kitchen Hood Operation	VAV-02 is not tied to the Kitchen Exhaust Hood operation. The hood operations are tied to VAV-01.	Reconfigure the Kitchen Hood Exhaust operation to VAV-02.	12/10/2020	LONG Building Intelligence	This issue has been corrected.
5	12/10/2020	Controls Contractor	VAVs - Space CO2 Inputs	The VAV BAS graphics do not show the space CO2 inputs. The VAV Report does not show the space CO2 inputs.	Update the VAV BAS graphics and VAV Report with the space CO2 inputs.	1/12/2021	LONG Building Intelligence	CO2 readings are displayed on VAV graphics and VAV report.
6	12/10/2020	Controls Contractor	EF-1 - Fan Status	EF-1 Fan Status does not show Off when the EF is Off.	Check the BAS connections and make modifications to enable the correct EF fan status reading.	1/12/2021	LONG Building Intelligence	EF-1 is showing OFF. The status is correct.
7	12/10/2020	Controls Contractor	EF-1 - BAS Start / Stop Schedule	EF-1 BAS trends show the EF is always Off.	Check the BAS schedule and make adjustments as needed to enable the EF start/stop operation.	1/12/2021	LONG Building Intelligence	Owner turned it off locally. She does not want it to run during occupied hours due to noise.
8	12/23/2020	Electrical Contractor	Storage Rm A4 - Occupancy Sensor	The wall occupancy sensor has not been installed.	Install the wall occupancy sensor and set to Vacancy mode to enable the Manual On / Auto Off lighting control.	3/10/2021	Central Electric	The wall occupancy sensor has been installed.
9	12/23/2020	Electrical Contractor	Art Rm A23 and Music Rm A19 - Occupancy Sensor Settings	The occupancy sensors operate with On/Off control. The lighting design indicates that the occupancy sensors are to be Vacancy sensors with Manual On and Auto Off control.	Modify the occupancy sensor settings and change to Vacancy control - Manual On and Auto Off.	3/10/2021	Central Electric	The occupancy sensor settings have been changed to Vacancy control.

Commissioning Issues Log

PCD Engineering | Project: **Steamboat Springs SD - Strawberry Park ES** | Date of This Report: 3/10/2021

Issue No.	Date Noted	Contractor	Affected Equipment	Issue Description	Recommendations	Date Closed	Responding Applicable Party	Applicable Party Response
10	12/23/2020	Electrical Contractor	Art Rm A23 - Occupancy Sensors Time Off Setting	The ceiling occupancy sensors do not turn Off the lights after being On for 30 min.	Modify the occupancy sensors time off setting, so that the lights will turn Off at or before 30 min. after being activated.	3/10/2021	Central Electric	PCD (1/28/21): Recheck this Cx issue. The lighting occupancy sensors currently turn lights Off after 1-hour when the room is unoccupied. Change the occupancy sensor settings so the lights turn Off after 15 min. of inactivity. Music Rm A19 is the same and the occupancy sensor settings need to be changed so the lights turn Off after 15 min. of inactivity. Reference lighting control programming requirements on Drawing E0.1 The occupancy sensor settings have been updated so the lights turn Off after 15 min. of inactivity.
11	12/23/2020	Electrical Contractor	Hallway A15 - Ceiling Occupancy Sensors	The ceiling occupancy sensors have not been installed.	Install the ceiling occupancy sensors to enable the On/Off lighting control.	3/5/2021	Central Electric	PCD (1/28/21): CE electrician / installer mentioned that the hallway light fixtures operate 24/7 and are on a security lighting circuit. Please confirm this change in lighting control design and provide documentation. PCD (3/5/21): Per CE, the owner prefers the hallway lighting to be On for egress and operate continuously.

Tab 5:
Functional PerformanceTests

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

Equipment: AHU-2 with CU-1
Location: Roof Penthouse / CU on Roof

Make:	Carrier
Model:	39MN14WL6122511XXE
Serial:	3720U40780

Equipment Description:

AHU Type: Variable Air Volume, Multizone Unit with HW Heating and DX Cooling

Area Served: Cafeteria, Art Classroom, and Music Classroom

Cooling: DX Cooling (remote Condensing Unit)

Heating: HW Heating

Fans: Supply Air Fan \ Area Exhaust Air Fans

Special Control Sequences:
Supply fan VFD control
Exhaust fan VFD control
Supply air temperature reset control
Min OA control
Economizer
HW Heating Control Valve
DX Cooling Coil
CO2 Control

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

ANALOG INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Supply Air Temperature (°F)		75.4	74.6	Yes	
Mixed Air temperature (°F)		71.7	72.8	Yes	
Return Air Temperature (°F)		75.1	74.1	Yes	
Outside Air CO2 (PPM)		470	452	Yes	
Outside Air Flow Station (CFM)		845	-	Yes	OA CFM Setpoint = 800 CFM
SA Duct Static Pressure (in WC)		1.20	1.21	Yes	
Space Static Pressure (in WC)		-0.006	-0.005	Yes	

ANALOG OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Supply fan VFD speed		Yes	Yes	Yes	
MA Damper (OA / RA)		Yes	Yes	Yes	
Relief Air Damper		Yes	Yes	Yes	
HW control valve		Yes	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

DIGITAL INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
Supply Fan Status		On/Off	Yes	Yes	
DX Cooling Status		On/Off	-	-	1

DIGITAL OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
Supply Fan Start/Stop			Yes	Yes	
DX Cooling Start / Stop			-	-	1

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

ANALOG ALARMS VERIFICATION						
Tested By: AN						
Test Date: 01/28/21						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		+/-5°F from Setpt	+/-5°F from Setpt	5	Yes	
Mixed Air Temperature Alarm (°F)		35	-	5	Yes	

DIGITAL ALARMS VERIFICATION					
Tested By: AN					
Test Date: 01/28/21					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Supply Fan Status Alarm		Normal	Yes	Yes	
High Duct Static Pressure Alarm		Normal	Yes	Yes	
Freeze Stat Alarm		Normal	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set system to normal occupied mode.	The VAV boxes are open at the initial AHU start-up.	Yes	AN	12/10/20	
		The MA damper is at minimum position using the OA flow station at AHU start up	Yes	AN	12/10/20	
		The Relief Air Damper is closed at AHU start up and modulates opens to maintain the SSP setpoint of +0.020 inWC.	Yes	AN	12/10/20	
		Supply fan speed modulates between 20% to 100% speed to maintain the Duct Static Pressure (DSP) setpoint.	Yes	AN	12/10/20	
		The BAS Start/Stop program enables the AHU at owner specific start and stop times.	Yes	AN	12/10/20	
Supply Fan Speed Control						
1	System is operating in normal occupied mode.	Supply Fan is running continuously and maintaining the DSP setpoint.	Yes	AN	12/10/20	
2	Open the air dampers to 100% position on two VAV boxes and wait 5 min. Override the air dampers to 50% position on the VAV boxes and wait 5 min.	The DSP Setpoint is reset between Max DSP = 1.25 (adj) and Min DSP = 0.75 inWC based on VAV box air damper positions. If VAV air dampers are >90%, then DSP setpoint increases. If VAV air dampers are <90%, the DSP setpoint decreases.	Yes	AN	12/10/20	
3	Remove all system overrides	AHU reverts to normal occupied mode	Yes	AN	12/10/20	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Space Pressure Control						
1	System is operating in normal occupied mode.	The Relief Air Damper is modulating open/closed to maintain the Space Static Pressure sepoint of +0.020 inWC.	Yes	AN	12/10/20	
2	Override the SSP input value to greater than the SSP setpoint.	The Relief Air Damper modulates open to lower the SSP and to maintain the SSP setpoint.	Yes	AN	12/10/20	
3	Override the SSP input value to less than the SSP setpoint.	The Relief Air Damper modulates toward closed position to increase the SSP and to maintain the SSP setpoint.	Yes	AN	12/10/20	
4	Remove all system overrides	AHU reverts to normal occupied mode	Yes	AN	12/10/20	
Supply Air Temperature Control						
1	System is operating in normal occupied mode. The SAT reset program is enabled.	The SAT resets from a minimum of 55°F for cooling and maximum of 95°F for heating based on the OAT.	Yes	AN	12/10/20	
2	Override the OAT to greater than 80°F and initiate a call for cooling at a VAV box.	The SAT begins to reset downward toward the minimum of 55°F for cooling.	Yes	AN	12/10/20	
3	Override the OAT to less than 50°F and initiate a call for heating at a VAV box.	The SAT begins to reset upward toward the maximum of 85°F for heating.	Yes	AN	12/10/20	
4	Remove all system overrides	AHU reverts to normal occupied mode	Yes	AN	12/10/20	
Mixed Air Temperature Control						
1	System is operating in normal occupied mode. Overried the OAT to 3°F less than the SAT.	The MA Dampers modulate to maintain the SAT setpoint.	Yes	AN	12/10/20	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Enable Economizer cooling by overriding the OAT to less than the RAT. Enable space cooling by overriding space temperature for a VAV box to 5°F greater than the space cooling temperature setpoint.	The MA dampers modulate open to maintain the SAT cooling setpoint.	Yes	AN	12/10/20	
3	Release the AHU overrides and turn On the kitchen hood exhaust fans, KEF-1 and -2.	The MA dampers modulate open to a minimum position of 30% (adj.).	Yes			
3	Remove all system overrides	AHU reverts to normal occupied mode	Yes	AN	12/10/20	
Mechanical Cooling Mode						
1	Enable mechanical cooling by overriding the OAT to greater than 80°F. Enable space cooling by overriding space temperature for a VAV box to 5°F greater than the space cooling temperature setpoint.	The DX cooling enables to maintain the SAT cooling setpoint.	-	AN	12/10/20	1
2	Remove all system overrides	AHU reverts to normal occupied mode.	-	AN	12/10/20	
Demand Control Ventilation - CO2 Control						
1	Enable Demand Ventilation Control by overriding the Space CO2 input to greater than 1,000 ppm CO2 at a VAV box.	The DCV program resets the VAV box minimum ventilation CFM to maintain the code required ventilation to the spaces.	Yes	AN	12/10/20	
		The DCV program calculates a new ventilation fraction and the MA damper modulates open above its min position to reduce CO2 concentration.	Yes	AN	12/10/20	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Release the Zone CO2 input override.	MA damper modulates back to minimum position on a drop in CO2 concentration.	Yes	AN	12/10/20	
3	Remove all system overrides	AHU reverts to normal occupied mode	Yes	AN	12/10/20	
Heating Mode						
1	Enable heating by overriding the OAT to less than 50°F and by overriding space temperature for a VAV box to 5°F less than the space heating temperature setpoint.	The HW control valve opens and modulates to maintain the SAT heating setpoint.	Yes	AN	12/10/20	
2	With the heating enable overrides in place, wait 10 min.	2nd Stage Heating enables. The HW control valve opens and modulates to maintain the SAT heating setpoint.	Yes	AN	12/10/20	
3	Remove all system overrides	AHU reverts to normal occupied mode.	Yes	AN	12/10/20	
Unoccupied Mode						
1	Set system to normal unoccupied mode.	Supply and Exhaust Fans are Off.	Yes	AN	12/10/20	
		OA and EA dampers are fully closed.	Yes	AN	12/10/20	
		RA damper is fully open.	Yes	AN	12/10/20	
		The HW control valve is 5% open.	Yes	AN	12/10/20	
Unoccupied Heating						
1	In unoccupied mode, enable heating by overriding the OAT to less than 50°F and by overriding space temperature at a VAV box to 5°F less than the space heating temperature setpoint.	Supply Fan turns On and fan speed varies per the DSP setpoint.	Yes	AN	12/10/20	
		OA damper remains closed.	Yes	AN	12/10/20	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
		The HW control valve opens and modulates to maintain the SAT heating setpoint.	Yes	AN	12/10/20	
2	Space temperature reaches unoccupied space heating temperature setpoint.	AHU reverts to normal unoccupied mode.	Yes	AN	12/10/20	
3	Reset all parameters to original unoccupied mode settings.	Unit reverts to normal unoccupied mode.	Yes	AN	12/10/20	
Morning Warm Up Mode						
1	Enable BAS control to initiate Warm Up Mode.	All VAV box air dampers modulate to full open position for the Max Cooling CFM.	Yes	AN	12/10/20	2
		After a 3 min. delay, Supply Fan turns On and fan speed varies per the DSP setpoint plus 0.10 inWC.	Yes	AN	12/10/20	
		OA and EA dampers are closed and the RA damper is open.	Yes	AN	12/10/20	
		BAS modulates the HW control valve to maintain the SAT heating temperature setpoint of 85°F.	Yes	AN	12/10/20	
		Once space temperature(s) at the VAV(s) calling for heat reaches setpoint, system enters occupied mode.	Yes	AN	12/10/20	
		System returns to original conditions.	Yes	AN	12/10/20	
Morning Cold Down Mode						
1	Enable BAS control to initiate Cold Down Mode.	All VAV box air dampers modulate to full open position for the Max Cooling CFM.	-	AN	12/10/20	3
		After a 3 min. delay, Supply Fan turns On and fan speed varies per the DSP setpoint plus 0.10 inWC.	-			

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
		The MA dampers modulate to maintain the SAT cooling temperature setpoint of 55°F.	-	AN	12/10/20	
		Once space temperature(s) at the VAV(s) calling for cooling reaches setpoint, system enters occupied mode.	-	AN	12/10/20	
		System returns to original conditions.	-	AN	12/10/20	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

Notes #	Description
1	The DX Cooling will be tested when ambient temperatures are warm in the Spring / Summer. Current Winter temperatures are below 32°F.
2	Checked trends with Long; AHU runs a lot during unoccupied, so the trends didn't show the pre-start. BAS programming checked and Morning Warm-Up is in place.
3	The Morning Cool-Down will be observed through BAS trend data when ambient temperatures are warm in the Spring / Summer.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-01

Equipment: VAV-01
Location: Cafeteria Rm A17

Make:	Carrier
Model:	35EN3000L080D
Serial:	See submittal data

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served: Kitchen

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-01

ANALOG INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)		66.8	65.7	Yes	
Supply Air Temperature (°F)		92.9	92.2	Yes	
Space CO2 (ppm)		608	598	Yes	

ANALOG OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position		Yes	Yes	Yes	
Reheat HW Coil Valve Position		Yes	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-01

ANALOG ALARMS VERIFICATION						
Tested By: AN						
Test Date: 01/28/21						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0	Yes	
Space Temperature Alarm (°F)		55	85	300	Yes	
Space CO2 Alarm (CO2)		-	1,400	300	Yes	

DIGITAL ALARMS VERIFICATION					
Tested By: AN					
Test Date: 01/28/21					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-01

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.	Yes	AN	12/10/2020	
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.	Yes	AN	12/10/2020	
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.	Yes	AN	12/10/2020	
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).	Yes	AN	12/10/2020	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.	Yes	AN	12/10/2020	
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	1
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.	Yes	AN	12/10/2020	
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-01

Notes #	Description
1	Checked trends with LONG; AHU runs a lot during unoccupied, so the trend data did not show pre-start. BAS programming was checked and Morning Warm-Up is in place.
2	Checked the Temp and CO2 alarms with LONG.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

Equipment: VAV-02
Location: Cafeteria Rm A17

Make:	Carrier
Model:	35EN3000L160D
Serial:	See submittal data

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served: Cafeteria

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

ANALOG INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)		67.5	67.8	Yes	
Supply Air Temperature (°F)		98.7	99.5	Yes	
Space CO2 (ppm)		545	595	Yes	

ANALOG OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position		Yes	Yes	Yes	
Reheat HW Coil Valve Position		Yes	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

ANALOG ALARMS VERIFICATION						
Tested By: AN						
Test Date: 01/28/21						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0	Yes	
Space Temperature Alarm (°F)		55	85	300	Yes	
Space CO2 Alarm (CO2)		-	1,400	300	Yes	

DIGITAL ALARMS VERIFICATION					
Tested By: AN					
Test Date: 01/28/21					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.	Yes	AN	12/10/2020	
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.	Yes	AN	12/10/2020	
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.	Yes	AN	12/10/2020	
Kitchen Ventilation Mode						
1	Set RTU to Occupied Mode. VAV is set to normal occupied mode.	VAV operates per the control sequence shown above.	Yes	AN	12/10/2020	
2	Activate the Kitchen Exhaust Hood by turning On the EF switch.	VAV is in Occupied Mode and unit damper opens fully to the CFM Max set point.	Yes	AN	12/10/2020	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
		VAV maintains constant volume air flow at CFM Max.	Yes			
3	Deactivate the Kitchen Exhaust Hood by turning Off the EF switch.	VAV returns to normal operating mode.	Yes	AN	12/10/2020	
4	Release all VAV overrides.	The unit reverts to normal operation and the damper should be in its minimum position.	Yes	AN	12/10/2020	
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).	Yes	AN	12/10/2020	
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.	Yes	AN	12/10/2020	
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	2
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.	Yes	AN	12/10/2020	
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

Notes #	Description
1	VAV-02 is not tied to the Kitchen Exhaust Hood operation. The hood operations are tied to VAV-01. Reconfigure the Kitchen Hood Exhaust operation to VAV-02. [This issue has been corrected.]
2	Checked trends with LONG; AHU runs a lot during unoccupied, so the trend data did not show pre-start. BAS programming was checked and Morning Warm-Up is in place.
3	Checked the Temp and CO2 alarms with LONG.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-03

Equipment: VAV-03	
Location:	

Make:	Carrier
Model:	35EN3000L080D
Serial:	See submittal data

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served: Art Storage

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-03

ANALOG INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)		65.5	65.0	Yes	
Supply Air Temperature (°F)		78.9	78.2	Yes	
Space CO2 (ppm)		532	581	Yes	

ANALOG OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position		Yes	Yes	Yes	
Reheat HW Coil Valve Position		Yes	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-03

ANALOG ALARMS VERIFICATION						
Tested By: AN						
Test Date: 01/28/21						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0	Yes	
Space Temperature Alarm (°F)		55	85	300	Yes	
Space CO2 Alarm (CO2)		-	1,400	300	Yes	

DIGITAL ALARMS VERIFICATION					
Tested By: AN					
Test Date: 01/28/21					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-03

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.	Yes	AN	12/10/2020	
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.	Yes	AN	12/10/2020	
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.	Yes	AN	12/10/2020	
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).	Yes	AN	12/10/2020	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.	Yes	AN	12/10/2020	
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	1
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.	Yes	AN	12/10/2020	
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-03

Notes #	Description
1	Checked trends with LONG; AHU runs a lot during unoccupied, so the trend data did not show pre-start. BAS programming was checked and Morning Warm-Up is in place.
2	All VAVs - Update the VAV BAS graphic and VAV Report with the Space CO2 level. [This issue has been corrected.]
3	Checked the Temp and CO2 alarms with LONG.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-04

Equipment: VAV-04
Location: Art Storage Rm A4

Make:	Carrier
Model:	35EN3000L120D
Serial:	See submittal data

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served: Art Classroom

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-04

ANALOG INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)		65.8	64.9	Yes	
Supply Air Temperature (°F)		74.0	74.8	Yes	
Space CO2 (ppm)		562	595	Yes	

ANALOG OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position		Yes	Yes	Yes	
Reheat HW Coil Valve Position		Yes	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-04

ANALOG ALARMS VERIFICATION						
Tested By: AN						
Test Date: 01/28/21						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0	Yes	
Space Temperature Alarm (°F)		55	85	300	Yes	
Space CO2 Alarm (CO2)		-	1,400	300	Yes	

DIGITAL ALARMS VERIFICATION					
Tested By: AN					
Test Date: 01/28/21					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-04

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.	Yes	AN	12/10/2020	
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.	Yes	AN	12/10/2020	
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.	Yes	AN	12/10/2020	
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).	Yes	AN	12/10/2020	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.	Yes	AN	12/10/2020	
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	1
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.	Yes	AN	12/10/2020	
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-04

Notes #	Description
1	Checked trends with LONG; AHU runs a lot during unoccupied, so the trend data did not show pre-start. BAS programming was checked and Morning Warm-Up is in place.
2	Checked the Temp and CO2 alarms with LONG.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-05

Equipment: VAV-05
Location: Corridor outside of Music Classroom A19

Make:	Carrier
Model:	35EN3000L120D
Serial:	See submittal data

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served: Music Classroom

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-05

ANALOG INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)		65.1	64.2	Yes	
Supply Air Temperature (°F)		76.6	75.6	Yes	
Space CO2 (ppm)		627	661	Yes	

ANALOG OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position		Yes	Yes	Yes	
Reheat HW Coil Valve Position		Yes	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-05

ANALOG ALARMS VERIFICATION						
Tested By: AN						
Test Date: 01/28/21						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0	Yes	
Space Temperature Alarm (°F)		55	85	300	Yes	
Space CO2 Alarm (CO2)		-	1,400	300	Yes	

DIGITAL ALARMS VERIFICATION					
Tested By: AN					
Test Date: 01/28/21					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-05

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.	Yes	AN	12/10/2020	
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.	Yes	AN	12/10/2020	
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.	Yes	AN	12/10/2020	
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.	Yes	AN	12/10/2020	
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).	Yes	AN	12/10/2020	

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.	Yes	AN	12/10/2020	
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.	Yes	AN	12/10/2020	1
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.	Yes	AN	12/10/2020	
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.	Yes	AN	12/10/2020	
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-05

Notes #	Description
1	Checked trends with LONG; AHU runs a lot during unoccupied, so the trend data did not show pre-start. BAS programming was checked and Morning Warm-Up is in place.
2	Checked the Temp and CO2 alarms with LONG.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

Equipment: KEF-1
Location: Roof

Make:	ACME Engineering
Model:	PNU150RF
Serial:	20L1230-1

Equipment Description:

Fan Type: Constant Volume, Direct Drive Roof Exhaust Fan

Area Served: Kitchen Hood Exhaust

Special Control Sequences: None

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

DIGITAL INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-1 Status	[BAS monitoring point]	On/Off	Yes	Yes	

DIGITAL OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-1 Start/Stop	[Local On/Off switch on hood]	On/Off	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Fan Control (for fans with manual On/Off control via switch): KEF-1						
1	Turn kitchen hood switch to On position.	Exhaust Fan turns On.	Yes	AN	12/10/2020	
		Associated VAV box switches to Kitchen Ventilation Mode and operates as a constant volume VAV.	Yes	AN	12/10/2020	
2	Turn kitchen hood switch to Off position.	Exhaust Fan Turns Off.	Yes	AN	12/10/2020	
		Associated VAV box reverts back to normal operating mode.	Yes	AN	12/10/2020	
3	Reset system to original parameters.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

Equipment: KEF-2
Location: Roof

Make:	ACME Engineering
Model:	PDU110RF
Serial:	20G1651

Equipment Description:

Fan Type: Constant Volume, Direct Drive Roof Exhaust Fan

Area Served: Kitchen Dishwasher Hood Exhaust

Special Control Sequences: None

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

DIGITAL INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-2 Status	[BAS monitoring point]	On/Off	Yes	Yes	

DIGITAL OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-2 Start/Stop	[Local On/Off switch on hood]	On/Off	Yes	Yes	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Fan Control (for fans with manual On/Off control via switch): KEF-2						
1	Turn kitchen hood switch to On position.	Exhaust Fan turns On.	Yes	AN	12/10/2020	
		Associated VAV box switches to Kitchen Ventilation Mode and operates as a constant volume VAV.	Yes	AN	12/10/2020	
2	Turn kitchen hood switch to Off position.	Exhaust Fan Turns Off.	Yes	AN	12/10/2020	
		Associated VAV box reverts back to normal operating mode.	Yes	AN	12/10/2020	
3	Reset system to original parameters.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

Equipment: EF-1, -2, -3, and -4	
Location:	

Make:	
Model:	
Serial:	

Equipment Description:

Fan Type: Constant Speed EFs, Inline and Ceiling Exhaust Fans

Area Served: Art Classroom, Pre-K Bathrooms & Kitchen, Kiln Room, and SPED Bathroom

Special Control Sequences: None

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

DIGITAL INPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
EF-1 Status		On/Off	Yes	Yes	2
EF-2 Status		On/Off	-	-	1

DIGITAL OUTPUTS VERIFICATION					
Tested By: AN					
Test Date: 12/10/20					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
EF-1 Start/Stop		On/Off	Yes	Yes	
EF-2 Start/Stop		On/Off	-	-	1

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Fan Control (for fans with BAS control): EF-1						
1	Override BAS schedule to "Occupied" mode.	Exhaust Fan turns On.	Yes	AN	12/10/2020	3
2	Override BAS schedule to "Unoccupied" mode.	Exhaust Fan Turns Off.	Yes	AN	12/10/2020	
3	Reset system to original parameters.	System returns to original conditions.	Yes	AN	12/10/2020	
Fan Control (for fans with BAS control): EF-2						
1	Override BAS schedule to "Occupied" mode.	Exhaust Fan turns On.				1
2	Override BAS schedule to "Unoccupied" mode.	Exhaust Fan Turns Off.				
3	Reset system to original parameters.	System returns to original conditions.				
Fan Control (for Kiln Room exhaust fan control): EF-3						
1	Adjust space thermostat setpoint to below current space temperature. The space temperature setpoint is 85°F.	Exhaust Fan turns On and run continuously.	Yes	AN	12/10/2020	
2	Adjust the space thermostat setpoint to above the current space temperature.	Exhaust Fan turns Off.	Yes	AN	12/10/2020	
3	Reset the space thermostat to original space temperature setpoint.	Exhaust fan operation returns to normal operating conditions.	Yes	AN	12/10/2020	
Fan Control (for fan interlocked w/ lighting occupancy sensor control): EF-4						
1	Turn wall light switch to ON position.	Exhaust Fan turns On.	Yes	AN	12/10/2020	
2	Turn wall light switch to OFF position.	Exhaust Fan Turns Off.	Yes	AN	12/10/2020	
3	Turn wall light switch to ON position, activate occupancy sensor.	Exhaust Fan turns On.	Yes	AN	12/10/2020	
4	Wait for occupancy sensor to time out.	Exhaust Fan Turns Off.	Yes	AN	12/10/2020	
5	Reset system to original parameters.	System returns to original conditions.	Yes	AN	12/10/2020	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

Notes #	Description
1	EF-2 is not installed yet; however, it will be installed in March / April 2021.
2	EF-1 Fan Status does not show Off when the EF is Off. Check the BAS connections and make modifications to enable the correct fan status reading. [This issue has been corrected.]
3	EF-1 BAS trends show the EF is always Off. Check the BAS schedule and enable the EF start/stop operation. [Owner has turned the EF off locally. The teacher does not want it to run during occupied hours due to noise.]
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: Snowmelt System - New Snowmelt Zones

Equipment: Snowmelt System - New Snowmelt Zones
Location: North and East Sides of Building

Make:	Rehau
Model:	See submittal data
Serial:	See submittal data

Equipment Description:

System Type. Three Existing Snowmelt Boilers; three new snowmelt zones

Area Served: Three new snowmelt zones: Snowmelt Boiler, SB-1 - Zone 1 - East side of building at entry to cafeteria; SB-2 - Zone 2 - East side of building near playground; and SB-3 - Zone 3 - North side of building at building entry and sidwalks.

Special Control Sequences:

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: Snowmelt System - New Snowmelt Zones

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Snowmelt System - Zone 1 - Temperature Control						
1	Override the BAS control inputs to enable the snowmelt system or observe the snowmelt system during a snow event.	SM pump is energized. The SM boiler is enabled.	Yes	AN	12/23/2021	1, 4
2	Override the BAS slab temperature input to less than 30°F and override the slab Wet / Dry sensor input to Wet or observe the snowmelt system during a snow event.	The SM zone maintains the slab temperature setpoint high enough to melt the snow / ice.	Yes	AN	12/23/2021	1, 4
3	Release the slab sensor overrides or observe the OA temperatuure and slab temperature rise above current lockout setpoints.	The SM system boiler and pump are Off.	Yes	AN	12/23/2021	
Snowmelt System - Zone 2 - Temperature Control						
1	Override the BAS control inputs to enable the snowmelt system or observe the snowmelt system during a snow event.	SM pump is energized. The SM boiler is enabled.	Yes	AN	12/23/2021	2, 4
2	Override the BAS slab temperature input to less than 30°F and override the slab Wet / Dry sensor input to Wet or observe the snowmelt system during a snow event.	The SM zone maintains the slab temperature setpoint high enough to melt the snow / ice.	Yes	AN	12/23/2021	2, 4
3	Release the slab sensor overrides or observe the OA temperatuure and slab temperature rise above current lockout setpoints.	The SM system boiler and pump are Off.	Yes	AN	12/23/2021	
Snowmelt System - Zone 3 - Temperature Control						
1	Override the BAS control inputs to enable the snowmelt system or observe the snowmelt system during a snow event.	SM pump is energized. The SM boiler is enabled.	Yes	AN	12/23/2021	3, 4
2	Override the BAS slab temperature input to less than 30°F and override the slab Wet / Dry sensor input to Wet or observe the snowmelt system during a snow event.	The SM zone maintains the slab temperature setpoint high enough to melt the snow / ice.	Yes	AN	12/23/2021	3, 4
3	Release the slab sensor overrides or observe the OA temperatuure and slab temperature rise above current lockout setpoints.	The SM system boiler and pump are Off.	Yes	AN	12/23/2021	

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: Snowmelt System - New Snowmelt Zones

Notes #	Description
1	(12/10/20) SM Boiler-1 serves the front of the building and the new snowmelt zone at the entry area to the Cafeteria. The SM Boiler was maintenanced on 12/9/20. Per discussion with Facility Maintenance staff, the snowmelt worked during the last snow event. The system enables with the snow/ice sensor located at the SM Boiler. The snowmelt loop pumps and Tekmar controller are located in a box enclosure next to the boiler.
2	(12/10/20) SM Boiler-2 serves the Trash Enclosure Area on the east side of the building near the playground. Per discussion with Facility Maintenance staff, the snowmelt system is operable and currently doesn't have any operating issues.
3	(12/10/20) SM Boiler-3 serves the rear of the building and the new snowmelt zone along the north area of the building. Per discussion with Facility Maintenance staff, the snowmelt system had air in the system that was blocking flow to the new snowmelt zone. The SM system was operated for 4 days to eliminate the air in the system. The SM system should be ready for the next snow event. The system enables with the snow/ice sensor located in the sidewalk straight east of the SM Boiler. The snowmelt loop pumps and Tekmar controller are located in a box enclosure next to the boiler.
4	12/23/20: The snowmelt system for the front of the school is working and has melted the snow from the front sidwalks. Also, the snow is melted by the Cafeteria entry area and by the Trash Enclosure area. The snowmelt system for the back of the building is not On and no snow has been melted. The snowmelt system is manually turned On when needed. The teachers and students are not at the school today due to the holiday break.
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: General Lighting Controls

Equipment: General Lighting Controls
Location: See plans

Make:	See plans
Model:	See submittal
Serial:	See submittal

Equipment Description:

Sensor Type: Ceiling / Wall mounted occupancy sensors; photocell sensors

Area Served: See plans.

Special Control Sequences:
Vacancy-Occupancy Sensors

PCD Engineering						Tested By:	AN	AN
Project/Location: Strawberry Park ES						Test Date:	12/23/2020	1/28/2021
		Occupancy Sensor No.	1	2	3	4	5	6
		Room No.:	Cafeteria Rm A17	Restroom A22	Storage Rm A4	Art Rm A23	Music Rm A19	Hall A15
		Occupancy Sensor Type:	Ceiling (11)	Wall	Wall	Ceiling (2)	Ceiling (2)	Ceiling (2)
Test Procedures		Notes:	-	-	1	2, 3	2	4
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**
Vacancy and On/Off - Occupancy Sensor Operation			**On/Off**	**On/Off**	**Vacancy**	**Vacancy**	**Vacancy**	**On/Off**
1	Turn switch to FULL ON position.	All lights turns ON.	Yes	Yes	Yes	Yes	Yes	-
2	Turn wall switch to OFF position.	Room lights are OFF.	Yes	Yes	Yes	Yes	Yes	-
3	Activate vacancy sensor.	Lights remain OFF.	N/A	N/A	Yes	Yes	Yes	-
4	Turn switch to ON position and activate occupancy sensor.	Lights turns ON.	Yes	Yes	Yes	Yes	Yes	-
5	Without tripping vacancy - occupancy sensor, verify time delay for lights to turn OFF.	Identify the time required for occupancy sensor to turn lights OFF: 15 to 20 min.	Yes	Yes	Yes	Yes	Yes	-
6	Turn wall switch to OFF position.	Lights turns OFF immediately.	Yes	Yes	Yes	Yes	Yes	-
7	Return all changed parameters & conditions to pre-test values.	System returns to normal operation.	Yes	Yes	Yes	Yes	Yes	-

PCD Engineering
Project/Location: Strawberry Park ES

		Occupancy Sensor No.	7	8	9
		Room No.:	Pre-K Classroom C2	Pre-K Classroom C3	Classroom Entry C15
		Occupancy Sensor Type:	Ceiling	Ceiling	Ceiling
Test Procedures		Notes:	-	-	-
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**
Vacancy and On/Off - Occupancy Sensor Operation			**Vacancy**	**Vacancy**	**On/Off**
1	Turn switch to FULL ON position.	All lights turns ON.			
2	Turn wall switch to OFF position.	Room lights are OFF.			
3	Activate vacancy sensor.	Lights remain OFF.			N/A
4	Turn switch to ON position and activate occupancy sensor.	Lights turns ON.			
5	Without tripping vacancy - occupancy sensor, verify time delay for lights to turn OFF.	Identify the time required for occupancy sensor to turn lights OFF: 15 to 20 min.			
6	Turn wall switch to OFF position.	Lights turns OFF immediately.			
7	Return all changed parameters & conditions to pre-test values.	System returns to normal operation.			

Phase 2 Work (to be done Spring 2021)

PCD Engineering						Tested By:	AN
Project/Location: Strawberry Park ES						Test Date:	12/23/2020
		Daylight Sensor No.	1	2	3	4	5
		Room No.:	Art Rm A23	Art Rm A23	Music Rm A19	Pre-K Classroom C2	Pre-K Classroom C3
Test Procedures		Notes:					
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**
Daylighting Controls - System Operation							
1	Turn wall switch to ON position and activate occupancy sensor.	Room lights are ON.	Yes	Yes	Yes		
2	Shine flashlight directly on photocell or observe photocell operation during daylight hours.	Lighting dimming level decreases.	Yes	Yes	Yes		
3	Remove flashlight from photocell and wait 5 min. or turn lights Off, then On and observe dimming.	Lighting dimming level increases and returns to light level before start of test.	Yes	Yes	Yes		
4	Turn wall switch to OFF position.	Lights turns OFF immediately.	Yes	Yes	Yes		
5	Return all changed parameters & conditions to pre-test values.	System returns to normal operation.	Yes	Yes	Yes		

Phase 2 Work (to be done Spring 2021)

PCD Engineering	Tested By:
Project/Location: Strawberry Park ES	Test Date:

Exterior Lighting Photocell Sensor Operation

Test Procedures

Task #	Action Item	Expected Response	Passed (Yes/No)	Verified By	Date	Note #
1	Observe photocell operation at dusk.	Lights turns ON.	Yes	AN	12/22/2020	-
2	Observe photocell operation after dawn.	Lights turn OFF.	Yes	AN	12/23/2020	-

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: General Lighting Controls

Notes #	Description
1	The wall occupancy sensor has not been installed. Install the wall occupancy sensor and set to Vacancy mode to enable the Manual On / Auto Off lighting control. [1/28/21: Checked; no occupancy sensor installed.]
2	The occupancy sensors operate with On/Off control. The lighting design indicates that the occupancy sensors are to be Vacancy sensors with Manual On and Auto Off. Modify the programming to change the occupancy sensors to Vacancy control - Manual On and Auto Off. [1/28/21: Checked; the lighting occupancy sensors are operating with On/Off control; re-check this issue.] [3/10/21: This issue has been verified with Central Electric and has been corrected.]
3	The ceiling occupancy sensors do not turn Off the lights after 15 min. when room is unoccupied. Modify the occupancy sensor time Off programming so that the lights will turn Off after 15 min. when the room is unoccupied. [1/28/21: Recheck this Cx issue. The lighting occupancy sensors currently turn lights Off after 1-hour when the room is unoccupied. Change the occupancy sensor settings so the lights turn Off after 15 min. of inactivity. Music Rmn A19 is the same and the occupancy sensor settings need to be changed so the lights turn Off after 15 min. of inactivity. Reference lighting control programming requirements on Drawing E0.1] [3/10/21: This issue has been verified with Central Electric and has been corrected.]
4	The ceiling occupancy sensors have not been installed. Install the ceiling occupancy sensors to enable the On/Off lighting control. [1/28/21: CE electrician / installer mentioned that the hallway light fixtures operate 24/7 and are on a security lighting circuit. Please confirm this change in lighting control design and provide documentation.] [PCD (3/5/21): Central Electric confirmed that the owner preferred the hallway lighting to be On and operate continuously.] [3/10/21: This issue has been verified with Central Electric and has been corrected.]
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Tab 6:
Recommissioning Management Manual

Recommissioning Management Manual

Strawberry Park Elementary School

Submitted To:

Steamboat Springs SD RE-2 & DPM

Submitted By:

PCD Engineering

323 3rd Avenue, Suite 100
Longmont, Colorado 80501
(303) 678-1108
pcdengineering.com

PCD Project Number: 20004

March 8, 2021

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Abbreviations/Acronyms

AC/ACU	Air conditioning / Air conditioning unit	HWS/ HWR	Hot water supply/Hot water return
AH/AHU	Air handler / Air handling unit	kBtu	Thousand British thermal units
BAS	Building automation system	kW	Thousand watts
BTU	British thermal unit	kWh	Kilowatt hour
CUH	Cabinet unit heater	MAU	Make-up Air Unit
CV	Constant volume	MA/ MAT	Mixed air / Mixed air temperature
DA/ DAT	Discharge air / Discharge air temperature	MBH	Thousand British thermal units
DDC	Direct digital control	MMBtu	Million British thermal units
DX	Direct expansion	OA/OSA	Outside air
EA/ EAT	Exhaust air / Exhaust air temperature	OAT	Outside air temperature
ECH	Electric cabinet heater	PCD	PCD Engineering Services
EF	Exhaust fan	RA/ RAT	Return air / Return air temperature
F	Fahrenheit	RCx	Recommissioning
FCU	Fan coil unit	RTU	Rooftop (packaged HVAC) unit
GPM	Gallons per minute	SA/ SAT	Supply air / Supply air temperature
HP	Horsepower	SF	Supply fan / Square Foot
HVAC	Heating, ventilating, and air-conditioning	UH	Unit heater
HV/ HVU	Heating ventilating unit	VAV	Variable Air Volume
HW	Hot water		

Strawberry Park Elementary School
RECOMMISSIONING MANAGEMENT MANUAL

1 OVERVIEW

The Recommissioning Management Manual provides guidance and establishes timelines for recommissioning of building systems and components in the new addition. The appendices contain additional information on the retesting instructions, blank test forms, and a sensor calibration plan. Further information can be found in the Final Cx Report as well as the Operations and Maintenance documentation.

1.1 General

The general overview is provided as background information for the existing building and the new classroom addition.

1.1.1 Strawberry Park Elementary School Overview

The Strawberry Park Elementary School is located at 39620 Amethyst Drive in Steamboat Springs, CO. The new building addition consists of an Art classroom and Music classroom. The following table provides a brief list of the building characteristics.

Table 1-1: Building Characteristics

Characteristic	Description
Building Construction	Original: 1981; Renovation: 2007; New Classroom Addition and Renovation: 2020
Building Area	Existing Building: 71,098 SF New Classroom Addition: 2,480 SF Cafeteria and Pre-K Classroom Renovation: 6,090 SF
Number of Stories	Single-story
Building Use	Education administration and classroom instruction
Weekly Hours of Operation	Classrooms: 8:00 am to 3:00 pm, weekly; General Hours: 7:30 am to 4:00 pm, Monday through Friday.

The new classroom addition and renovation floor plans are shown in the following figures.

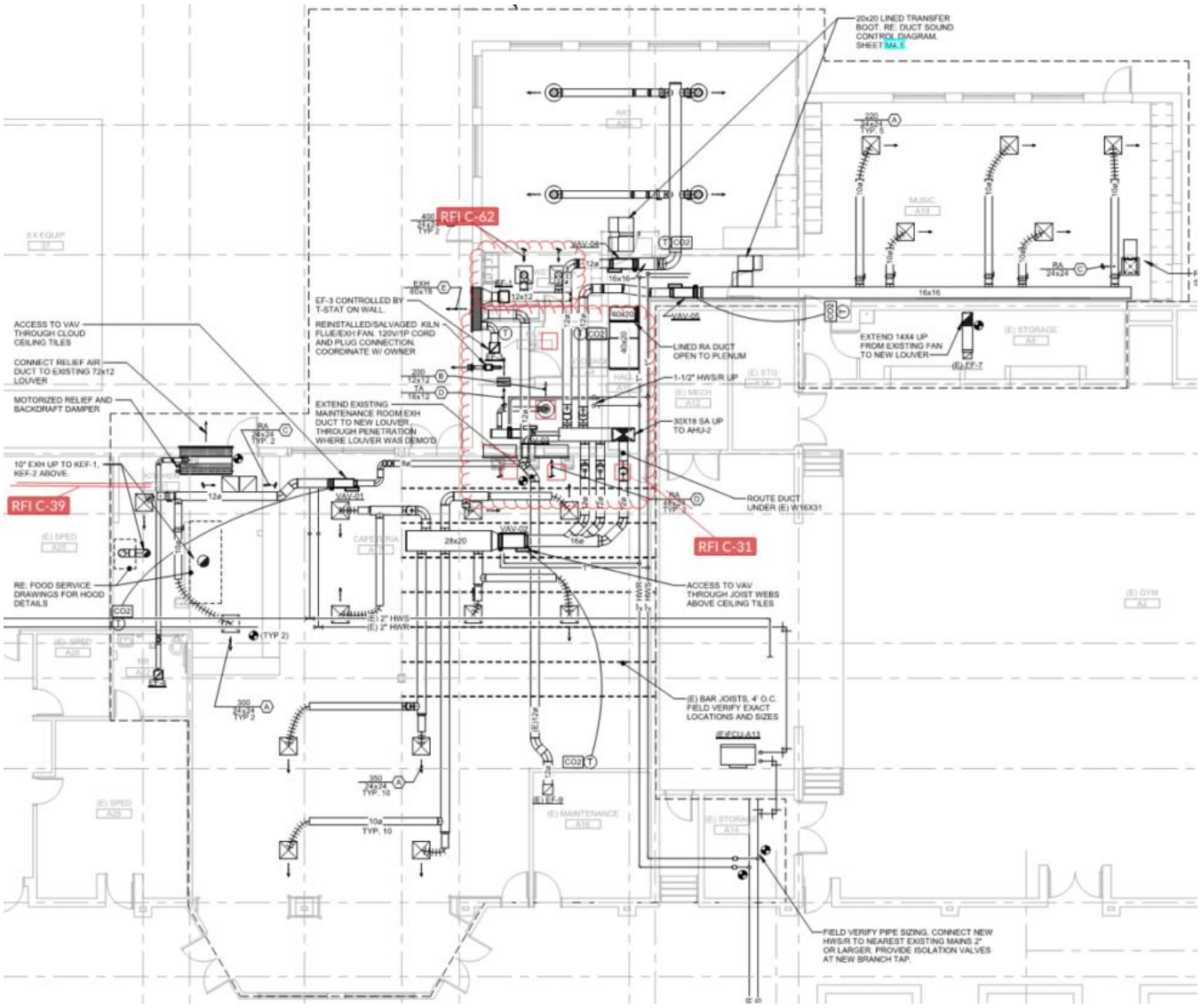

Figure 1-1: New Classroom and Cafeteria Renovation Floor Plan

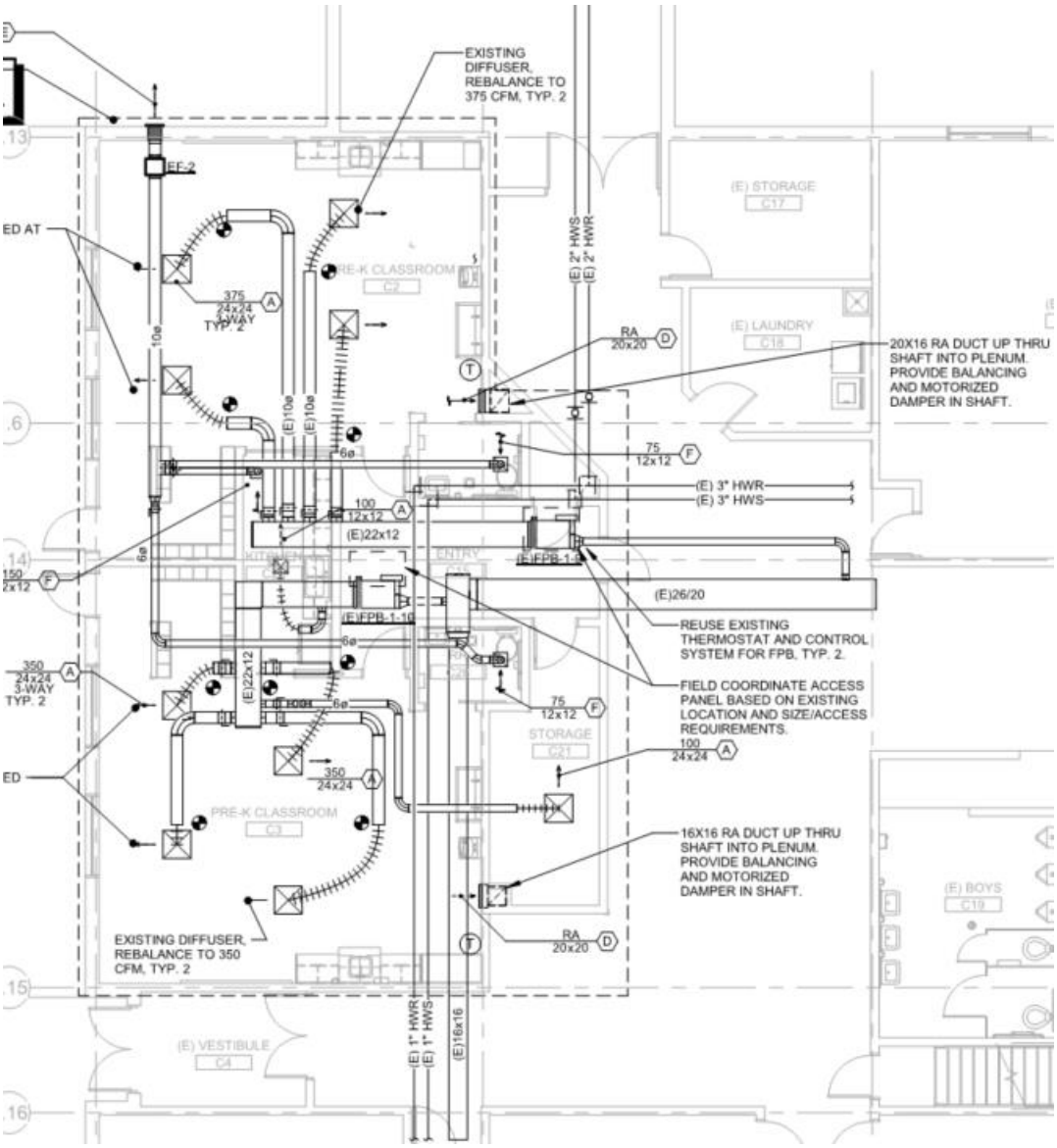

Figure 1-2: Pre-K Classroom Renovation Floor Plan

The Strawberry Park Elementary School new classroom addition and renovation included the following HVAC systems:

- AHU-2 with HW heating and DX cooling;
- (5) VAV air terminal units with HW reheat coils;
- (1) Kitchen dishwashing machine exhaust fan;
- (1) Kitchen hood exhaust fan;
- (2) Restroom exhaust fan;
- (1) Art Classroom exhaust fan;
- (1) Kiln Room exhaust fan and
- (3) (E) Snowmelt System HW boilers with new snowmelt zones.

The lighting fixtures throughout the new addition and areas renovated are LED with occupancy sensors and daylight dimming lighting controls. The exterior LED lighting operation is controlled by a photocell sensor.

2 RECOMMISSIONING PLAN

2.1 Recommissioning Process Description

Recommissioning is recommended for the HVAC equipment / controls and the lighting controls. The major HVAC equipment and lighting controls should be re-tested in an ongoing basis in the future. Any changes to the building operating plan and facility requirements should be updated also.

2.1.1 Roles and Responsibilities

The recommissioning tasks should be conducted by the in-house maintenance personnel. The same maintenance personnel would be in-charge of normal preventive maintenance activities for the equipment / systems. The in-house maintenance personnel should recommission the equipment / systems using the functional performance tests (FPTs) provided in Appendix A. Recommissioning the equipment / systems may increase the maintenance personnel's knowledge and understanding of the building operations.

A third-party commissioning agent (CxA) should be considered for the recommissioning tasks. The CxA would be responsible for conducting the FPTs and reporting issues for repair and resolution. If the facility requirements change or the equipment / systems are modified from the original design, the CxA of record may need to be retained to ensure that FPTs are up to date and adequately documented.

2.1.2 Recommissioning Schedule and Test Forms

The major HVAC equipment / controls and lighting controls are recommended for recommissioning and to be re-tested in an ongoing manner in the future.

The recommissioning schedule provides the following information:

- Equipment Tags;
- Quantity;
- Equipment Type;
- Re-test Interval (years); and
- Sample Rate for Testing.

The recommissioning schedule has suggested time intervals for re-testing of equipment / systems. A sample rate for testing has been provided to help with the recommissioning effort. If a significant number of issues are found during recommissioning, consider increasing the sample rate for testing.

The recommissioning schedule for the equipment / systems is presented in Appendix A.

Consider utilizing a third-party CxA for recommissioning to help analyze building control trends and discover opportunities for additional improvements after the M&V and warranty periods are completed.

The blank FPT forms for the HVAC equipment / systems and the lighting controls are presented in Appendix A. The forms should be used for the recommissioning activities and re-testing. A blank issues log is also included in Appendix A.

2.1.3 Calibration Schedule for HVAC BAS Control Sensors and Actuators

The control sensor / actuator calibration schedule is presented in Appendix B. The schedule describes which sensors / actuators should be calibrated, how frequently they need to be checked, and the acceptable measurement range between control sensors / actuators and calibrated hand-held meters.

The control sensor / actuator calibration form is provided to track the status of the BAS sensors and actuators. The calibration form is presented in Appendix B.

Appendix A

Recommissioning:

- **Schedules**
- **Issues Log**
- **Blank FTP Forms**

Re-test Schedule for Recommissioning of As-Built Systems, Blank Test Forms, and Blank Issues Log

We recommend that the major building equipment and controls for recommissioning and to be re-tested in an ongoing basis in the future. Consider utilizing a continuous / ongoing commissioning consultant to help analyze building trends and discover opportunities for additional improvements after the M&V and warranty periods are completed.

The following is a suggested schedule for re-testing of the equipment / systems. We recommend that samples be taken; if problems are found consider increasing the sample rate.

SSSD Strawberry Park ES:
Re-test Schedule

Tag	Qty.	Equipment Type	Re-test interval (years)	Sample Rate (%)
Air-side Equipment				
AHU-2 with CU-1	1	Variable Air Volume, Multizone Unit with HW Heating and DX Cooling	2	100
VAV-01, -03, -04, and -05	4	VAV Terminal Boxes	2	100
VAV-02	1	VAV Terminal Box interlocked with Kitchen Exhaust Fan	2	100
KEF-1	1	Dishwasher Hood Exhaust Fan	2	100
KEF-2	1	Kitchen Hood Exhaust Fan	2	100
EF-1	1	Art Classroom Exhaust Fan	2	100
EF-2 and -4	2	Restroom Exhaust Fans	2	100
EF-3	1	Kiln Exhaust Fan	2	100
Lighting Controls				
Occupancy Sensors	30	Ceiling and Wall lighting occupancy sensors	1.5	50
Daylighting-Dimming Photocell Sensors	5	Ceiling-mounted daylight photocell sensors	2	100
Exterior Lighting Photocell Sensor	1	Wall-mounted photocell sensor	2	100

The blank re-test forms are included below, as well as a blank issues log.

Recommissioning Issues Log

ISSUES LOG

Project: **Strawberry Park ES - Recommissioning**

Date of This Report:

Issue No.	Date Noted	Affected Equipment	Issue Description	Recommendations	Date Closed	Comments	Anticipated Finish Date
1							
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Recommissioning Issues Log

Project: **Strawberry Park ES - Recommissioning** Date of This Report:

Issue No.	Date Noted	Affected Equipment	Issue Description	Recommendations	Date Closed	Comments	Anticipated Finish Date
33							
34							
35							
36							
37							
38							
39							
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

Equipment: AHU-2 with CU-1
Location: Roof Penthouse / CU on Roof

Make:	Carrier
Model:	39MN14WL6122511XXE
Serial:	3720U40780

Equipment Description:

AHU Type: Variable Air Volume, Multizone Unit with HW Heating and DX Cooling

Area Served: Cafeteria, Art Classroom, and Music Classroom

Cooling: DX Cooling (remote Condensing Unit)

Heating: HW Heating

Fans: Supply Air Fan \ Area Exhaust Air Fans

Special Control Sequences:
Supply fan VFD control
Exhaust fan VFD control
Supply air temperature reset control
Min OA control
Economizer
HW Heating Control Valve
DX Cooling Coil
CO2 Control

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

ANALOG INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Supply Air Temperature (°F)					
Mixed Air temperature (°F)					
Return Air Temperature (°F)					
Outside Air CO2 (PPM)					
Outside Air Flow Station (CFM)					
SA Duct Static Pressure (in WC)					
Space Static Pressure (in WC)					

ANALOG OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Supply fan VFD speed					
MA Damper (OA / RA)					
Relief Air Damper					
HW control valve					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

DIGITAL INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
Supply Fan Status		On/Off			
DX Cooling Status		On/Off			

DIGITAL OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
Supply Fan Start/Stop					
DX Cooling Start / Stop					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

ANALOG ALARMS VERIFICATION						
Tested By:						
Test Date:						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		+/-5°F from Setpt	+/-5°F from Setpt	5		
Mixed Air Temperature Alarm (°F)		35	-	5		

DIGITAL ALARMS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Supply Fan Status Alarm		Normal			
High Duct Static Pressure Alarm		Normal			
Freeze Stat Alarm		Normal			

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set system to normal occupied mode.	The VAV boxes are open at the initial AHU start-up.				
		The MA damper is at minimum position using the OA flow station at AHU start up				
		The Relief Air Damper is closed at AHU start up and modulates opens to maintain the SSP setpoint of +0.020 inWC.				
		Supply fan speed modulates between 20% to 100% speed to maintain the Duct Static Pressure (DSP) setpoint.				
		The BAS Start/Stop program enables the AHU at owner specific start and stop times.				
Supply Fan Speed Control						
1	System is operating in normal occupied mode.	Supply Fan is running continuously and maintaining the DSP setpoint.				
2	Open the air dampers to 100% position on two VAV boxes and wait 5 min. Override the air dampers to 50% position on the VAV boxes and wait 5 min.	The DSP Setpoint is reset between Max DSP = 1.25 (adj) and Min DSP = 0.75 inWC based on VAV box air damper positions. If VAV air dampers are >90%, then DSP setpoint increases. If VAV air dampers are <90%, the DSP setpoint decreases.				
3	Remove all system overrides	AHU reverts to normal occupied mode				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Space Pressure Control						
1	System is operating in normal occupied mode.	The Relief Air Damper is modulating open/closed to maintain the Space Static Pressure sepoint of +0.020 inWC.				
2	Override the SSP input value to greater than the SSP setpoint.	The Relief Air Damper modulates open to lower the SSP and to maintain the SSP setpoint.				
3	Override the SSP input value to less than the SSP setpoint.	The Relief Air Damper modulates toward closed position to increase the SSP and to maintain the SSP setpoint.				
4	Remove all system overrides	AHU reverts to normal occupied mode				
Supply Air Temperature Control						
1	System is operating in normal occupied mode. The SAT reset program is enabled.	The SAT resets from a minimum of 55°F for cooling and maximum of 95°F for heating based on the OAT.				
2	Override the OAT to greater than 80°F and initiate a call for cooling at a VAV box.	The SAT begins to reset downward toward the minimum of 55°F for cooling.				
3	Override the OAT to less than 50°F and initiate a call for heating at a VAV box.	The SAT begins to reset upward toward the maximum of 85°F for heating.				
4	Remove all system overrides	AHU reverts to normal occupied mode				
Mixed Air Temperature Control						
1	System is operating in normal occupied mode. Overried the OAT to 3°F less than the SAT.	The MA Dampers modulate to maintain the SAT setpoint.				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Enable Economizer cooling by overriding the OAT to less than the RAT. Enable space cooling by overriding space temperature for a VAV box to 5°F greater than the space cooling temperature setpoint.	The MA dampers modulate open to maintain the SAT cooling setpoint.				
3	Release the AHU overrides and turn On the kitchen hood exhaust fans, KEF-1 and -2.	The MA dampers modulate open to a minimum position of 30% (adj.).				
3	Remove all system overrides	AHU reverts to normal occupied mode				
Mechanical Cooling Mode						
1	Enable mechanical cooling by overriding the OAT to greater than 80°F. Enable space cooling by overriding space temperature for a VAV box to 5°F greater than the space cooling temperature setpoint.	The DX cooling enables to maintain the SAT cooling setpoint.				
2	Remove all system overrides	AHU reverts to normal occupied mode.				
Demand Control Ventilation - CO2 Control						
1	Enable Demand Ventilation Control by overriding the Space CO2 input to greater than 1,000 ppm CO2 at a VAV box.	The DCV program resets the VAV box minimum ventilation CFM to maintain the code required ventilation to the spaces.				
		The DCV program calculates a new ventilation fraction and the MA damper modulates open above its min position to reduce CO2 concentration.				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Release the Zone CO2 input override.	MA damper modulates back to minimum position on a drop in CO2 concentration.				
3	Remove all system overrides	AHU reverts to normal occupied mode				
Heating Mode						
1	Enable heating by overriding the OAT to less than 50°F and by overriding space temperature for a VAV box to 5°F less than the space heating temperature setpoint.	The HW control valve opens and modulates to maintain the SAT heating setpoint.				
2	With the heating enable overrides in place, wait 10 min.	2nd Stage Heating enables. The HW control valve opens and modulates to maintain the SAT heating setpoint.				
3	Remove all system overrides	AHU reverts to normal occupied mode.				
Unoccupied Mode						
1	Set system to normal unoccupied mode.	Supply and Exhaust Fans are Off.				
		OA and EA dampers are fully closed.				
		RA damper is fully open.				
		The HW control valve is 5% open.				
Unoccupied Heating						
1	In unoccupied mode, enable heating by overriding the OAT to less than 50°F and by overriding space temperature at a VAV box to 5°F less than the space heating temperature setpoint.	Supply Fan turns On and fan speed varies per the DSP setpoint.				
		OA damper remains closed.				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
		The HW control valve opens and modulates to maintain the SAT heating setpoint.				
2	Space temperature reaches unoccupied space heating temperature setpoint.	AHU reverts to normal unoccupied mode.				
3	Reset all parameters to original unoccupied mode settings.	Unit reverts to normal unoccupied mode.				
Morning Warm Up Mode						
1	Enable BAS control to initiate Warm Up Mode.	All VAV box air dampers modulate to full open position for the Max Cooling CFM.				
		After a 3 min. delay, Supply Fan turns On and fan speed varies per the DSP setpoint plus 0.10 inWC.				
		OA and EA dampers are closed and the RA damper is open.				
		BAS modulates the HW control valve to maintain the SAT heating temperature setpoint of 85°F.				
		Once space temperature(s) at the VAV(s) calling for heat reaches setpoint, system enters occupied mode.				
		System returns to original conditions.				
Morning Cold Down Mode						
1	Enable BAS control to initiate Cold Down Mode.	All VAV box air dampers modulate to full open position for the Max Cooling CFM.				
		After a 3 min. delay, Supply Fan turns On and fan speed varies per the DSP setpoint plus 0.10 inWC.				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
		The MA dampers modulate to maintain the SAT cooling temperature setpoint of 55°F.				
		Once space temperature(s) at the VAV(s) calling for cooling reaches setpoint, system enters occupied mode.				
		System returns to original conditions.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: AHU-2 with CU-1

Notes #	Description
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-____

Equipment: VAV-____

Make:	Carrier
Model:	
Serial:	

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served:

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-____

ANALOG INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)					
Supply Air Temperature (°F)					
Space CO2 (ppm)					

ANALOG OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position					
Reheat HW Coil Valve Position					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-____

ANALOG ALARMS VERIFICATION						
Tested By:						
Test Date:						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0		
Space Temperature Alarm (°F)		55	85	300		
Space CO2 Alarm (CO2)		-	1,400	300		

DIGITAL ALARMS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-____

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.				
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.				
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.				
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.				
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.				
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.				
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.				
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.				
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.				
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.				
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.				
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-____

Notes #	Description
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

Equipment: VAV-02
Location: Cafeteria Rm A17

Make:	Carrier
Model:	35EN3000L160D
Serial:	See submittal data

Equipment Description:

Unit Type: Variable air volume terminal unit (VAV box); Single Duct w/ Hot Water Reheat Coil

Area Served: Cafeteria

Special Control Sequences:
None.

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

ANALOG INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Gauge or BAS Value**	**Instrument Measured Value**	**Passed (Yes/No)**	**Note #**
Space Temperature (°F)					
Supply Air Temperature (°F)					
Space CO2 (ppm)					

ANALOG OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Verify Position At 0% Command**	**Verify Position At 50% Command**	**Verify Position At 100% Command**	**Note #**
Air Damper Position					
Reheat HW Coil Valve Position					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

ANALOG ALARMS VERIFICATION						
Tested By:						
Test Date:						
Point Name	**BAS System Name/ Address**	**Low Alarm Limit**	**High Alarm Limit**	**Delay Time (Sec)**	**Alarm Received**	**Note #**
Supply Air Temperature Alarm (°F)		45	130	0		
Space Temperature Alarm (°F)		55	85	300		
Space CO2 Alarm (CO2)		-	1,400	300		

DIGITAL ALARMS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Mode (Graphics)**	**Alarm Indicated (Graphics)**	**Alarm Received**	**Note #**
Not Used					

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Occupied Mode						
1	Set RTU to Occupied Mode. Adjust space temperature setpoint to equal current space temperature.	Damper goes to minimum position. The CFM setpoint is at CFM Min per the TAB setpoint. Heating control valve is closed.				
2	Adjust the space heating temperature setpoint to be 5°F greater than the current space temperature.	The unit enters Heating Mode and the CFM setpoint changes to the Min Heating setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.				
		The CFM setpoint resets between the Min Heat CFM setpoint and the Cooling CFM setpoint based on space temperature deviation from setpoint to meet the space temperature setpoint.				
3	Adjust the space cooling temperature setpoint to be 5°F lower than the current space temperature	The unit enters Cooling Mode and the unit damper opens fully to the Cooling CFM set point. Heating coil valve is closed. The CFM setpoint resets between Cooling CFM and Min Heating CFM based on space temperature deviation from setpoint to meet the space temperature setpoint.				
4	Release all overrides and adjust the space CO2 reading to 1,200 ppm. The space CO2 setpoint is 900 ppm (adj).	The CFM setpoint initially goes to the Cooling CFM setpoint. The CFM setpoint resets linearly between Cooling CFM and the Min Heating CFM setpoints. Heating coil valve is closed.				
5	Release all VAV overrides; set space temperature setpoints to original values.	The unit reverts to normal operation and the damper should be in its minimum position.				
Kitchen Ventilation Mode						
1	Set RTU to Occupied Mode. VAV is set to normal occupied mode.	VAV operates per the control sequence shown above.				
2	Activate the Kitchen Exhaust Hood by turning On the EF switch.	VAV is in Occupied Mode and unit damper opens fully to the CFM Max set point.				

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
		VAV maintains constant volume air flow at CFM Max.				
3	Deactivate the Kitchen Exhaust Hood by turning Off the EF switch.	VAV returns to normal operating mode.				
4	Release all VAV overrides.	The unit reverts to normal operation and the damper should be in its minimum position.				
Unoccupied Mode						
1	Place the RTU into Unoccupied Mode.	Damper is at full open position. The space temperature setpoint is 60°F (adj.).				
2	Adjust the space temperature to less than 60°F.	The RTU starts, the VAV box enters Heating Mode, and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint. The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.				
3	Reset the space temperature setpoint to the original value.	System returns to original conditions.				
VAV Box Warm-Up Mode						
1	Observe VAV box when RTU is in Warm-Up Mode.	The VAV box enters Heating Mode and the CFM setpoint changes to the Min Heating CFM setpoint. Heating control valve opens and modulates to maintain the space heating temperature setpoint.				
		The CFM setpoint resets between the Min Heating CFM setpoint and the Cooling CFM setpoint.				
2	Respective space reaches its Occupied Heating setpoint.	The unit damper modulates to its Min Heating CFM setpoint and remains at minimum position until the RTU goes into Occupied Mode.				
3	Reset the any setpoints or parameters back to original values.	System returns to original conditions.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: VAV-02

Notes #	Description
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

Equipment: KEF-1
Location: Roof

Make:	ACME Engineering
Model:	PNU150RF
Serial:	20L1230-1

Equipment Description:

Fan Type: Constant Volume, Direct Drive Roof Exhaust Fan

Area Served: Kitchen Hood Exhaust

Special Control Sequences: None

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

DIGITAL INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-1 Status	[BAS monitoring point]	On/Off			

DIGITAL OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-1 Start/Stop	[Local On/Off switch on hood]	On/Off			

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Fan Control (for fans with manual On/Off control via switch): KEF-1						
1	Turn kitchen hood switch to On position.	Exhaust Fan turns On.				
		Associated VAV box switches to Kitchen Ventilation Mode and operates as a constant volume VAV.				
2	Turn kitchen hood switch to Off position.	Exhaust Fan Turns Off.				
		Associated VAV box reverts back to normal operating mode.				
3	Reset system to original parameters.	System returns to original conditions.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-1

Notes #	Description
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

Equipment: KEF-2
Location: Roof

Make:	ACME Engineering
Model:	PDU110RF
Serial:	20G1651

Equipment Description:

Fan Type: Constant Volume, Direct Drive Roof Exhaust Fan

Area Served: Kitchen Dishwasher Hood Exhaust

Special Control Sequences: None

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

DIGITAL INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-2 Status	[BAS monitoring point]	On/Off			

DIGITAL OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
KEF-2 Start/Stop	[Local On/Off switch on hood]	On/Off			

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Fan Control (for fans with manual On/Off control via switch): KEF-2						
1	Turn kitchen hood switch to On position.	Exhaust Fan turns On.				
		Associated VAV box switches to Kitchen Ventilation Mode and operates as a constant volume VAV.				
2	Turn kitchen hood switch to Off position.	Exhaust Fan Turns Off.				
		Associated VAV box reverts back to normal operating mode.				
3	Reset system to original parameters.	System returns to original conditions.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: KEF-2

Notes #	Description
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

Equipment: EF-1, -2, -3, and -4	
Location:	

Make:	
Model:	
Serial:	

Equipment Description:

Fan Type: Constant Speed EFs, Inline and Ceiling Exhaust Fans

Area Served: Art Classroom, Pre-K Bathrooms & Kitchen, Kiln Room, and SPED Bathroom

Special Control Sequences: None

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

DIGITAL INPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
EF-1 Status		On/Off			
EF-2 Status		On/Off			

DIGITAL OUTPUTS VERIFICATION					
Tested By:					
Test Date:					
Point Name	**BAS System Name/ Address**	**Normal Position**	**On**	**Off**	**Note #**
EF-1 Start/Stop		On/Off			
EF-2 Start/Stop		On/Off			

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

Test Procedures						
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Verified By**	**Date**	**Note #**
Fan Control (for fans with BAS control): EF-1						
1	Override BAS schedule to "Occupied" mode.	Exhaust Fan turns On.				
2	Override BAS schedule to "Unoccupied" mode.	Exhaust Fan Turns Off.				
3	Reset system to original parameters.	System returns to original conditions.				
Fan Control (for fans with BAS control): EF-2						
1	Override BAS schedule to "Occupied" mode.	Exhaust Fan turns On.				
2	Override BAS schedule to "Unoccupied" mode.	Exhaust Fan Turns Off.				
3	Reset system to original parameters.	System returns to original conditions.				
Fan Control (for Kiln Room exhaust fan control): EF-3						
1	Adjust space thermostat setpoint to below current space temperature. The space temperature setpoint is 85°F.	Exhaust Fan turns On and run continuously.				
2	Adjust the space thermostat setpoint to above the current space temperature.	Exhaust Fan turns Off.				
3	Reset the space thermostat to original space temperature setpoint.	Exhaust fan operation returns to normal operating conditions.				
Fan Control (for fan interlocked w/ lighting occupancy sensor control): EF-4						
1	Turn wall light switch to ON position.	Exhaust Fan turns On.				
2	Turn wall light switch to OFF position.	Exhaust Fan Turns Off.				
3	Turn wall light switch to ON position, activate occupancy sensor.	Exhaust Fan turns On.				
4	Wait for occupancy sensor to time out.	Exhaust Fan Turns Off.				
5	Reset system to original parameters.	System returns to original conditions.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: EF-1, -2, -3, and -4

Notes #	Description
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PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: General Lighting Controls

Equipment: General Lighting Controls
Location: See plans

Make:	See plans
Model:	See submittal
Serial:	See submittal

Equipment Description:

Sensor Type: Ceiling / Wall mounted occupancy sensors; photocell sensors

Area Served: See plans.

Special Control Sequences:
Vacancy-Occupancy Sensors

PCD Engineering						Tested By:		
Project/Location: Strawberry Park ES						Test Date:		
		Occupancy Sensor No.	1	2	3	4	5	6
		Room No.:	Cafeteria Rm A17	Restroom A22	Storage Rm A4	Art Rm A23	Music Rm A19	Hall A15
		Occupancy Sensor Type:	Ceiling (11)	Wall	Wall	Ceiling (2)	Ceiling (2)	Ceiling (2)
Test Procedures		Notes:	-	-	1	2, 3	2	4
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**
Vacancy and On/Off - Occupancy Sensor Operation			**On/Off**	**On/Off**	**Vacancy**	**Vacancy**	**Vacancy**	**On/Off**
1	Turn switch to FULL ON position.	All lights turns ON.						-
2	Turn wall switch to OFF position.	Room lights are OFF.						-
3	Activate vacancy sensor.	Lights remain OFF.	N/A	N/A				-
4	Turn switch to ON position and activate occupancy sensor.	Lights turns ON.						-
5	Without tripping vacancy - occupancy sensor, verify time delay for lights to turn OFF.	Identify the time required for occupancy sensor to turn lights OFF: 15 to 20 min.						-
6	Turn wall switch to OFF position.	Lights turns OFF immediately.						-
7	Return all changed parameters & conditions to pre-test values.	System returns to normal operation.						-

PCD Engineering
Project/Location: Strawberry Park ES

		Occupancy Sensor No.	7	8	9
		Room No.:	Pre-K Classroom C2	Pre-K Classroom C3	Classroom Entry C15
		Occupancy Sensor Type:	Ceiling	Ceiling	Ceiling
Test Procedures		Notes:	-	-	-
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**
Vacancy and On/Off - Occupancy Sensor Operation			**Vacancy**	**Vacancy**	**On/Off**
1	Turn switch to FULL ON position.	All lights turns ON.			
2	Turn wall switch to OFF position.	Room lights are OFF.			
3	Activate vacancy sensor.	Lights remain OFF.			N/A
4	Turn switch to ON position and activate occupancy sensor.	Lights turns ON.			
5	Without tripping vacancy - occupancy sensor, verify time delay for lights to turn OFF.	Identify the time required for occupancy sensor to turn lights OFF: 15 to 20 min.			
6	Turn wall switch to OFF position.	Lights turns OFF immediately.			
7	Return all changed parameters & conditions to pre-test values.	System returns to normal operation.			

PCD Engineering						Tested By:	
Project/Location: Strawberry Park ES						Test Date:	
		Daylight Sensor No.	1	2	3	4	5
		Room No.:	Art Rm A23	Art Rm A23	Music Rm A19	Pre-K Classroom C2	Pre-K Classroom C3
Test Procedures		Notes:					
Task #	**Action Item**	**Expected Response**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**	**Passed (Yes/No)**
Daylighting Controls - System Operation							
1	Turn wall switch to ON position and activate occupancy sensor.	Room lights are ON.					
2	Shine flashlight directly on photocell or observe photocell operation during daylight hours.	Lighting dimming level decreases.					
3	Remove flashlight from photocell and wait 5 min. or turn lights Off, then On and observe dimming.	Lighting dimming level increases and returns to light level before start of test.					
4	Turn wall switch to OFF position.	Lights turns OFF immediately.					
5	Return all changed parameters & conditions to pre-test values.	System returns to normal operation.					

PCD Engineering	Tested By:
Project/Location: Strawberry Park ES	Test Date:

Exterior Lighting Photocell Sensor Operation

Test Procedures

Task #	Action Item	Expected Response	Passed (Yes/No)	Verified By	Date	Note #
1	Observe photocell operation at dusk.	Lights turns ON.				
2	Observe photocell operation after dawn.	Lights turn OFF.				

PCD Engineering
Project/Location: Steamboat Springs SD, Strawberry Park ES
Equipment: General Lighting Controls

Notes #	Description
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Appendix B

Recommended Schedule for Calibrating Sensors and Actuators

Recommended Schedule for Calibrating HVAC BAS Control Sensors and Actuators

The BAS control sensors should be checked and calibrated regularly as part of recommissioning activities. The control system actuators should be checked and adjusted if applicable.

The Control Sensor / Actuator Calibration Schedule describes which control sensors should be calibrated / which control actuators should be adjusted, how frequently they need to be checked, and the acceptable measurement ranges between control sensors / actuators and calibrated hand-held meters.

Control Sensor / Actuator Calibration Schedule

AHU-2 Calibration Points

POINT	Acceptable Range	Frequency
Supply air temperature	±1°F	Annually
Mixed air temperature	±1°F	Annually
Return air temperature	±1°F	Annually
OA CO2 (ppm)	±50 ppm	Annually
Supply duct static pressure	±0.01 in WC	Annually
Space static pressure	±0.01 in WC	Annually
HW control valve actuator	±5%	Annually
MA (mixed air) damper actuator	±5%	Annually
Relief air damper actuator	±5%	Annually

VAV Terminal Unit Calibration Points

POINT	Acceptable Range	Frequency
Space air temperature	±1°F	Annually
Supply air temperature	±1°F	Annually
Space CO2 (ppm)	±50 ppm	Annually
HW Reheat control valve actuator	±5%	Annually
Air damper actuator	±5%	Annually

Recommended Hand-held Measurement Devices

(All hand-held measurement devices used to calibrate sensors should periodically be sent out for recalibration per the manufacturer's recommendations and schedule)

Measuring Device	Frequency	Company Name	Phone #
TPI 623 Digital Manometer	Annually	Global Test Supply	(888) 610-7664
Fluke 54 II Digital Thermometer	Annually	Fluke	(877) 355-3225
Fluke 179 Multimeter	Annually	Fluke	(877) 355-3225

The following form can be used for record-keeping purposes. It can be useful in tracking sensors / actuators that are repeatedly going out of calibration to provide proof of a need for

replacement. If a sensor / actuator must be replaced, a field calibration check on the new sensor / actuator must also be conducted to ensure that the proper offset for the new sensor / actuator is programmed into the BAS.

Control Sensor / Actuator Calibration Form

Point Name	Date Calibrated	Sensor / Actuator Condition and Placement Ok? (Y/N)	Field Measured Value (°F) / (%)	BAS Value (°F) / (%)	As-found BAS Offset from Measured Temp (°F) / Actuator (%)	New BAS Offset to Correct to Measured Value	Final Measured Value	Final BAS Value with Notes

Tab 7:

HVAC System Control Drawings / Lighting Control Drawings

SSSD Strawberry Park ES

39620 Amethyst Drive

Steamboat Springs, CO 80487

Architect: TAB Associates

Engineer: BG Building Works

Contractor: FCI CONSTRUCTORS INC

Project Number: TC6230

Drawing Index:

Notes

(1) Hot Water System installed under project TC6068.

LONG™

Long live your building!

Grand Junction

388 Indian Road

Grand Junction

CO 81501

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Service: (970) 434-5664

Fax: (303) 936-2755

LONG

ALASKA - COLORADO - OREGON
NEVADA - UTAH - WASHINGTON
WYOMING

Revision: Submitted

#	Change:	Date:
1		
2		
3		
4		
5		

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Title Page

Job Number TC6230

Last Saved 6/18/2020

Last Printed 6/18/2020

File Name

Sheet Number TC1.1

ABBREVIATIONS

TAG	DESCRIPTION	TAG	DESCRIPTION
AC	AIR COMPRESSOR	HT	HUMIDITY TRANSMITTER
AD	AIR DRYER	HTHWR	HIGH TEMP HEATING WATER RETURN
ADJ	ADJUSTABLE	HTHWS	HIGH TEMP HEATING WATER SUPPLY
A.F.F.	ABOVE FINISHED FLOOR	HW	HOT WATER
AHU	AIR HANDLING UNIT	HWP	HEATING WATER PUMP
AI	ANALOG INPUT	HWR	HEATING WATER RETURN
ALM	ALARM	HWS	HEATING WATER SUPPLY
AM	AMMETER	HX	HEAT EXCHANGER
AO	ANALOG OUTPUT	KWM	KW METER
AP	ALARM PANEL	LL	LOW LIMIT
AQ	AIR QUALITY	LLSV	LIQUID LINE SOLENOID VALVE
AR	ALARM RELAY	LS	LIMIT SWITCH
AUX	AUXILIARY	mA	MILLIAMPS
B	BOILER	MA	MIXED AIR
BFP	BOILER FEEDWATER PUMP	MAG	MAGNETIC MOTOR STARTER
C	COIL	MAU	MAKEUP AIR UNIT
CB	CIRCUIT BREAKER	MAT	MIXED AIR TEMPERATURE
CFP	CHEMICAL FEED PUMP	MAX	MAXIMUM
CH	CHILLER	MCC	MOTOR CONTROL CENTER
CHW	CHILLED WATER	MDM	MODEM
CHWP	CHILLED WATER PUMP	MH	MAGNAHELIC
CHWR	CHILLED WATER RETURN	MIN	MINIMUM
CHWS	CHILLED WATER SUPPLY	MTR	MOTOR
CI	CONTACT INPUT	N.C.	NORMALLY CLOSED
CO	CONTACT OUTPUT	N.O.	NORMALLY OPEN
COM	COMMON	OA	OUTSIDE AIR
COMM	COMMUNICATIONS CARD	OAD	OUTSIDE AIR DAMPER
CP	CONTROL PANEL	OAT	OUTSIDE AIR TEMPERATURE
CRAC	COMPUTER ROOM AIR CONDITIONER	OL	OVERLOAD
CR	CONTROL RELAY	OS	OCCUPANCY SENSOR
CRP	CONDENSER RETURN PUMP	PB	PUSHBUTTON
CS	CURRENT SENSING SWITCH	PC	PERSONAL COMPUTER
CT	CURRENT TRANSFORMER	PE	PNEUMATIC/ELECTRIC SWITCH
CU	CONDENSING UNIT	PL	PILOT LIGHT
CUH	CABINET UNIT HEATER	POT	POTENTIOMETER
CW	CONDENSER WATER	PS	PRESSURE SWITCH
CWP	CONDENSER WATER PUMP	PSI	POUNDS PER SQ. INCH
CWR	CONDENSER WATER RETURN	PSIA	POUNDS PER SQ. INCH ABSOLUTE
CWS	CONDENSER WATER SUPPLY	PSID	POUNDS PER SQ. INCH DIFF.
DMPR	DAMPER	PSIG	POUNDS PER SQ. INCH GAUGE
D.A.	DIRECT ACTING	R	RELAY
DA	DISCHARGE AIR	R.A.	REVERSE ACTING
DAD	DISCHARGE AIR DAMPER	RA	RETURN AIR
DAT	DISCHARGE AIR TEMPERATURE	RAD	RETURN AIR DAMPER
DDC	DIRECT DIGITAL CONTROL	RAT	RETURN AIR TEMPERATURE
DHWP	DOMESTIC HOT WATER PUMP	RC	RECEIVER CONTROLLER
DHWR	DOMESTIC HOT WATER RECIRC.	RES	RESISTOR
DHWS	DOMESTIC HOT WATER SUPPLY	RF	RETURN FAN
DI	DIGITAL INPUT	RHC	REHEAT COIL
DISAB	DISABLE	RIB	RELAY IN A BOX
DM	DAMPER MOTOR	RMT	ROOM TEMPERATURE
DO	DIGITAL OUTPUT	RTU	ROOF TOP UNIT
DPS	DIFFERENTIAL PRESS. SWITCH	SA	SUPPLY AIR
DPT	DIFFERENTIAL PRESS. TRANSMITTER	SD	SMOKE DETECTOR
DTC	DATA TERMINATION CABINET	SF	SUPPLY FAN
DWH	DOMESTIC WATER HEATER	SG	STEAM GENERATOR
DX	DIRECT EXPANSION COOLING	SPT	STATIC PRESSURE TRANSMITTER
(E)	EXISTING	SS	START/STOP
EA	EXHAUST AIR	STS	STATUS
EAD	EXHAUST AIR DAMPER	SV	SOLENOID VALVE
EDH	ELECTRIC DUCT HEATER	SW	SWITCH
EF	EXHAUST FAN	T	THERMOSTAT
ENAB	ENABLE	TB	TERMINAL BLOCK
EOL	END OF LINE	(TC#####)	JOB NUMBER FOR PREVIOUS SCOPE
EP	ELECTRIC/PNEUMATIC VALVE	TC	TIME CLOCK
EPT	VOLTAGE TO PNEUMATIC TRANSDUCER	TCC	TEMPERATURE CONTROL CONTRACTOR
ES	END SWITCH	TCP	TEMPERATURE CONTROL PANEL
F	FUSE	TDR	TIME DELAY RELAY
F.C.	FAIL CLOSE	TF	TRANSFER FAN
F.O.	FAIL OPEN	TK	PNEUMATIC THERMOSTAT
FAP	FIRE ALARM PANEL	TR	TRANSFORMER
FCR	FLUID COOLER	TS	TEMPERATURE SENSOR
FCU	FAN COIL UNIT	TSP	TWISTED SHIELDED PAIR
FE	FLOW ELEMENT	TT	TEMPERATURE TRANSMITTER
FLS	FLOAT SWITCH	UH	UNIT HEATER
FM	FLOW METER	UI	UNIVERSAL INPUT
FMOD	FIRE MODULE	V	VALVE
FOP	FUEL OIL PUMP	VA	VOLTAMPS
FS	FLOW SWITCH	VAC	VOLTS ALTERNATING CURRENT
FT	FLOW TRANSMITTER	VAV	VARIABLE AIR VOLUME
FTP	FUEL OIL TRANSFER PUMP	VDC	VOLTS DIRECT CURRENT
G	GAUGE	VFD	VARIABLE FREQUENCY DRIVE
GND	GROUND	VM	VOLTMETER
L1	120V HOT	W.C.	WATER COLUMN
L2	120V NEUTRAL	Z	ZONE
H	HUMIDISTAT		

Drawing Legend (1 of 3)

PNEUMATIC TUBING SPECIFICATIONS

COLOR	USE
Black	20 PSI main line
White	Pneumatic branch line
Red	Fire dampers OR emergency main air OR hot water valves
Orange	Air Handling Unit dampers
Green	Outside Air static pressure reference
Blue	Chilled water valve
Purple	Duct static pressure reference
Yellow	Building static pressure reference
Twin Tube	Plain tube is main air; Tube with labeling is pneumatic branch line

DRAWING SYMBOLS

- (1) — REFER TO EXPLANATION IN "SHEET NOTES"
- 1 — DRAWING REFERENCE
- 1 — AREA AFFECTED BY REVISION
- 1 — DRAWING AFFECTED BY REVISION
- 2 — REFERENCE TO DETAIL DRAWING

INPUT AND OUTPUT RESISTORS

DMS – MICROSMART controllers

- ® 1K Ohm, 1%, ¼ watt resistor – Converts analog input to digital input
- ® 500 Ohm, 1%, ¼ watt resistor – Converts 4-20mA output to 0-10VDC
- ® 750 Ohm, 1%, ¼ watt resistor – Converts 4-20mA output to 0-15VDC

R500 SERIES ONLY

- ® 22.1 Ohm, 1%, ¼ watt resistor – on 4-20mA inputs

NETWORK 8000 (MICROZONE II)

- 250Ω — 250 Ohm, 1%, ¼ watt resistor – Converts 4-20mA input to 1-5VDC
- 500Ω — 500 Ohm, 1%, ¼ watt resistor – Converts 4-20mA input to 0-10VDC

NOTE: THIS LEGEND IS TYPICAL FOR ALL LONG BI PROJECTS.
NOT ALL NOTES, SYMBOLS, ETC. INCLUDED HERE APPLY TO THE DRAWING SET.

TYPICAL INSTALLATION NOTES:

PNEUMATIC INSTALLATION NOTES:
ALL EXPOSED PNEUMATIC TUBING WILL BE POLYETHYLENE TUBING ENCLOSED IN METAL RACEWAY, OR WILL BE SEAMLESS HARD DRAWN COPPER. ALL CONCEALED PIPING WILL BE SEAMLESS SOFT DRAWN COPPER, HARD DRAWN COPPER OR POLYETHYLENE TUBING ENCLOSED IN CONDUIT. POLYETHYLENE FIRE RATED TUBING MAY BE RUN IN CONCEALED AND FULLY ACCESSIBLE AREAS PROVIDED THERE IS NO POSSIBILITY OF PHYSICAL DAMAGE. COPPER HARD DRAWN TUBING INSTALLATIONS EXPOSED TO VIEW WILL HAVE A MAXIMUM UNSUPPORTED LENGTH OF 3 FEET, (7 FEET IN ALL OTHER LOCATIONS). A SUPPORT WILL BE PROVIDED WITHIN 12 INCHES OF EACH CHANGE OF DIRECTION. POLYETHYLENE TUBING WILL BE ROUTED IN CABLE TRAY, METALLIC RACEWAY, ATTACHED TO CONDUIT DEDICATED FOR THAT SOLE PURPOSE, OR SUPPORT WIRES THAT PROVIDE SECURE SUPPORT AND THAT ARE INSTALLED IN ADDITION TO THE CEILING GRID SUPPORT WIRES. TUBING SHALL NOT BE ATTACHED TO PIPES OR CONDUIT INSTALLED BY OTHERS OR CEILING GRID SUPPORT WIRES. TUBING WILL BE INSTALLED PARALLEL WITH BUILDING LINES. TUBING SHALL NOT BE LOOSELY DRAPED BETWEEN SUPPORTS OR LAID ACROSS CEILING TILES AND WILL NOT BE INSTALLED IN THE SAME CONDUIT AS WIRING. SMALL AMOUNTS OF SLACK MAY BE LEFT WHEN CONNECTING TO CONTROL PARTS SUCH AS ACTUATORS OR WHERE VIBRATION DAMAGE MAY OCCUR. TUBING USED IN A CONCRETE POUR MUST BE INSTALLED IN METALLIC CONDUIT OR RIDGED NONMETALLIC CONDUIT.

WIRING INSTALLATION NOTES:
INSTALLATION OF WIRING, CABLE, CONDUIT ETC. WILL CONFORM TO DIVISION 16 REQUIREMENTS. PLENUM WIRING MAY BE INSTALLED IN ACCESSIBLE AREAS WHERE NOT EXPOSED TO VIEW OR SUBJECT TO PHYSICAL DAMAGE. PLENUM WIRING WILL NOT CARRY ANY VOLTAGE GREATER THAN 24 VOLTS. PLENUM WIRE OR CABLE WILL BE ROUTED IN CABLE TRAY, METALLIC RACEWAY, ATTACHED TO CONDUIT DEDICATED FOR THAT SOLE PURPOSE, OR SUPPORT WIRES THAT PROVIDE SECURE SUPPORT AND THAT ARE INSTALLED IN ADDITION TO THE CEILING GRID SUPPORT WIRES. WIRING SHALL NOT BE ATTACHED TO PIPES OR CONDUIT INSTALLED BY OTHERS OR CEILING GRID SUPPORT WIRES. WIRING WILL BE INSTALLED PARALLEL WITH BUILDING LINES AND SECURED AT LENGTHS NO GREATER THAN 4 1/2 FEET. PLENUM WIRING SHALL MAINTAIN A MINIMUM SPACING OF 6 INCHES FROM ANY LINE VOLTAGE CONDUIT OR DEVICE. PLENUM COMMUNICATION CABLE SHALL BE ROUTED NO CLOSER THAN 12 INCHES FROM ANY FLUORESCENT OR HIGH DISCHARGE ELECTRICAL LIGHTING AND 3 FEET FROM VOLTAGES AND TRANSFORMERS GREATER THAN 600 VOLTS. PLENUM WIRING WITH OR WITHOUT SHIELD WILL NOT BE SPLICED OUTSIDE OF CONTROL DEVICES UNLESS ABSOLUTELY NECESSARY THEN IT MUST BE DONE WITHIN AN APPROVED ENCLOSURE CONTAINING TERMINAL BLOCK CONNECTIONS LOCATED IN AN ACCESSIBLE AREA. COMMUNICATION WIRING WILL NOT BE RUN IN THE SAME CONDUIT OR ENCLOSURE AS LINE VOLTAGE WIRING WITH THE EXCEPTION OF INSIDE D.D.C. CONTROL PANELS. CONTROL WIRING AND LINE VOLTAGE WIRING WILL BE ALLOWED TO OCCUPY THE SAME ENCLOSURE ONLY WHEN FUNCTIONALLY ASSOCIATED FOR THE CONTROL OF THE LINE VOLTAGE EQUIPMENT.

ALL APPLICABLE CODES AND SPECIFICATIONS SHALL APPLY. THOSE MORE STRINGENT THAN THE ABOVE GUIDELINES SHALL TAKE PRECEDENCE.

LONG
ALASKA - COLORADO - OREGON
NEVADA - UTAH - WASHINGTON
WYOMING

Revision: Submitted

#	Change:	Date:
1		
2		
3		
4		
5		

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC
Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

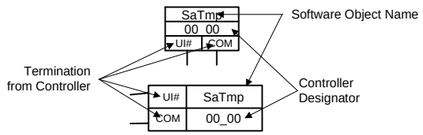
Drawing Legend (1 of 3)

Job Number TC6230
Last Saved 6/18/2020
Last Printed 6/18/2020
File Name
Sheet Number TC2.1

Drawing Legend (2 of 3)

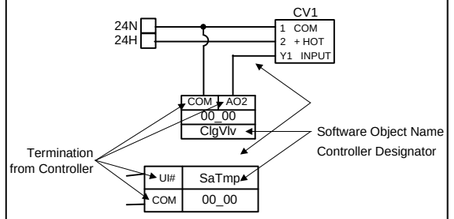
Symbol Legend

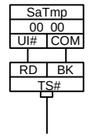
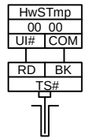
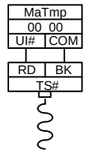
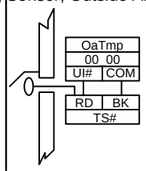
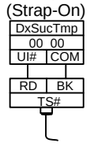
Input/Output Blocks

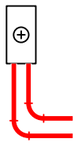
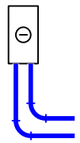
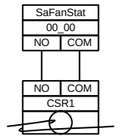
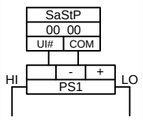
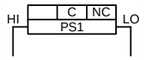


Damper or Valve Actuator

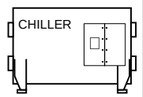
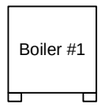
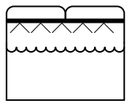
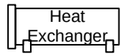
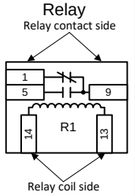
LONG standard color is WHT-24N, BLK-24H, RED-Signal unless otherwise dictated by the MFG provided wire whip

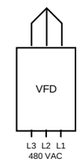
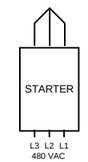
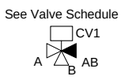
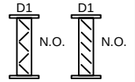


Temperature Sensor, Duct Probe	Temperature Sensor, Immersion	Temperature Sensor, Averaging	Temperature Sensor, Outside Air	Temperature Sensor, Room	Temperature Sensor, Bulb (Strap-On)
					

Hydronic Heating Coil	Hydronic Cooling Coil	Gas Heating	Current Sensor	Pressure Sensor	Pressure Switch
					

DX Cooling 1 Stage	HeatPump or Dual Pipe Coil	Electric Heating	Smoke Detector	Transformer	Filter
					

Chiller	Boiler	Cooling Tower	Pump	Heat Exchanger	Relay
					

VFD	Motor Starter	3-way Valve	2-way Valve	Fan	Damper
					

General Notes

1. All room thermostats/sensors/controllers shall be installed at height indicated on the mechanical drawings. For replacement of existing devices, leave sufficient rolled coil of wire above the ceiling should the device need to be moved down to meet this requirement in the future.

2. Wire pulls require spare conductors be pulled for future use. Consult with the project manager or construction manager for details. The shield/drain is not suitable for a conductor.

3. All thermowells shall be filled with heat conductive compound.

4. Wiring Terminations designated as '#' or '##' indicate information was unavailable at time of submittal. Please inform LONG before making field terminations.

5. Remote control devices, not in local panels, shall be accessible for adjustment and service - below 7' above fixed floor whenever possible or as shown on the provided Construction prints.

6. Only prints marked "CONSTRUCTION" are to be used during installation. If the prints are not marked Construction, the installer will correct any discrepancies between prints used and Construction at no cost to LONG.

7. All new BAS controller panels shall have a dedicated 120Vac power source. This source shall be located and marked in the electrical panel as well as on the control prints returned to LONG for Record prints.

8. Installer responsible for maintaining existing safeties into new BAS control – electrically or pneumatically connected.

9. See Division 23 09 00 for any additional information on installation standards.

Detail Name

Color	3-Letter	2-Letter	1-Letter
Black	BLK	BK	b
Brown	BRN	BR	n
Red	RED	RD	r
Orange	ORG	OR	o
Yellow	YEL	YL	y
Green	GRN	GN	g
Blue	BLU	BU	u
Violet	VIO	VL	v
Gray	GRY	GY	a
White	WHT	WH	w
Gold	GLD	GL	d
Silver	SLV	SV	s
Pink	PNK	PK	p

1-Letter abbreviations used for color of stripe on wire. (WH/o = White wire with orange stripe)

Cable Specifications

COMMUNICATIONS

ASD BUS (NW8) - 22/2 Plenum/Shielded/Blue
DIII-NET (DAIKIN) - 18/2 Plenum/No Shield
- White with Black stripe between gateway and CU
- White with Orange stripe between CU and BS (or FCU)
- White with Green stripe between BS and FCU
- White with Purple stripe between FCU and Sensor

ECHELON (I/A) - 22/2 Plenum/No Shield/Orange
EIA-485 TIER 2 (KMD) - 18/2 Plenum/Shielded/Teal
I-NET (CSI) LAN - 22/2 Plenum/Shielded/White with Orange stripe
I-NET (CSI) SUBLAN - 22/2 Plenum/Shielded/White with Blue stripe
MICRONET U-BUS - 22/2 Plenum/No Shield/Grey
MICROSMART BUS (DMS) - 22/2 Plenum/Shielded/Blue
MODBUS - 18/2 Plenum/Shielded/Pink or 18/4 Plenum/Shielded/White or device manufacturer's recommendations
MSTP (KMC & TAC) - 24/2 Plenum/Shielded/White with Red stripe
BACnet IP (KMC & DisTech) – 24/8 Cat 5E Plenum/No Shield/Green

CONTROLLER INPUTS AND OUTPUTS

(Consisting of all controllers except MICRONET Devices)
18/2 Plenum/Shielded/Yellow
18/2 Plenum/Shielded/Tan
18/2 Plenum/Shielded/Cream
18/2 Plenum/Shielded/Light Purple
18/2 Plenum/Shielded/Light Blue
18/2 Plenum/Shielded/Teal
18/2 Plenum/Shielded/Pink
KMD Netsensor (KMC) - 24/6 Plenum/No Shield/Brown
STE Netsensor/Smartvue (KMC & DisTech) – 24/8 Cat5E Plenum/No Shield/Purple

MICRONET Controller inputs and outputs

U-LINK (SENSOR) - 22/2 Plenum/No Shield/Purple
FLOATING VALVE - 18/3 Plenum/No Shield/White
MICRONET POWER - 16/2 Plenum/No Shield/White

NOTE: Wires carrying an external power source that enter our TCPs will be yellow for all applications

NOTE: Shields will not be connected to the controllers or grounded for inputs and outputs unless determined necessary by the control technician. Strip and tape as instructed by installation manager. Communication shields are to be connected through out line but not grounded unless determined necessary by the control technician.

LONG
ALASKA - COLORADO - OREGON
NEVADA - UTAH - WASHINGTON
WYOMING

Revision: Submitted

#	Change:	Date:
1		
2		
3		
4		
5		

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC
Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Drawing Legend (2 of 3)

Job Number TC6230
Last Saved 6/18/2020
Last Printed 6/18/2020
File Name
Sheet Number TC2.2

Drawing Legend (3 of 3)

SEBA STANDARD POINT NAMES

Standard Name	Point Type	General Description
2pP#Cmd	DO	2-Pipe Pump Command
2pP#Sts	DI	2-Pipe Pump Status
2pRTmp	AI	2-Pipe Return Temperature
2pSTmp	AI	2-Pipe Supply Temperature
2pSwoVlvCmd	DO	2-Pipe Switchover Valve Command
2pVlvPos	DI	2-Pipe Valve Position
AirFl	AI	Air Flow
AlmSig	DI	Alarm Signal
AuxCmd	DI	Auxiliary Command
AuxConSts	DI	Auxiliary Contact Status
BldgDP	AI	Building Differential Pressure
BldgHwRTmp	AI	Building Hot Water Return Temperature
BldgHwSTmp	AI	Building Hot Water Supply Temperature
BldgStPr	AI	Building Static Pressure
Blr##Alm	DI	Boiler ## Alarm
Blr##CpCmd	DO	Boiler ## Circulation Pump Command
Blr##CpSts	DI	Boiler ## Circulation Pump Status
Blr##Ena	DO	Boiler ## Enable
Blr##IsoVlvCmd	DO	Boiler ## Isolation Valve Command
Blr##RTmp	AI	Boiler ## Return Temperature
Blr##STmp	AI	Boiler ## Supply Temperature
Blr##Sts	DI	Boiler ## Status
BlrBypVlvPos	AO	Boiler Bypass Valve Position
BypDprPos	AO	Bypass Damper Position
BypTmp	AI	Bypass Temperature
CdStPr	AI	Cold Deck Static Pressure
CdTmp	AI	Cold Deck Temperature
Ch##Alm	DI	Chiller ## Alarm
Ch##CwRTmp	AI	Chiller ## Condenser Water Return Temperature
Ch##CwSTmp	AI	Chiller ## Condenser Water Supply Temperature
Ch##DP	AI	Chiller ## Differential Pressure
Ch##Ena	DO	Chiller ## Enable
Ch##Falm	DI	Chiller ## Fail Alarm
Ch##Fl	AI	Chiller ## Flow
Ch##FlSw	DI	Chiller ## Flow Switch
Ch##IsoVlvCmd	DO	Chiller ## Iso Valve Command
Ch##RTmp	AI	Chiller ## Return Temperature
Ch##STmp	AI	Chiller ## Supply Temperature
Ch##Sts	DI	Chiller ## Status
ChwBypFl	AI	Chilled Water Bypass Flow
ChwBypTmp	AI	Chilled Water Bypass Temperature
ChwBypVlvCmd	DO	Chilled Water Bypass Valve Command
ChwBypVlvPos	AO	Chilled Water Control Valve
ChwDP	AI	Chilled Water Differential Pressure
ChwDtmp	AI	Chilled Water Differential Temperature
ChwFl	AI	Chilled Water Flow Meter
ChwMixVlvPos	AO	Chilled Water Control Valve
ChwP##Alm	DI	Chilled Water Pump ## Alarm
ChwP##Amp	AI	Chilled Water Pump ## Amperage
ChwP##Cmd	DO	Chilled Water Pump ## Command
ChwP##DP	AI	Chilled Water Pump ## Differential Pressure
ChwP##Fbk	AI	Chilled Water Pump ## Feedback
ChwP##Spd	AO	Chilled Water Pump ## Speed Command
ChwP##Sts	DI	Chilled Water Pump ## Status
ChwP#Spd	AO	Chilled Water Pump ## Speed
ChwRFl	AI	Chilled Water Return Flow
ChwRPr	AI	Chilled Water Return Pressure
ChwRTmp	AI	Chilled Water Return Temperature
ChwSFl	AI	Chilled Water Supply Flow
ChwSPr	AI	Chilled Water Supply Pressure
ChwSTmp	AI	Chilled Water Supply Temperature
ChwVlvFbk	AI	Chilled Water Valve Feedback
ChwVlvPos	AO	Chilled Water Valve Position
Clg#Cmd	DO	Cooling Device Command
ClgPos	AO	Cooling Position
ClgStg1Cmd	DO	Cooling Stage 1 Command
ClgStg2Cmd	DO	Cooling Stage 2 Command
ClgTmp	AI	Cooling Coil Discharge Temperature
ClrTmp	AI	Cooler Temperature
Cmp#Cmd	DO	Compressor Command
Ct##BsnTmp	AI	Cooling Tower 1 Basin Temperature
Ct##BypVlvPos	AO	Cooling Tower ## Bypass Valve Position
Ct##Fan#Cmd	DO	Cooling Tower ## Fan # Command
Ct##Fan#Fbk	AI	Cooling Tower ## Fan # Feedback
Ct##Fan#Spd	AO	Cooling Tower ## Fan # Speed Command
Ct##Fan#Sts	DI	Cooling Tower ## Fan # Status Indication
Ct##IsoVlvPos	AO	Cooling Tower ## Iso Valve Command
Ct#RTmp	AI	Cooling Tower Return Temperature
Ct#STmp	AI	Cooling Tower Supply Temperature
CwBypVlvPos	AO	Condenser Water Bypass Valve Position
CwP#Cmd	DO	Condenser Water Pump # Command
CwP#Fbk	AI	Condenser Water Pump # Feedback
CwP#Spd	AO	Condenser Water Pump # Speed
CwP#Sts	DI	Condenser Water Pump # Status
CwRTmp	AI	Condenser Water Return Temperature
CwSTmp	AI	Condenser Water Supply Temperature
DaTmp	AI	Discharge Air Temperature
DehMdSts	DO	Dehumidification Mode Output Status
DewTmp	AI	Dew Point Temperature
DhwEna	DO	Domestic Hot Water Enable
DhwSTmp	AI	Domestic Hot Water Supply Temperature
Dx#Cmd	DO	Direct Expansion Stage # Command
EaDprCls	DI	Exhaust Air Damper In Close Position
EaDprOpn	DI	Exhaust Air Damper In Open Position
EaDprPos	AO	Exhaust Air Damper Modulation
EaFanAmp	AI	Exhaust Air Fan Amperage
EaFanCmd	DO	Exhaust Air Fan Start/Stop
EaFanHoa	DI	Exhaust Air Fan Hand-Off-Auto Position
EaFanSpd	AO	Exhaust Air Fan VFD Speed
EaFanSts	DI	Exhaust Air Fan Status
EaFanVfdFlt	DI	Exhaust Air Fan VFD Fault
EaHstPLmtSw	DI	Exhaust Air Static Hi Pressure Limit Switch
EaLstPLmtSw	DI	Exhaust Air Static Low Pressure Limit Switch
EaRh	AI	Exhaust Air Relative Humidity
EaStPr	AI	Exhaust Air Static Pressure
EaVPr	AI	Exhaust Air Velocity Pressure
EconDprPos	AO	Economizer Damper Modulation
EffOcc	DO	Effective Occupancy
Eh#Cmd	DO	Electric Heat Stage # Command
FbDprPos	AO	Face/Bypass Damper Modulation
FilDP	DI	Filter Differential Pressure Switch
FrstDetAlm	DI	Frost Detection Alarm
FrzTmp	AI	Freezer Temperature
Gh#Cmd	DO	Gas Heat Stage # Command
HdStPr	AI	Hot Deck Static Pressure
HdTmp	AI	Hot Deck Temperature
Htg#Cmd	DO	Heating Device Command
HtgPos	AO	Heating Position
HtgStg1Cmd	DO	Heating Stage 1 Command
HtgStg2Cmd	DO	Heating Stage 2 Commande
HumIsoVlvCmd	DO	Humidifier Steam Cutoff Valve
HumMdSts	DO	Humidification Mode Output Status
HumVlvPos	AO	Humidifier Valve Modulation
HwBypVlvPos	AO	Hot Water Bypass Valve Position
HwDP	AI	Hot Water Differential Pressure
HwP#Amp	AI	Hot Water Pump # Amperage
HwP#Cmd	DO	Hot Water Pump # Command
HwP#Fbk	AI	Hot Water Pump # Feedback
HwP#Spd	AO	Hot Water Pump # Speed
HwP#Sts	DI	Hot Water Pump # Status
HwRadVlvCmd	DO	Hot Water Radiation (Fin Tube) Control Valve - 2 Position
HwRadVlvPos	AO	Hot Water Radiation (Fin Tube) Control Valve - Modulation
HwRFl	AI	Hot Water Return Flow
HwRPr	AI	Hot Water Return Pressure
HwRTmp	AI	Hot Water Return Temperature
HwSFl	AI	Hot Water Supply Flow
HwSPr	AI	Hot Water Supply Pressure
HwSTmp	AI	Hot Water Supply Temperature
HwVlvCmd	DO	Hot Water Valve Command - 2 Position
HwVlvFbk	AI	Hot Water Valve Feedback
HwVlvPos	AO	Hot Water Valve Position
IgvDprPos	AO	Inlet Vane Damper Position
KwhPul	DI	kWh Pulse Input
KwPul	DI	KW Pulse
Lt##Cmd	DO	Lighting ## Command
MaTmp	AI	Mixed Air Temperature
MoaDprCmd	DO	Minimum Outside Air Damper Command
MoaDprPos	AO	Minimum Outside Air Damper Position
OaCO2	AI	Outside Air CO2 Level
OaDew	AI	Outside Air Dewpoint
OaDprCls	DI	Outside Air Damper In Close Position
OaDprCmd	AO	Outside Air Damper Command
OaDprFbk	AI	Outside Air Damper Feedback
OaDprOpn	DI	Outside Air Damper In Open Position
OaDprPos	AO	Outside Air Damper Modulation
OaEnth	AI	Outside Air Enthalpy
OaFanCmd	DO	Outside Air Fan Command
OaFanFbk	AI	Outside Air Fan Feedback
OaFanSpd	AO	Outside Air Fan Speed Command
OaFanSts	DI	Outside Air Fan Status
OaFl	AI	Outside Air Flow
OaRh	AI	Outside Air Relative Humidity
OaTmp	AI	Outside Air Temperature
OaVPr	AI	Outside Air Velocity Pressure
OaWb	AI	Outside Air Wet Bulb
OccSig	DI	Occupancy Signal
PchwP#Cmd	DO	Primary Chilled Water Pump Command
PchwP#Fbk	AI	Primary Chilled Water Pump Feedback
PchwP#Spd	AO	Primary Chilled Water Pump Speed Command
PchwP#Sts	DI	Primary Chilled Water Pump Status
PchwRTmp	AI	Primary Chilled Water Return Temperature
PchwSTmp	AI	Primary Chilled Water Supply Temperature
PclTmp	AI	Precool Temperature
PclVlvPos	AO	PreCool Valve Position
PhtTmp	AI	Preheat Coil Discharge Temperature
PhtVlvPos	AO	Preheat Coil Valve Modulation
RaCO2	AI	Return Air CO2
RaDprCmd	DO	Return Air Damper Command
RaDprPos	AO	Return Air Damper Position
RaEnth	AI	Return Air Enthalpy
RaFanAmp	AI	Return Air Fan Amperage
RaFanCmd	DO	Return Air Fan Start/Stop
RaFanFbk	AI	Return Air Fan Speed Feedback
RaFanHoa	DI	Return Air Fan Hand-Off-Auto Position
RaFanSpd	AO	Return Air Fan VFD Speed
RaFanSts	DI	Return Air Fan Status
RaFanVfdFlt	DI	Return Air Fan VFD Fault
RaHstPrLmtSw	DI	Return Air Static Hi Pressure Limit Switch
RaLstPrLmtSw	DI	Return Air Static Low Pressure Limit Switch
RaRh	AI	Return Air Relative Humidity
RaSmkDet	DI	Return Air Smoke Detector
RaStPr	AI	Return Air Static Pressure
RaTmp	AI	Return Air Temperature
RaVPr	AI	Return Air Velocity Pressure
RefAlm	DI	Refrigerant Alarm Indication
RevVlvCmd	DO	Reversing Valve Command
RhtTmp	AI	Reheat Temperature
RhtVlvCmd	DO	Reheat Valve Command
RhtVlvPos	AO	Reheat Valve Position
RlfDprCmd	DO	Relief Damper Command
RlfDprPos	AO	Relief Damper Position
RlfFanCmd	DO	Relief Fan Command
RlfFanSts	DI	Relief Fan Status
RmCO2	AI	Room CO2
RmDew	AI	Room Dewpoint
RmOvr	DI	Room Occupancy Override
RmRh	AI	Room Relative Humidity
RmTmp	AI	Room Temperature
RmTmpSptAdj	AI	Room Slide Setpoint Adjustment
SaCO2	AI	Supply Air CO2 Level
SaDP	AI	Supply Air Differential Pressure
SaDprPos	AO	Supply Air Damper Position
SaFanAmp	AI	Supply Air Fan Amperage
SaFanCmd	DO	Supply Air Fan Start/Stop
SaFanFbk	AI	Supply Air Fan Feedback
SaFanFl	AI	Supply Air Fan Flow
SaFanHoa	DI	Supply Air Fan Hand-Off-Auto Position
SaFanSpd	AO	Supply Air Fan VFD Speed
SaFanSts	DI	Supply Air Fan Status
SaFanVfdFlt	DI	Supply Air Fan VFD Fault
SaFl	AI	Supply Air Flow
SaHstPr	DI	Supply Air High Static Cut Out
SaHstPrLmtSw	DI	Supply Air Static Hi Pressure Limit Switch
SaLstPrLmtSw	DI	Supply Air Static Low Pressure Limit Switch
SaRh	AI	Supply Air Relative Humidity
SaSmkDet	DI	Supply Air Smoke Detector
SaStPr	AI	Supply Air Static Pressure
SaTmp	AI	Supply Air Temperature
SaVPr	AI	Supply Air Velocity Pressure
SchwP#Cmd	DO	Secondary Chilled Water Pump Command
SchwP#Fbk	AI	Secondary Chilled Water Pump Feedback
SchwP#Spd	AO	Secondary Chilled Water Pump Speed Command
SchwP#Sts	DI	Secondary Chilled Water Pump Status
SchwRPr	AI	Secondary Chilled Water Return Pressure
SchwRTmp	AI	Secondary Chilled Water Return Temperature
SchwSFl	AI	Secondary Chilled Water Supply Flow
SchwSPr	AI	Secondary Chilled Water Supply Pressure
SchwSTmp	AI	Secondary Chilled Water Supply Temperature
ShwP#Cmd	DO	Secondary Hot Water Pump Command
ShwP#Fbk	AI	Secondary Hot Water Pump VFD Speed Feedback
ShwP#Spd	AO	Secondary Hot Water Pump Speed Command
ShwP#Sts	DI	Secondary Hot Water Pump Status
ShwRPr	AI	Secondary Hot Water Return Pressure
ShwRTmp	AI	Secondary Hot Water Return Temperature
ShwSPr	AI	Secondary Hot Water Supply Pressure
ShwSTmp	AI	Secondary Hot Water Supply Temperature
Sl#Tmp	AI	Suction Line Temperature
SmkAlm	DI	Smoke Alarm
SmkDetAlm	DI	Smoke Detector Alarm
StmVlv1Pos	DO	Steam 1/3 Control Valve Position
StmVlv2Pos	DO	Steam 2/3 Control Valve Position
StmVlvPos	AO	Steam Control Valve Position
TmpLlmtAlm	DI	Temperature Low Limit Alarm
UOATmp	AI	Unit Outside Air Temperature
VAV####AieFl	AI	VAV Flow
VAV####DprPos	AO	VAV Damper Position
VAV####FanCmd	DO	VAV Fan Command
WbTmp	AI	Wet Bulb Temperature
Zn###CdDprPos	AO	Zone Cold Deck Damper Position
Zn###ClgEna	DO	Zone Cooling Enable
Zn###CO2	AI	Zone CO2
Zn###Dew	AI	Zone Dewpoint
Zn###DprPos	AO	Zone Damper Position
Zn###Ena	DO	Zone Unit Enable
Zn###HdDprPos	AO	Zone Hot Deck Damper Position
Zn###HtgEna	DO	Zone Heating Enable
Zn###Ovr	DI	Zone Occupancy Override
Zn###RaTmp	AI	Zone Return Air Temperature
Zn###Rh	AI	Zone Relative Humidity
Zn###RhvCmd	DO	Zone Reheat Valve Command - 2 Position
Zn###RhvPos	AO	Zone Reheat Valve Position
Zn###SaTmp	AI	Zone Supply Air Temperature
Zn###StvPos	AO	Zone Steam Valve Position
Zn###Tmp	AI	Zone Temperature
Zn###TmpSptAdj	AI	Zone Slide Setpoint Adjustment
Zn###VdPos	AO	Zone Volume Damper Position

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Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
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Drawing Legend (3 of 3)

Job Number TC6230
Last Saved 6/18/2020
Last Printed 6/18/2020
File Name
Sheet Number TC2.3

1

Total Bill of Material Schedule

Device	Qty	Part Number	Description	Manufacturer	Drawing Pages	Notes
AMS-3x	1	GTx-116-xx	THERMAL AIRFLOW MEASURING STATION	Ebtron		
CB-1	1	9926251010	Circuit Breaker, 10AMP	Weidmuller		
CO2-1	1	CT1-O-0A3X	Outdoor Air CO2 Sensor.	Senva		
CS-9	5	C-2300	CURRENT SWITCH, 1A-100A, GO/NO	Senva Sensors, Inc.		
DHL-1A	1	AFS-460	DIFF PRESS SWITCH, 0.4-12IN SPST SWITCH WITH MANUAL RESET	Cleveland Controls		
DM-3	3	AFB24-SR	Damper Actuator,180 in-lb,Spring Return,24V,Modulating	Belimo Air Controls		
DPT-13	1	ZPS-05-LR51-EZ-NT-D	EZ PRESSURE SENSOR, LOW RANGE, 0 TO 0.10" W.C. DISPLAY, WITH NO TUBE OR PROBE	Building Automation Products		
DPT-14	2	ZPS-05-SR75-EZ-NT-D	UNIVERSAL PRESSURE TRANSDUCER WITH LCD	Building Automation Products		
ECB650-1	1	CDIB-650X-00	B-AAC prog cntlr, LCD Display, 16 UI, 12 UO. Expandable with expansion module up to 76 points	Distech		
ECBVAV-1 - ECBVAV-5	4	CDIB-VAXX-IMP-10	B-ASC single-duct VAV cntlr, 4 UI, 4 DO (Triac), diff prs transducer, actuator, IMP Units	Distech		
ENC-001	1	ENC-001	12" X 18" X 4" Enclosure with 24 VAC transformer.	Tridium		
ENCL-4	1	243610RC	ENCLOSURE, 24 X 36 X 10, TYPE 1, RECESSED COVER	Unity Manufacturing		
HCV-1	1	B320+LF24-SR US	CCV,0.75",3 Way,14 Cv,w/ Spring Return,24V,Modulating	Belimo Air Controls		
HCV-2	1	B210+TR24-SR US	CCV,0.5",2 Way,1.2 Cv,w/ Non-Spring,24V,Modulating	Belimo Air Controls		
HCV-3	1	B213+TR24-SR US	CCV,0.5",2 Way,4.7 Cv,w/ Non-Spring,24V,Modulating	Belimo Air Controls		
HCV-4	1	B207+TR24-SR US	CCV,0.5",2 Way,0.3 Cv,w/ Non-Spring,24V,Modulating	Belimo Air Controls		
HCV-5, HCV-6	2	B211+TR24-SR US	CCV,0.5",2 Way,1.9 Cv,w/ Non-Spring,24V,Modulating	Belimo Air Controls		
J-8025	1	J-8025	JACE 8000 Ctlr, 2 10/100 Mb Ethernet ports, 2 RS-485 serial ports. Licensed for 25 Device/1250 Point Limit.	Tridium		
J-8025_2	1	SMA-8025-1YR-INIT	JACE 8025 - Init 18 month maintenance must be purch in conjunction with init Core software.	Tridium		
LL-4A	1	TS-FS-50-DIS	Low limit temperature control, DPDT, manual reset, 20' capillary	Distech		
OAP-3	1	ZPS-ACC10	STATIC PRESSURE SENSOR (OUTSIDE)	Building Automation Products		
OUT-1	1	CR20-W	120VAC Receptacle	Leviton		
R-3	3	RH3B-ULAC24V	3PDT RELAY 24VAC w/ LED	IDEC		
R-3_1	3	SH3B-05	3PDT RELAY BASE	IDEC		
RIB-7	5	RIBU1C	ENCLOSED RELAY, 10-30VAC/DC 120 VAC, 10AMP RESISTIVE @ 277VAC, LED INDICATOR	Functional Devices		
SPP-1	3	A-520-1-A-1	Duct Static Pressure Probe	Mamac Systems		
SS-1	1	HSP-121BT1RU	ADVANCED, THREE-STAGE, HYBRID SOLID-STATE POWER LINE PROTECTOR 120 VAC IN-LINE TERMINALS	Edco		
SVUC	4	PDITE-SMRTVUC-00	Allure EC-Smart-Vue Comm sensor temperature, CO2, display and graphical menus	Distech		
SVUC_1	4	LONG-75C5PL/PUR	75 ft. Cat5E PLNM w/Boots Purple (Room Sensor)	Windy City Wire		
T-1A	1	ETD9STS	Two-Position Room Thermostat, 50 Deg-90 Deg.F. Thermostat, SPDT With Thermometer	Columbus Electric Mfg.		
TR-2	4	120-024-100-TF-CB (LE12100)	Transformer, 96VA, W/4A. Ckt. Brkr	Core Components		
TS-1C	2	TE-702-B-7-B	Duct Temperature Sensor, 10k, 6" probe, Galv. steel NEMA-1 enclosure	Mamac Systems		
TS-2.24F	1	TE-707-B-7-C-2	Duct Avg Temperature Sensor, 10k, 24' Armored Cable, Galv. Steel Enclosure	Mamac Systems		
TS-5C	1	TE-205-F-7	Outdoor Air Temperature Sensor, 10K Type 3	Mamac Systems		
TS-7CX	4	TE-701-BX-7-B	Duct Temperature Sensor, 10k, 6" probe, 12' plenum cable W/ quick disconnects	Mamac Systems		

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Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
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Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Total Bill of Material Schedule

Job Number: TC6230
File Name:
Last Saved: 6/18/2020
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Sheet Number: TC3.1

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Valve Schedule

BOM Tag	Qty	Equipment Served	Location	Valve Assembly Part #	Valve Manufacturer	Actuator Signal	Valve Pattern	Valve Size	Pipe Size	Normal/Failsafe	Connection Type	GPM	#/HR	Calculated Cv	Actual Cv	Prs Drop (PSI)	Close Off Prs (PSI)
HCV-1	1	AHU-1	Roof Area A	B320+LF24-SR US	Belimo	2-10VDC	3 Way Mixing/Diverting	3/4"	1"	N.O./F.O.	Screwed	15.00	0.0	6.71	14.00	1.15	200
HCV-2	1	VAV-01	Kitchen A21	B210+TR24-SR US	Belimo	2-10VDC	2 Way Straight	1/2"	3/4"	N.O./F.O.	Screwed	1.60	0.0	0.72	1.20	1.78	200
HCV-3	1	VAV-02	Cafeteria A17	B213+TR24-SR US	Belimo	2-10VDC	2 Way Straight	1/2"	3/4"	N.O./F.O.	Screwed	6.90	0.0	3.09	4.70	2.16	200
HCV-4	1	VAV-03	Storage A4	B207+TR24-SR US	Belimo	2-10VDC	2 Way Straight	1/2"	3/4"	N.O./F.O.	Screwed	0.40	0.0	0.18	0.30	1.78	200
HCV-5	1	VAV-04	Art Room A23	B211+TR24-SR US	Belimo	2-10VDC	2 Way Straight	1/2"	3/4"	N.O./F.O.	Screwed	2.20	0.0	0.98	1.90	1.34	200
HCV-6	1	VAV-05	Music Room A19	B211+TR24-SR US	Belimo	2-10VDC	2 Way Straight	1/2"	3/4"	N.O./F.O.	Screwed	2.10	0.0	0.94	1.90	1.22	200

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Valve Schedule

Job Number TC6230
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Last Saved 6/18/2020
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Sheet Number TC3.2

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Controller Addressing Schedule

Controller Number	System	UDP Port	IP	Subnet Mask	Gateway	Network	DI Number	MAC Address	Location	Comments
	Workstation	47808 (0xBAC0)	172.187.0.0							
ECY303-1	Hot Water System	47808 (0xBAC0)	172.187.0.4						Mech Room	
	JACE 8025	47808 (0xBAC0)	172.187.0.5	255.255.255.0	172.187.0.1					
ECB650-1	AHU-1	47808 (0xBAC0)					101104	04	TCP-1	
ECBVAV-05	VAV-05	47808 (0xBAC0)					101105	05	Music Room A19	
ECBVAV-04	VAV-04	47808 (0xBAC0)					101106	06	Art Room A23	
ECBVAV-03	VAV-03	47808 (0xBAC0)					101107	07	Storage A4	
ECBVAV-02	VAV-02	47808 (0xBAC0)					101108	08	Cafeteria A17	
ECBVAV-01	VAV-01	47808 (0xBAC0)					101109	09	Kitchen A21	

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Controller Addressing Schedule

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
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Job Number: TC6230
File Name:
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Sheet Number: TC3.3

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VAV Schedule

VAV Number	Controller Part Number	VAV Type	Size	Min CFM	Max CFM	Reheat CFM	Power Source	Power Location	Power Circuit	Associated Unit	DO1	DO2	DO3	DO4	UO5	UO6	UI1	UI2	UI3	UI4	Rm Sensor Part Number	Rm Sensor Qty	Controller EOL	Notes
VAV-01	CDIB-VAXX-IMP-10	VAV_HWV	8	-	800	-	TCP-1 TR #4	Storage Room A24						SaFanCmd					KEF1Sts	KEF2Sts	PDITE-SMRTVUC-00 (T/C)	1	True	
VAV-02	CDIB-VAXX-IMP-10	VAV_HWV	16	-	3500	-	TCP-1 TR #4	Storage Room A24			EF2Cmd			SaFanCmd					EF2Sts		PDITE-SMRTVUC-00 (T/C)	1	False	
VAV-03	CDIB-VAXX-IMP-10	VAV_HWV	5	-	200	-	TCP-1 TR #4	Storage Room A24						SaFanCmd							PDITE-SMRTVUC-00 (T/C)	1	False	
VAV-04	CDIB-VAXX-IMP-10	VAV_HWV	12	-	1100	-	TCP-1 TR #4	Storage Room A24			EF1Cmd			SaFanCmd					EF1Sts		PDITE-SMRTVUC-00 (T/C)	1	False	
VAV-05	CDIB-VAXX-IMP-10	VAV_HWV	12	-	110	-	TCP-1 TR #4	Storage Room A24						SaFanCmd							PDITE-SMRTVUC-00 (T/C)	1	False	

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SSSD Strawberry Park ES
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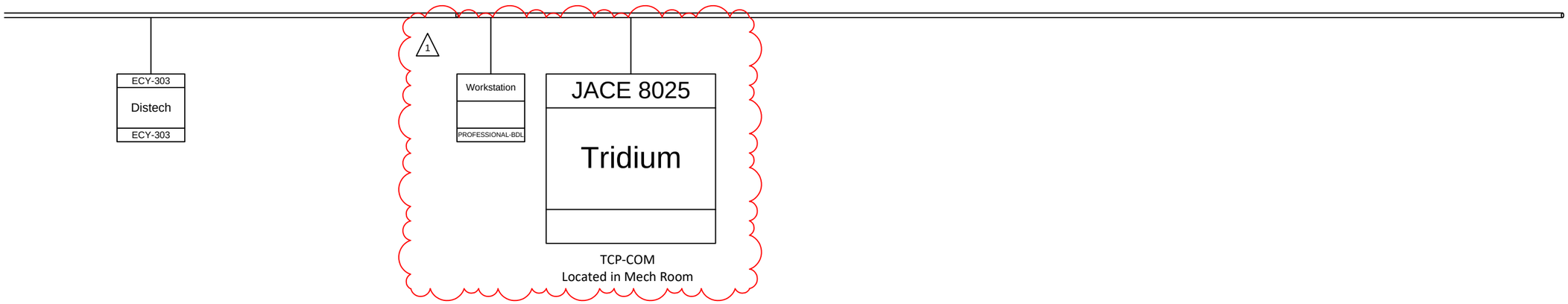
VAV Schedule

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

Network Architecture (1 of 2)



Notes

1. Technician to verify: Mac addresses, device instance, max master, and end of line terminations
2. End of lines need to be on both ends of every comm line (Dip switch, jumper, or 120 ohm resistors).
3. Highest mac address to be set as max master

There are no Parts in the Bill of Material

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Architect: TAB Associates
Engineer: BG Building Works
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Designed by: REK Date: 6/8/2020
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SSSD Strawberry Park ES
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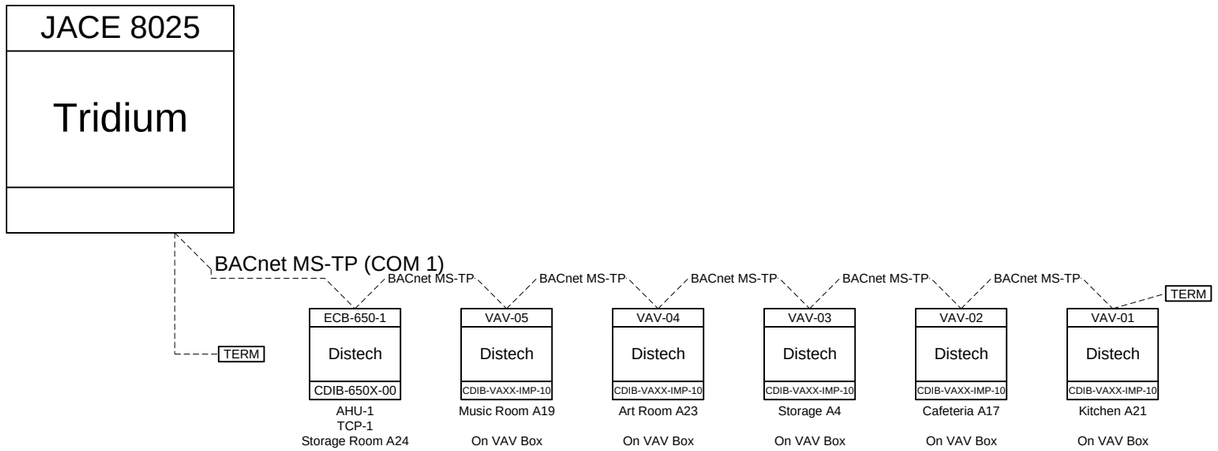
Network Architecture (1 of 2)

Job Number TC6230
File Name
Last Saved 6/18/2020
Last Printed 6/18/2020
Sheet Number TC4.1

Network Architecture (2 of 2)



Notes

1. Technician to verify: Mac addresses, device instance, max master, and end of line terminations
2. End of lines need to be on both ends of every comm line (Dip switch, jumper, or 120 ohm resistors).
3. Highest mac address to be set as max master

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Network Architecture (2 of 2)

Job Number: TC6230
Last Saved: 6/18/2020
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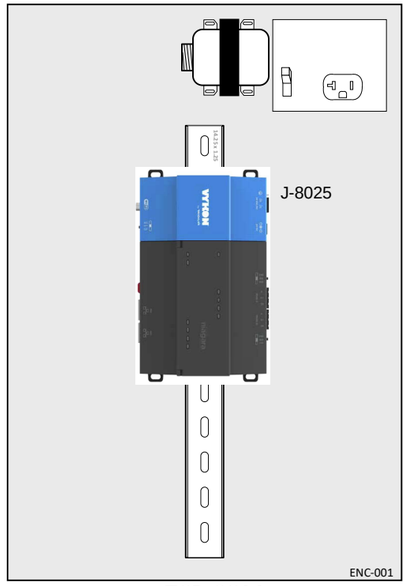
TCP-COM Panel Layout

1



TCP-COM
Locate panel in Boiler Mech Room

Device	Qty	Part Number	Description	Manufacturer
ENC-001	1	ENC-001	Small Enclosure	Tridium [ENC-001]
J-8025	1	J-8025	J-8000 with 25 Device Limit	Tridium
J-8025_2	1	SMA-8025-1YR-INIT	JACE 8025 - 18 mo Maintenance	Tridium

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SSSD Strawberry Park ES
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TCP-COM Panel Layout

Job Number: TC6230
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1 AHU SF VFD W/ DDC Control and Safeties Detail

2 Single Phase Motor W/ DDC Control

3 Single Phase Motor W/ DDC Control

4 Belimo 2-10VDC Actuator Detail

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Drawing Details

Job Number TC6230
File Name
Last Saved 6/18/2020
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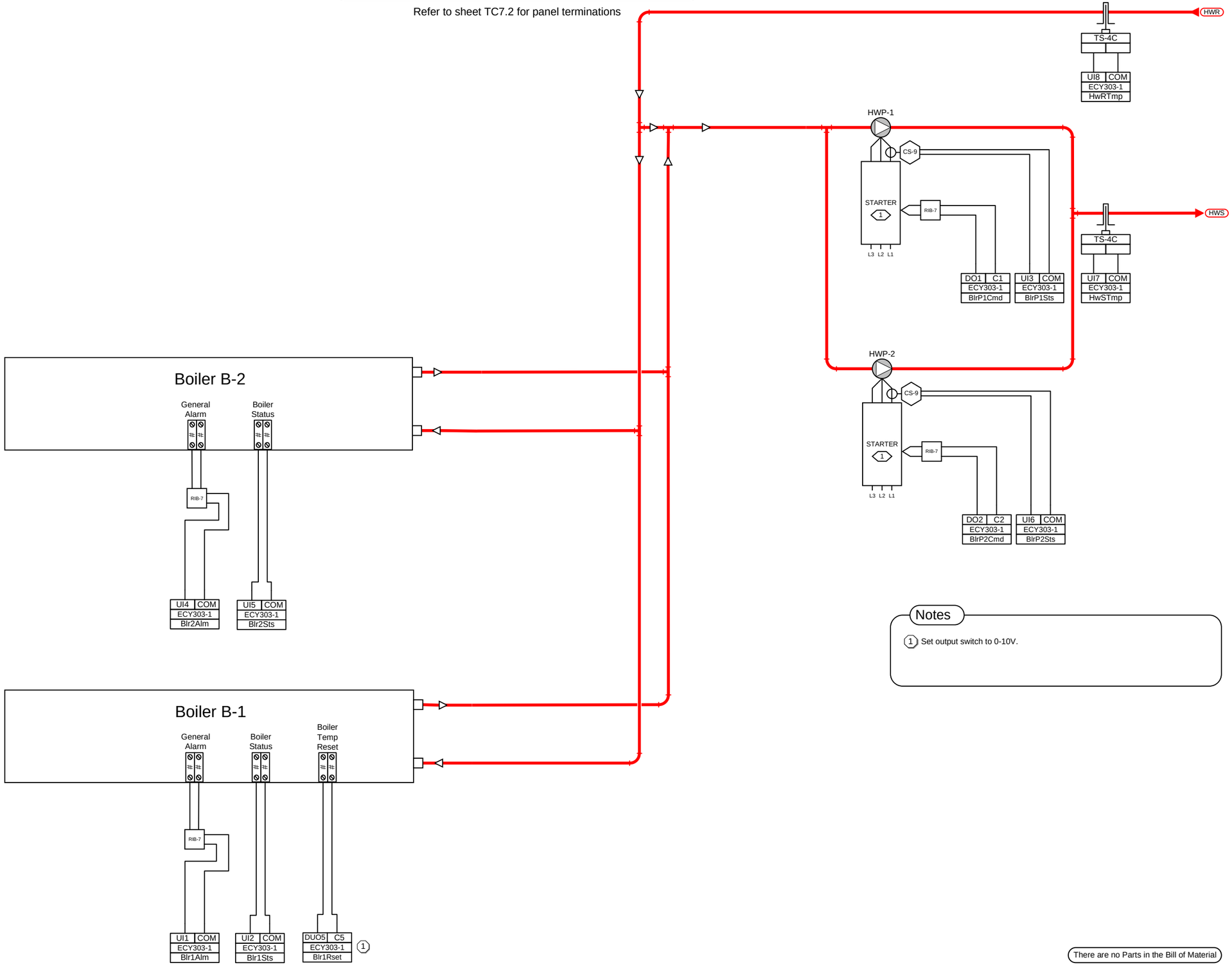
Hot Water System Control Diagram

Refer to sheet TC7.2 for panel terminations



Notes

1. Set output switch to 0-10V.

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Architect: TAB Associates
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Hot Water System Control Diagram

Job Number TC6230
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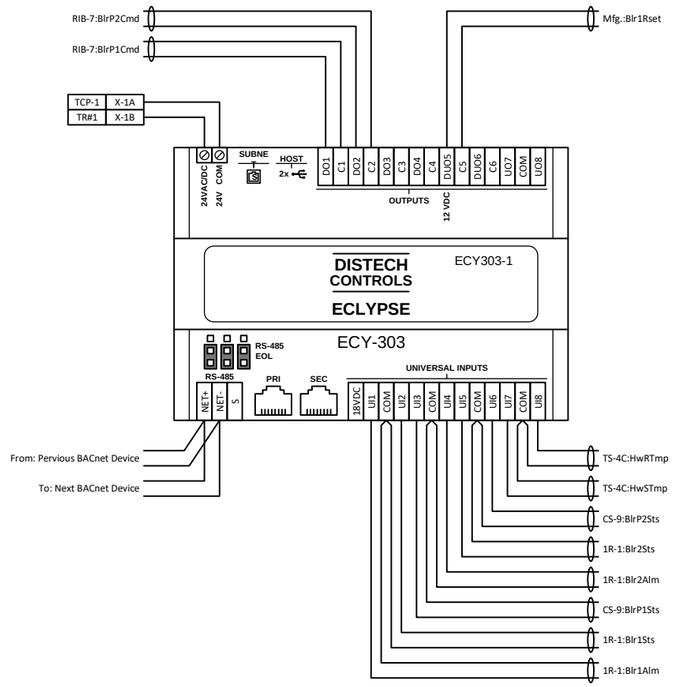
File Name hws.vsd
Sheet Number TC7.1

Hot Water System Controller Wiring



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Revision: As-Built

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Architect: TAB Associates
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SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487
Hot Water System Controller Wiring

Job Number TC6230
Last Saved 6/18/2020
File Name hws.vsd
Last Printed 6/18/2020
Sheet Number TC7.2

Hot Water System Sequence of Operation

Heating Water System:

The Distech ECY-300 BACnet Series Direct Digital Controller (DDC) provides control of the system as follows.

Life Safety:
An emergency power off (EPO) shall be provided that disables the heating water boilers. EPOs to be located per code at each boiler room exit door.

All safeties specified with boiler shall be left in operation as recommended by the boiler manufacturer.

General:
System pumps to be controlled by the DDC system. Boilers to be controlled by the DDC system. The DDC system will provide the boilers with all required inputs to include but not limited to the following: required water supply temperature, enable/disable command.

The DDC system shall be capable of monitoring the status of all alarms including those from the boilers. As a minimum the DDC will pull the following alarms to the district workstation: Flame failure, low water, high temperature limit, individual boiler supply temperature.

System Pumping:
The DDC system will monitor boiler flame status. If the member (lag) Boiler is called to run the DDC will enable the lac recirculation pump. Pumps shall duty cycle on a primary/standby seven-day cycle (initially 7:00 p.m. on Tuesdays).

After proof of water flow, as determined by pump status, enable the boilers when the OAT < 65°F (adj.). The DDC system shall disable the boiler plant when the OAT > 68°F (adj.).

Boiler Control:
The DDC system shall provide the boilers with the required supply water temperature as determined from the temperature reset sequence shown below. The DDC system will modulate the boilers and corresponding circulating pumps in tandem to maintain highest plant efficiency (staging determined by the boiler manufacturer) that will provide required supply water temperature as called for by DDC system. Proof of flow through the boiler shall be established before boiler is fired.

Provide supply and return heating water temperature sensors for DDC monitoring.

Heating Water Temperature Reset:
The heating water nominal supply temperature shall be based upon the following:

10°F OAT	150°F HWS
65°F OAT	110°F HWS

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Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

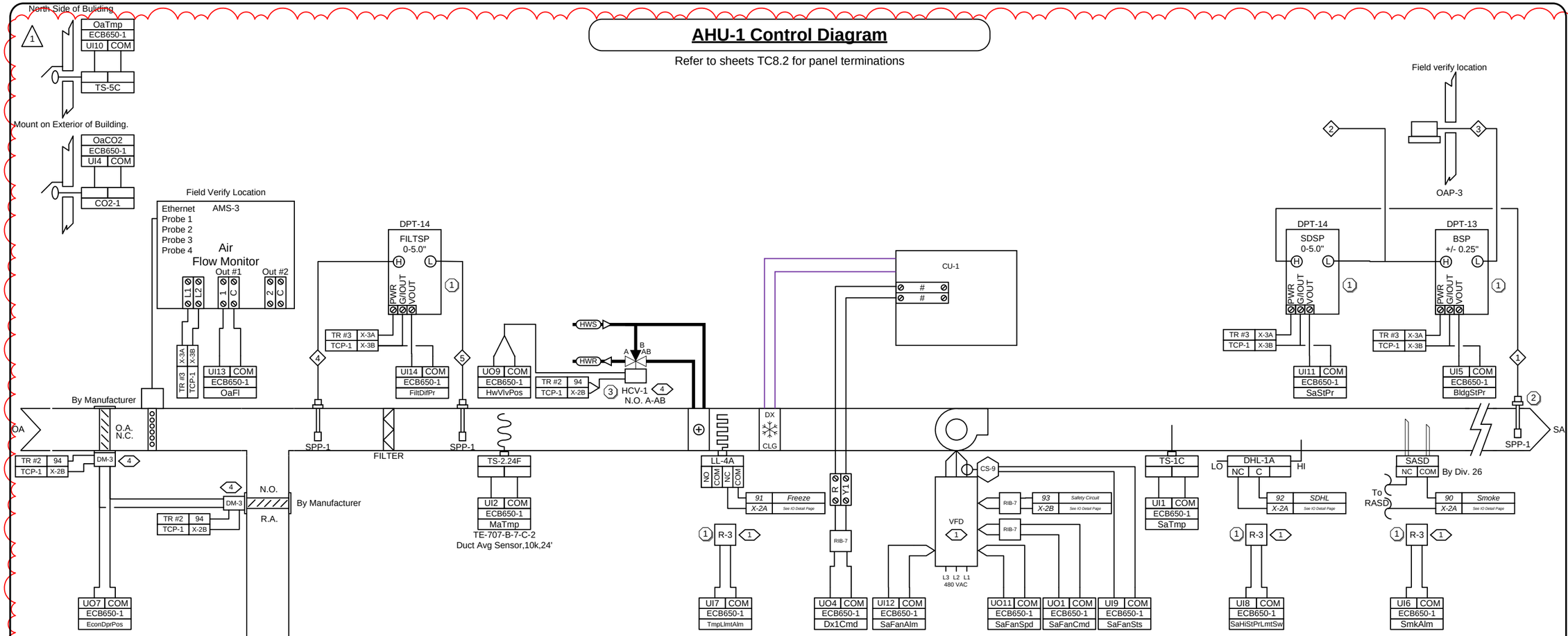
SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Hot Water System Sequence of Operation

Job Number TC6230
Last Saved 6/18/2020
File Name hws.vsd
Last Printed 6/18/2020
Sheet Number TC7.3

AHU-1 Control Diagram

Refer to sheets TC8.2 for panel terminations



Notes

1. Device is located in temperature control panel.
2. Field verify location 2/3rds way down main supply duct.
3. Refer to sheet TC3.2 for valve schedule.

Device	Qty	Part Number	Description	Manufacturer
AMS-3x	1	GTx-116-xx	THERMAL AIRFLOW MEASURING STAT	Ebtron
CO2-1	1	CT1-O-0A3X	Outdoor Air CO2 Sensor.	Senva
CS-9	1	C-2300	CURR SW, 1A-100A, GO/NO	Senva Sensors, Inc.
DHL-1A	1	AFS-460	.4-12IN SPST SWITCH W/MAN RES	Cleveland Controls
DM-3	3	AFB24-SR	DA,180"lb,SpR,24V,Mod	Belimo Air Controls
LL-4A	1	TS-FS-50-DIS	Low Limit, Manual, 20' cap	Distech
OAP-3	1	ZPS-ACC10	PRESSURE PICKUP PORTS OUTDOOR	Building Automation Products
RIB-7	3	RIBU1C	RELAY ENC SPDT 10-30VAC/DC 120	Functional Devices
SPP-1	3	A-520-1-A-1	Duct Static Probe	Mamac Systems
TS-1C	2	TE-702-B-7-B	Duct Sensor, 10k, 6", Stl Enc	Mamac Systems
TS-2.24F	1	TE-707-B-7-C-2	Duct Avg Sensor,10k,24'	Mamac Systems
TS-5C	1	TE-205-F-7	OSA Temp Sensor, 10K Type 3	Mamac Systems

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Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC
Designed by: REK Date: 6/8/2020
Software by: Date: 6/11/2020
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SSSD Strawberry Park ES
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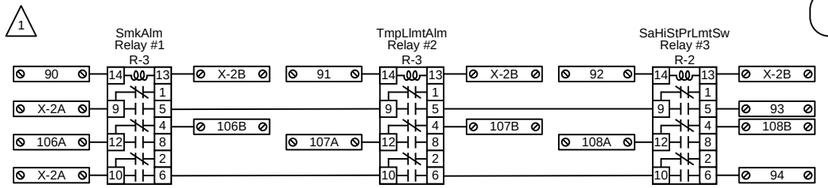
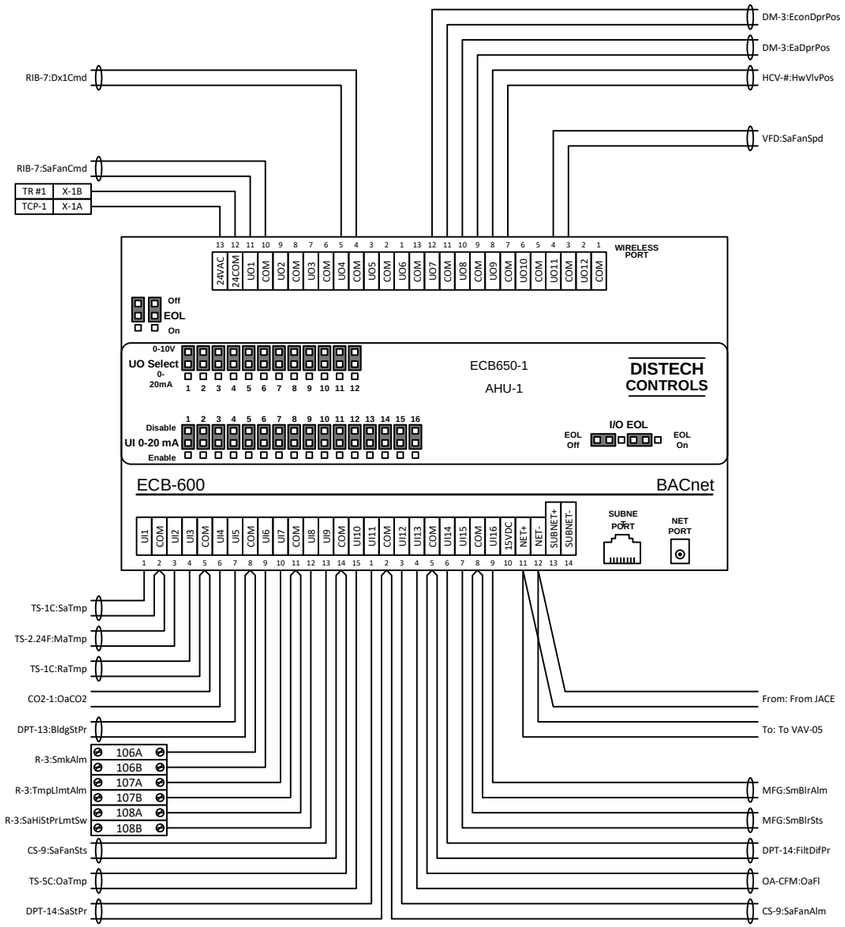
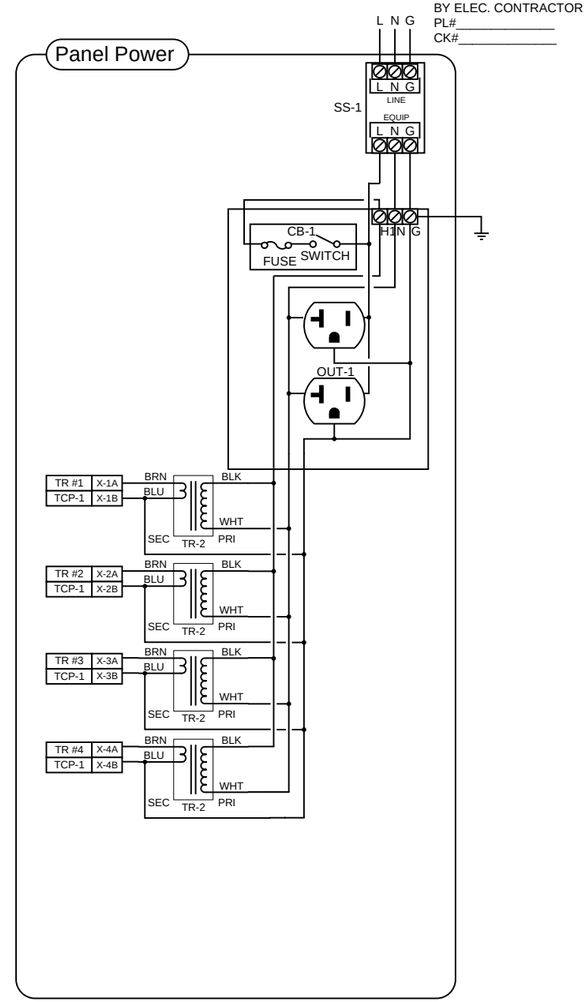
AHU-1 Control Diagram

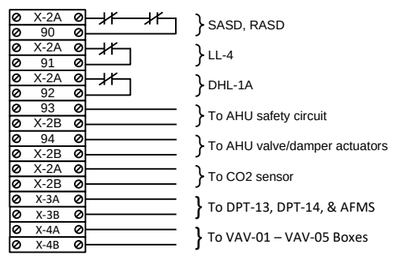
Job Number: TC6230
Last Saved: 6/18/2020
Last Printed: 6/18/2020
File Name:
Sheet Number: TC8.1

TCP-1 Panel I/O Detail









There are no Parts in the Bill of Material

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Software by: Date: 6/11/2020
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TCP-1 Panel I/O Detail

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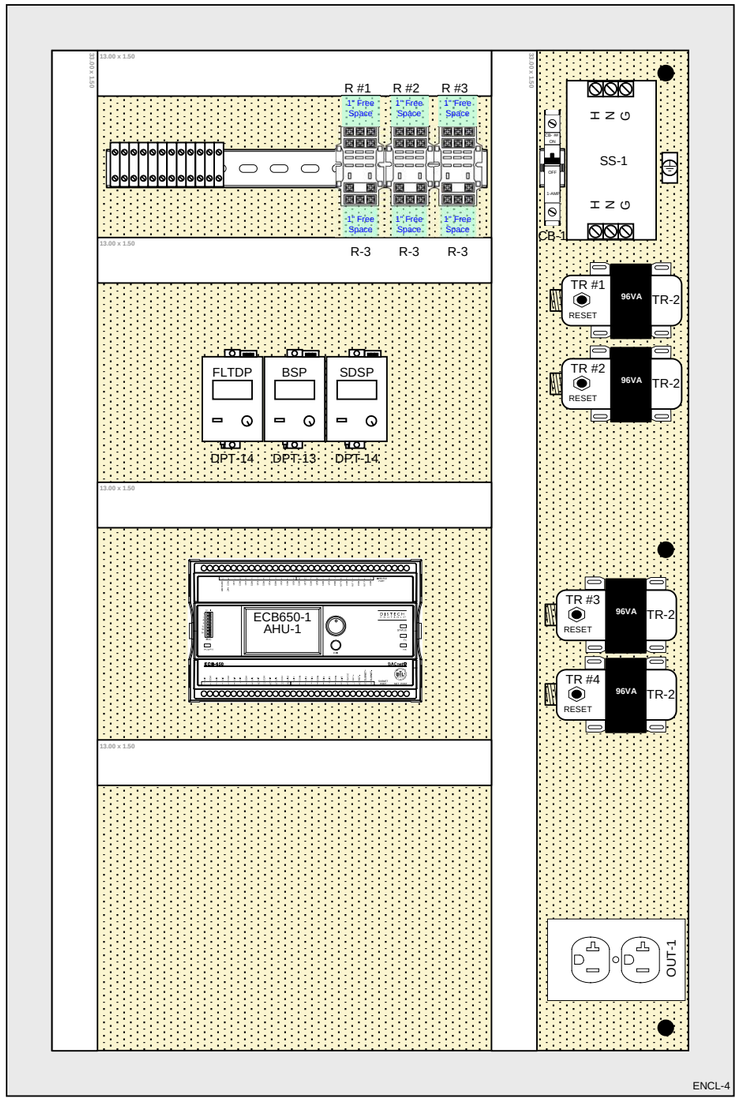
File Name: LONG-AHU-SZVV-SAF-RAF-mWxP-DX4-EOA-CO2-ECB650-D360.vsd
Sheet Number: TC8.2

1

TCP-1 Panel Layout



TCP-1
Panel Located in Storage Room A21

Device	Qty	Part Number	Description	Manufacturer
CB-1	1	9926251010	Circuit Breaker, 10AMP	Weidmuller
DPT-13	1	ZPS-05-LR51-EZ-NT-D	PRESSURE SENSOR - LOW RANGE	Building Automation Products
DPT-14	2	ZPS-05-SR75-EZ-NT-D	PRESSURE SENSOR - STD RANGE	Building Automation Products
ECB650-1	1	CDIB-650X-00	ECB-650 B-AAC prog cntlr,LCD	Distech
ENCL-4	1	243610RC	ENC, 24X36X10, TYPE 1, RC	Unity Manufacturing
OUT-1	1	CR20-W	120VAC Receptacle	Leviton
R-3	3	RH3B-ULAC24V	3PDT RELAY 24VAC w/ LED	IDEC
R-3_1	3	SH3B-05	3PDT RELAY BASE	IDEC
SS-1	1	HSP-121BT1RU	120VAC INLINE W/TERM BLK SRG	Edco
TR-2	4	120-024-100-TF-CB (LE12100)	Transformer, 96VA, W/4A BKR	Core Components

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Designed by: REK Date: 6/8/2020
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TCP-1 Panel Layout

Job Number: TC6230
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File Name: LONG-AHU-SZVV-SAF-RAF-mHW-P-DX-EOA-CO2-ECB650-D360.vsd
Sheet Number: TC8.3

AHU-1 Sequence of Operation

DESCRIPTION - THE SYSTEM CONSISTS OF A NEW ROOF TOP AIR HANDLING UNIT COMPLETE WITH MIXING BOX, AIR BLENDER, FILTER SECTION, HOT WATER COIL, DX COOLING, AND SUPPLY FAN WITH VFD. DAMPERS, CONTROL VALVES, AND THEIR ACTUATORS, AS WELL AS ALL OTHER CONTROLS REQUIRED WILL BE NEW EQUIPMENT FURNISHED AND INSTALLED BY THE TEMPERATURE CONTROLS CONTRACTOR. DX COOLING EQUIPMENT CONTROLS WILL BE INSTALLED BY EQUIPMENT MANUFACTURER WITH HARDWIRED MONITORING AND CONTROL POINTS AVAILABLE AS SHOWN.

SCHEDULING - THE AIR HANDLING UNIT (AHU) WILL BE SCHEDULED IN EITHER OCCUPIED OR UNOCCUPIED MODE BASED ON FEEDBACK STATUS FROM THE RESPECTIVE TERMINAL BOX ZONES SERVED BY THE AHU. WHEN ALL RESPECTIVE ZONES SERVED ARE IN UNOCCUPIED MODE, THE AHU OPERATIONAL MODE WILL BE UNOCCUPIED. WHEN ANY OF THE RESPECTIVE ZONES ARE IN OCCUPIED MODE, THE AHU OPERATIONAL MODE WILL BE OCCUPIED. WHEN IN OCCUPIED MODE, SUPPLY FAN WILL OPERATE AND CONTROLLED DEVICES WILL POSITION WITH RESPECT TO THEIR PI CONTROL LOOP. WHEN IN UNOCCUPIED MODE, FAN WILL SHUT OFF RETURN DAMPER FULL OPEN, OUTSIDE AIR DAMPERS CLOSED, HOT WATER VALVE 10% OPEN TO COIL, AND DX SYSTEMS DISABLED.

MORNING WARM-UP: WILL BE SCHEDULED TO OCCUR PRIOR TO OCCUPANCY. PROVIDE ADJUSTABLE DURATION TO PERMIT BLDG. OPERATOR TO TUNE TIME PERIOD REQUIRED TO FULLY EXECUTE WARM-UP EXERCISE PRIOR TO OCCUPANCY. DURING MORNING WARM-UP, FIRST ALL VAV BOXES WILL OPEN UP TO 100% OF BALANCED MAXIMUM COOLING CFM, AFTER A 3 MINUTE DELAY (USER ADJUSTABLE) THE SUPPLY FAN WILL START AND THE VFD WILL MODULATE TO MAINTAIN THE MAXIMUM DUCT STATIC PRESSURE SETPOINT (AS DETERMINED BY BALANCE CONTRACTOR) PLUS 0.10″ WC. AHU WILL SUPPLY 85℉ DAT. OUTSIDE AIR & EXHAUST AIR DAMPERS WILL BE CLOSED, RETURN AIR DAMPER WILL BE OPEN. RETURN FAN WILL TRACK SUPPLY FAN SPEED (OR WILL BE OFF, IF EXHAUST FAN CONFIGURATION). AS THE ZONES REACH OCCUPIED SETPOINT, THE AHU HEATING COIL CONTROL VALVE WILL CLOSE AND THE AHU FAN SPEED WILL MODULATE TO MAINTAIN DUCT STATIC PRESSURE SETPOINT BASED ON RESET SCHEDULE.

MORNING COOL-DOWN: WILL BE BASED UPON TREND DATA COLLECTED OVER THE PREVIOUS 7 DAYS (ADJ) TO DETERMINE WHETHER OR NOT MORNING COOL-DOWN IS WARRANTED. MORNING COOL DOWN WILL BE DEEMED WARRANTED IF:

1. DEMAND FOR COOLING OCCURRED ON THE MAJORITY OF THE DAYS IN PREVIOUS PERIOD POLLED.
2. -OR- DAILY MAXIMUM OUTSIDE AIR TEMPERATURE EXCEEDED SPACE TEMPERATURE SETPOINT FOR A MAJORITY OF THE DAYS THE IN PREVIOUS PERIOD POLLED.

WHEN DEEMED WARRANTED, MORNING COOLDOWN WILL BE EXECUTED IN LIEU OF MORNING WARM-UP ROUTINE. THE NIGHT VENT COOLING ROUTINE WILL BE SCHEDULED TO OCCUR PRIOR TO OCCUPANCY. PROVIDE ADJUSTABLE DURATION TO PERMIT BLDG. OPERATOR TO TUNE TIME PERIOD REQUIRED TO FULLY EXECUTE COOL-DOWN EXERCISE PRIOR TO OCCUPANCY. DURING MORNING COOL-DOWN, FIRST ALL VAV BOXES WILL OPEN TO 100% OF BALANCED MAXIMUM CFM, AFTER A 3 MINUTE DELAY, FANS WILL START AND MODULATE TO MAINTAIN THE MAXIMUM DUCT STATIC PRESSURE SETPOINT (AS DETERMINED BY BALANCE CONTRACTOR) PLUS 0.10" WC. DURING NIGHT VENT COOLING, AHU WILL MODULATE MIXING BOX POSITION TO ACHIEVE COOLING DISCHARGE AIR TEMPERATURE SETPOINT (IE 48℉ TO 58℉). TARGET SPACE SETPOINT FOR THE RESPECTIVE WILL BE THE BOTTOM OF THE HEATING/COOLING DEADBAND (IE 68℉). AS ZONES REACH THEIR RESPECTIVE MORNING COOLDOWN SETPOINTS (IE 60°F TO 68℉) THEIR RESPECTIVE VAV DAMPERS WILL CYCLE TO FULLY CLOSED.

MIXED AIR CONTROL: MIXING BOX CONTROL IS CONTROLLED BY MULTIPLE CONTROL LOOPS- BCS WILL HIGH SELECT CONTROL POSITION AMONGST THE FOLLOWING LOOPS:

OCCUPIED/UNOCCUPIED: DAMPER CLOSED DURING UNOCCUPIED AND OPEN TO MINIMUM POSITION DURING OCCUPIED. MINIMUM OUTSIDE AIR POSITIONS WILL NOT BE LESS THAN 30% OUTSIDE AIR DURING OCCUPIED PERIODS.

MIXED AIR TEMPERATURE CONTROL LOOP: WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW DISCHARGE AIR SETPOINT BY 1 DEGREE, MIXING DAMPERS WILL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT.

ECONOMIZER CONTROL LOOP: OPEN OUTSIDE AIR DAMPER, CLOSE RETURN AIR DAMPER, AND OPEN RELIEF DAMPER (WHERE APPLICABLE), DURING ECONOMIZER MODE. COOLING IS VIA ECONOMIZER MODE ONLY, DISABLE ECONOMIZER COOLING WHEN OUTSIDE AIR TEMPERATURES ARE GREATER THAN INDOOR SPACE TEMPERATURE SETPOINT.

Sequence of Operation - Cont'd

DISCHARGE AIR TEMPERATURE (DAT) CONTROL: DAT SETPOINT WILL BE BASED ON OUTSIDE AIR TEMPERATURE RESET SCHEDULE BELOW.

OUTSIDE AIR TEMPERATURE	RETURN AIR TEMPERATURE
40 DEG F	65 DEG F
70 DEG F	55 DEG F

MODULATE MIXING BOX POSITION TO MAINTAIN DAT AT SETPOINT DURING ECONOMIZER COOLING. IF THE OUTSIDE AIR DAMPERS ARE AT MINIMUM POSITION AND THE MIXED AIR TEMPERATURE IS BELOW DAT SETPOINT, MODULATE HEATING WATER VALVE TO MAINTAIN DAT AT SETPOINT. IF OUTSIDE AIR TEMPERATURE IS GREATER THAN DAT SETPOINT, MODULATE MIXING DAMPERS TO MINIMUM POSITION. ENABLE COOLING SYSTEM (RTU-1 ONLY) AS REQUIRED TO MAINTAIN DAT AT SETPOINT.

SUPPLY FAN CONTROL:
THE SUPPLY FAN VFD WILL BE MODULATED BASED ON DUCT STATIC PRESSURE FEEDBACK TO MAINTAIN DUCT STATIC PRESSURE AT SETPOINT. EMPLOY CRITICAL VALVE RESET LOGIC TO MAINTAIN THE MOST OPEN PRIMARY AIR VALVE IN THE SYSTEM AT 90% OR GREATER. POLL ALL VALVE POSITIONS TO DETERMINE MOST OPEN (CRITICAL) VALVE. RESET STATIC PRESSURE SETPOINT PER THE SCHEDULE BELOW.

STATIC PRESSURE SETPOINT	CRITICAL VALVE POSITION (% OF FULL OPEN)
MINIMUM	85%
MAXIMUM	98%

DURING BALANCING/START-UP CONSULT THE ENGINEER TO DETERMINE WHICH THREE OR FOUR TERMINAL BOXES WILL BE PROGRAMED TO REMAIN OPEN UNDER SATISFIED CONDITIONS TO ALLOW FOR A MINIMUM FAN FLOW RATE WITHOUT OVER-PRESSURIZING THE SUPPLY DUCTS.

FEATURES -
1. DISCHARGE AIR TEMPERATURE SHALL BE TRENDED HOURLY.
2. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG F OR MORE.
3. GENERATE FILTER CHANGE ALARM SHOULD FILTER DIFFERENTIAL PRESSURE EXCEED FILTER CHANGE SETPOINT (ADJUSTABLE AT THE OPERATOR INTERFACE).
4. GENERATE AN ALARM SHOULD ANY FAN STATUS NOT MATCH FAN COMMAND.
5. GENERATE AN ALARM AND OPEN HEATING VALVE TO 100% SHOULD FREEZE STAT TRIP AND DAMPERS WILL GO TO UNOCCUPIED MODE POSITION.
6. GENERATE AN ALARM SHOULD SMOKE DETECTOR TRIP AND SHUT UNIT DOWN, VALVES AND DAMPERS WILL GO TO UNOCCUPIED MODE.
7. DISABLE SUPPLY FAN AND GENERATE ALARM SHOULD DUCT HIGH STATIC PRESSURE SWITCH TRIP.
8. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.
9. GENERATE ALARMS AS INDICATED IN THE POINTS LIST AND IN THE SEQUENCE OF CONTROL ABOVE.

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Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC

Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

AHU-1 Sequence of Operation

Job Number TC6230

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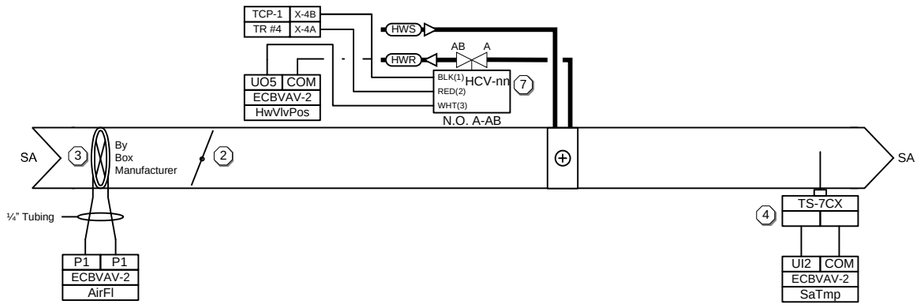
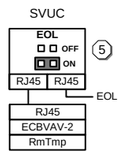
File Name LONG-AHU-SZVV-SAF-RAF-mHWcP DX4-EOA-CO2-ECB660-D360.vsd

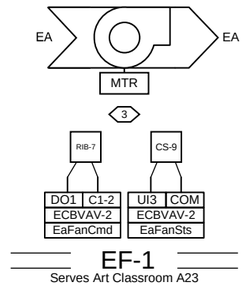
Sheet Number TC8.4

VAV Control Diagrams

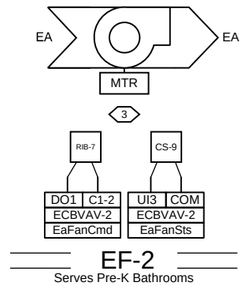
VAV
(Typical Of 2)



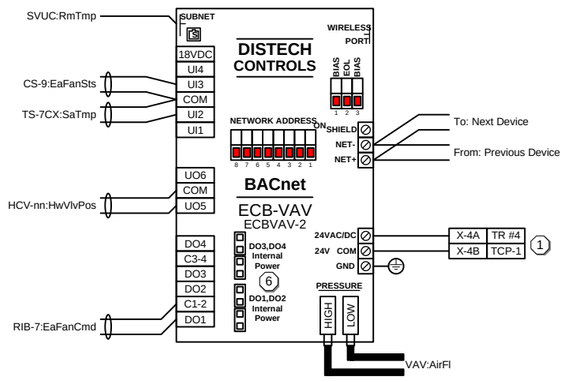




EF-1
Serves Art Classroom A23



EF-2
Serves Pre-K Bathrooms



Notes

1. VAV controller power consumption is 10VA. Use a maximum of 80% from transformer.
2. Mount controller with integrated damper actuator directly on VAV damper shaft. Mount so that 0 degrees equal damper open position.
3. For accurate airflow measurement, mechanical contractor to install terminal box with straight duct at inlet of at least 3 duct diameters.
4. Sensor shall be mounted at discharge of unit as far away from coil as possible. Do not mount into flex duct!
5. Refer to plans and specifications for location and height. Coordinate with Architect/Owner.
6. Digital outputs are default from the factory for internal power source. For outputs utilizing external power set jumpers accordingly.
7. Refer to valve schedule on sheet TC3.2.

Device	Qty	Part Number	Description	Manufacturer
CS-9	2	C-2300	CURR SW, 1A-100A, GO/NO	Senva Sensors, Inc.
ECBVAV-2	2	CDIB-VAXX-IMP-10	ECB-VAX B-ASC VAV cntlr,IMP	Distech
RIB-7	2	RIBU1C	RELAY ENC SPDT 10-30VAC/DC 120	Functional Devices
SVUC	2	PDITE-SMRTVUC-00	Allure EC-Smart-Vue-C	Distech
SVUC_1	2	LONG-75C5PL/PUR	75 ft. Cat5E PLNM w/Boots Purp	Windy City Wire
TS-7CX	2	TE-701-BX-7-B	Duct Sensor, 10k, 6", plen	Mamac Systems

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VAV Control Diagrams

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File Name LONG-ATB-mHW-ECBVAV-D360.vsd
Sheet Number TC9.1

VAV Sequence of Operation

1

Sequence of Operation

DESCRIPTION - THE NEW SYSTEMS CONSIST OF A PRESSURE INDEPENDENT VARIABLE AIR VOLUME BOX COMPLETE WITH MOTORIZED DAMPER, HOT WATER REHEAT COIL, FLOATING POINT OR PROPORTIONAL CONTROL VALVE, AND AIR FLOW PRESSURE TRANSDUCER.

SCHEDULING - OCCUPIED/UNOCCUPIED SCHEDULING APPLIES TO THESE SYSTEMS. SCHEDULES TO BE DETERMINED BY OWNER AND WILL BE AVAILABLE THROUGH THE OPERATOR WORKSTATION INTERFACE.

SCHEDULING CONTROLS SPACE SETPOINT TEMPERATURE. DURING OCCUPIED MODE, TERMINAL UNIT WILL MAINTAIN SPACE TEMPERATURE AT SETPOINT DICTATED BY SPACE MOUNTED THERMOSTAT (I.E. 68-72℉ HEATING, 76-80℉ COOLING). DURING UNOCCUPIED MODE, TERMINAL UNIT WILL MAINTAIN SPACE TEMPERATURE AT SETBACK TEMPERATURE SETPOINT (I.E. 60℉ HEATING, N/A COOLING)

OCCUPIED/UNOCCUPIED SCHEDULING ALSO CONTROLS VENTILATION. WHEN SCHEDULED IN THE OCCUPIED MODE, TERMINAL UNIT WILL PROVIDE MINIMUM VENTILATION CFM CALCULATED BY THE DEMAND CONTROL VENTILATION PROGRAM. WHEN SCHEDULED IN THE UNOCCUPIED MODE, DAMPER WILL BE SHUT. TERMINAL BOX WILL BE PERMITTED TO OPEN AS REQUIRED ON DEMAND FOR HEATING ONLY, DURING UNOCCUPIED PERIODS.

TIMED OVERRIDE - SHOULD THE TIMED OVERRIDE BE SWITCHED TO OCCUPIED DURING UNOCCUPIED MODE, OCCUPIED MODE OPERATION WILL APPLY FOR THE TIMED OCCUPANCY DURATION.

CONTROL - THE AIRFLOW PRESSURE TRANSDUCER WILL INDICATE TO THE UNIT MOUNTED DDC CONTROLLER MEASURED AIRFLOW. THE DDC CONTROLLER WILL MODULATE THE VAV BOX DAMPER TO MAINTAIN AIRFLOW AT SETPOINT. AIRFLOW SETPOINT AND REHEAT VALVE WILL BE MODULATED BASED ON SPACE TEMPERATURE DEVIATION FROM SETPOINT PER THE SAMPLE RESET SCHEDULES BELOW INDICATING DEADBAND, HEATING AND COOLING RAMP-UP RANGES, AND MINIMUM AIRFLOWS.

WHEN KITCHEN VENTILATION MODE IS ACTIVATED, THE DDC CONTROLLER WILL DRIVE THE AIRFLOW TO CONSTANT VOLUME AT MAXIMUM CFM AND MODULATE THE REHEAT VALVE TO MAINTAIN SPACE TEMPERATURE SETPOINT.

NOTES:
1. THE ADJACENT GRAPHICS ARE PROVIDED FOR REFERENCE ONLY.
2. EACH TERMINAL BOX IS UNIQUE AND MAY HAVE REQUIREMENTS THAT VARY FROM THOSE DEPICTED ABOVE.
3. INCLUDE LOGIC TO OPERATE REHEAT VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (I.E. 85℉ MAX AT -2℉ AND GREATER DEVIATI ON FROM SETPOINT)
4. REFER TO EQUIPMENT SCHEDULES FOR INITIAL AIR DELIVERY (CFM) SETTINGS.

THE SPACE MOUNTED TEMPERATURE SENSOR WILL INCORPORATE A WARMER/COOLER ADJUSTMENT ALLOWING ZONE OCCUPANTS TO BIAS THE SPACE TEMPERATURE SETPOINT BY A FIXED AMOUNT IN EITHER DIRECTION.

FEATURES -
1. COOPERATION WITH NIGHT VENT COOLING, MORNING WARMUP, AND DCV LOGIC WHERE SPECIFIED IN RESPECTIVE AHU SEQUENCES.
2. SPACE TEMPERATURE WILL BE TRENDED HOURLY.
3. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
4. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.

EXHAUST FAN EF-1 (ART ROOM EXHAUST):
FAN WILL BE MONITORED AND CONTROLLED BY BUILDING AUTOMATION SYSTEM.

FAN WILL OPERATE CONTINUOUSLY DURING OCCUPIED PERIODS. FAN WILL BE OFF DURING UNOCCUPIED PERIODS

EXHAUST FAN EF-2 (PRE-K RESTROOMS):
FAN WILL BE MONITORED AND CONTROLLED BY BUILDING AUTOMATION SYSTEM.

FAN WILL OPERATE CONTINUOUSLY DURING OCCUPIED PERIODS. FAN WILL BE OFF DURING UNOCCUPIED PERIODS

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Steamboat Springs, CO 80487

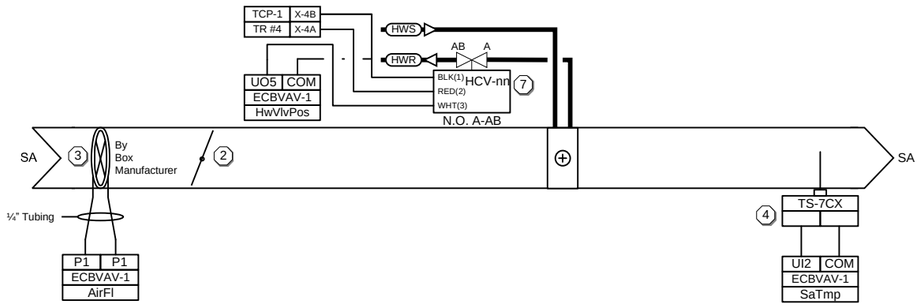
VAV Sequence of Operation

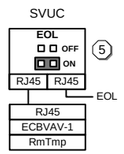
Architect:	TAB Associates
Engineer:	BG Building Works
Contractor:	FCI CONSTRUCTORS INC
Designed by:	REK Date: 6/8/2020
Software by:	Date:
Checked by:	JJV Date: 6/11/2020

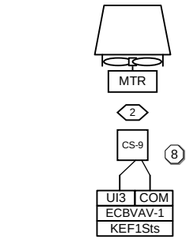
Job Number TC6230
Last Saved 6/18/2020
Last Printed 6/18/2020
File Name LONG-ATB-mHW-ECBVAV-D360.vsd
Sheet Number TC9.2

Kitchen VAV Control Diagram

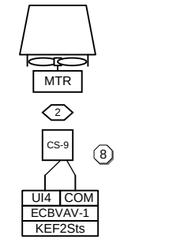
VAV
(Typical Of 2)



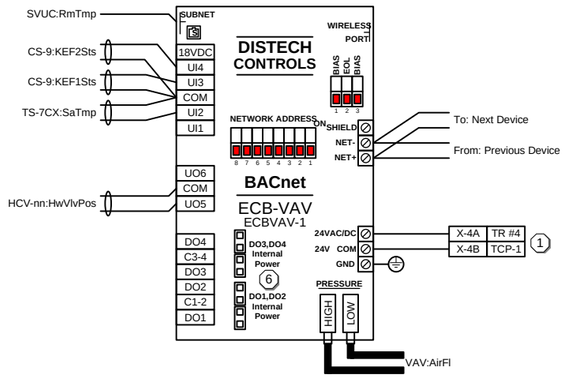




KEF-1
Serves Kitchen Hood



KEF-2
Serves Kitchen Hood



Notes

1. VAV controller power consumption is 10VA. Use a maximum of 80% from transformer.
2. Mount controller with integrated damper actuator directly on VAV damper shaft. Mount so that 0 degrees equal damper open position.
3. For accurate airflow measurement, mechanical contractor to install terminal box with straight duct at inlet of at least 3 duct diameters.
4. Sensor shall be mounted at discharge of unit as far away from coil as possible. Do not mount into flex duct!
5. Refer to plans and specifications for location and height. Coordinate with Architect/Owner.
6. Digital outputs are default from the factory for internal power source. For outputs utilizing external power set jumpers accordingly.
7. Refer to valve schedule on sheet TC3.2.
8. Kitchen Exhaust Fans Status' wired to VAV-01.

Device	Qty	Part Number	Description	Manufacturer
CS-9	2	C-2300	CURR SW, 1A-100A, GO/NO	Senva Sensors, Inc.
ECBVAV-1	2	CDIB-VAXX-IMP-10	ECB-VAX B-ASC VAV cntlr,IMP	Distech
SVUC	2	PDITE-SMRTVUC-00	Allure EC-Smart-Vue-C	Distech
SVUC_1	2	LONG-75C5PL/PUR	75 ft. Cat5E PLNM w/Boots Purp	Windy City Wire
TS-7CX	2	TE-701-BX-7-B	Duct Sensor, 10k, 6", plen	Mamac Systems

LONG
ALASKA - COLORADO - OREGON
NEVADA - UTAH - WASHINGTON
WYOMING

Revision: Submitted

#	Change:	Date:
1		
2		
3		
4		
5		

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC
Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Kitchen VAV Control Diagram

Job Number TC6230
Last Saved 6/18/2020
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File Name LONG-ATB-mHW-ECBVAV-D360.vsd
Sheet Number TC10.1

Kitchen VAV Sequence of Operation

1

Sequence of Operation

DESCRIPTION - THE NEW SYSTEMS CONSIST OF A PRESSURE INDEPENDENT VARIABLE AIR VOLUME BOX COMPLETE WITH MOTORIZED DAMPER, HOT WATER REHEAT COIL, FLOATING POINT OR PROPORTIONAL CONTROL VALVE, AND AIR FLOW PRESSURE TRANSDUCER.

SCHEDULING - OCCUPIED/UNOCCUPIED SCHEDULING APPLIES TO THESE SYSTEMS. SCHEDULES TO BE DETERMINED BY OWNER AND WILL BE AVAILABLE THROUGH THE OPERATOR WORKSTATION INTERFACE.

SCHEDULING CONTROLS SPACE SETPOINT TEMPERATURE. DURING OCCUPIED MODE, TERMINAL UNIT WILL MAINTAIN SPACE TEMPERATURE AT SETPOINT DICTATED BY SPACE MOUNTED THERMOSTAT (I.E. 68-72℉ HEATING, 76-80℉ COOLING). DURING UNOCCUPIED MODE, TERMINAL UNIT WILL MAINTAIN SPACE TEMPERATURE AT SETBACK TEMPERATURE SETPOINT (I.E. 60℉ HEATING, N/A COOLING)

OCCUPIED/UNOCCUPIED SCHEDULING ALSO CONTROLS VENTILATION. WHEN SCHEDULED IN THE OCCUPIED MODE, TERMINAL UNIT WILL PROVIDE MINIMUM VENTILATION CFM CALCULATED BY THE DEMAND CONTROL VENTILATION PROGRAM. WHEN SCHEDULED IN THE UNOCCUPIED MODE, DAMPER WILL BE SHUT. TERMINAL BOX WILL BE PERMITTED TO OPEN AS REQUIRED ON DEMAND FOR HEATING ONLY, DURING UNOCCUPIED PERIODS.

TIMED OVERRIDE - SHOULD THE TIMED OVERRIDE BE SWITCHED TO OCCUPIED DURING UNOCCUPIED MODE, OCCUPIED MODE OPERATION WILL APPLY FOR THE TIMED OCCUPANCY DURATION.

KITCHEN HOOD VENTILATION MODE. WHEN KITCHEN EXHAUST HOOD IS ACTIVATED, VAV WILL BE OVERRIDDEN TO OCCUPIED MODE AND MAX DESIGN CFM. WHEN KITCHEN EXHAUST IS OFF, VAV WILL RETURN TO NORMAL OPERATION.

CONTROL - THE AIRFLOW PRESSURE TRANSDUCER WILL INDICATE TO THE UNIT MOUNTED DDC CONTROLLER MEASURED AIRFLOW. THE DDC CONTROLLER WILL MODULATE THE VAV BOX DAMPER TO MAINTAIN AIRFLOW AT SETPOINT. AIRFLOW SETPOINT AND REHEAT VALVE WILL BE MODULATED BASED ON SPACE TEMPERATURE DEVIATION FROM SETPOINT PER THE SAMPLE RESET SCHEDULES BELOW INDICATING DEADBAND, HEATING AND COOLING RAMP-UP RANGES, AND MINIMUM AIRFLOWS.

WHEN KITCHEN VENTILATION MODE IS ACTIVATED, THE DDC CONTROLLER WILL DRIVE THE AIRFLOW TO CONSTANT VOLUME AT MAXIMUM CFM AND MODULATE THE REHEAT VALVE TO MAINTAIN SPACE TEMPERATURE SETPOINT.

NOTES:
1. THE ADJACENT GRAPHICS ARE PROVIDED FOR REFERENCE ONLY.
2. EACH TERMINAL BOX IS UNIQUE AND MAY HAVE REQUIREMENTS THAT VARY FROM THOSE DEPICTED ABOVE.
3. INCLUDE LOGIC TO OPERATE REHEAT VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (I.E. 85℉ MAX AT -2℉ AND GREATER DEVIATI ON FROM SETPOINT)
4. REFER TO EQUIPMENT SCHEDULES FOR INITIAL AIR DELIVERY (CFM) SETTINGS.

THE SPACE MOUNTED TEMPERATURE SENSOR WILL INCORPORATE A WARMER/COOLER ADJUSTMENT ALLOWING ZONE OCCUPANTS TO BIAS THE SPACE TEMPERATURE SETPOINT BY A FIXED AMOUNT IN EITHER DIRECTION.

FEATURES -
1. COOPERATION WITH NIGHT VENT COOLING, MORNING WARMUP, AND DCV LOGIC WHERE SPECIFIED IN RESPECTIVE AHU SEQUENCES.
2. SPACE TEMPERATURE WILL BE TRENDED HOURLY.
3. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
4. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.

KITCHEN EXHAUST FANS KEF-1 & KEF-2:
BI EXHAUST HOOD WALL SWITCH/FAN STATUS

CONTROL:
KITCHEN SPACE TEMPERATURE WILL BE MAINTAINED BY VAV SYSTEM. UPON DETECTION OF EXHAUST HOOD/FAN BEING ENERGIZED BY ASSOCIATED WALL SWITCH, OVERRIDE VAV TO CONSTANT VOLUME OPERATION PER VAV SEQUENCE.

LONG
ALASKA - COLORADO - OREGON
NEVADA - UTAH - WASHINGTON
WYOMING

Submitted

Revision:

#	Change:	Date:
1		
2		
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4		
5		

Architect: TAB Associates
Engineer: BG Building Works
Contractor: FCI CONSTRUCTORS INC
Designed by: REK Date: 6/8/2020
Software by: Date:
Checked by: JJV Date: 6/11/2020

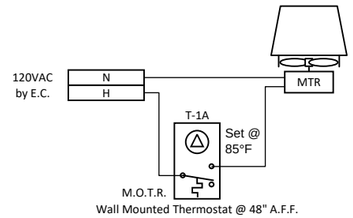
SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Kitchen VAV Sequence of Operation

Job Number: TC6230
Last Saved: 6/18/2020
Last Printed: 6/18/2020
File Name: LONG-ATB-mHW-ECBVAV-D360.vsd
Sheet Number: TC10.2

Miscellaneous Control Diagrams

1



EF-3

Serves Kiln Room 19

Sequence of Operation

A WALL MOUNTED THERMOSTAT (T-1A) WILL CYCLE THE EXHAUST FAN TO MAINTAIN SPACE TEMPERATURE AT 85 DEG F (ADJUSTABLE).

Device	Qty	Part Number	Description	Manufacturer
T-1A	1	ETD9STS	THERMOSTAT/SPDT W/THERM	Columbus Electric Mfg.

LONG

ALASKA - COLORADO - OREGON
NEVADA - UTAH - WASHINGTON
WYOMING

Revision: Submitted

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4		
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Architect: TAB Associates
Engineer: BG Building Works
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Designed by: REK Date: 6/8/2020
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SSSD Strawberry Park ES
39620 Amethyst Drive
Steamboat Springs, CO 80487

Miscellaneous Control Diagrams

Job Number: TC6230
File Name:
Last Saved: 6/18/2020
Last Printed: 6/18/2020
Sheet Number: TC11.1

Acuity Brands Drawing Package

LC0.1	SYSTEM NOTES
LC0.2	DETAILS & WIRING DIAGRAMS
LC1.X SERIES	SYSTEM LAYOUTS
LC1.B	SYSTEM BACKBONE

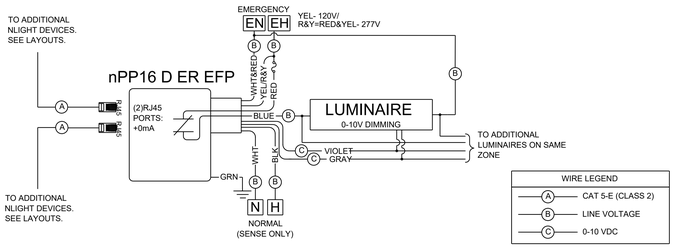
AcuityBrands

Strawberry Park Elementary
Steamboat Springs, CO

Drawing Type:

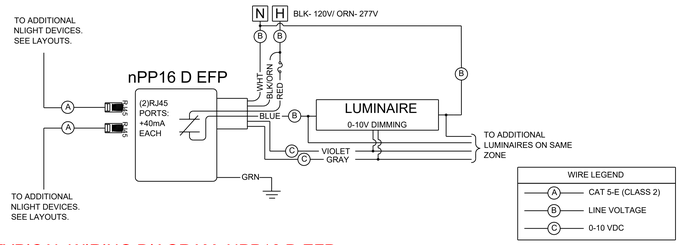
Prepared For:
CED

Date: 03/04/2020
Scale: NOT TO SCALE
Drawn By: rcosenza
Project #: 134479
DWG Ref: NONE
Sheet: LC0.0



TYPICAL WIRING DIAGRAM: NPP16 D ER EFP

N.T.S.



TYPICAL WIRING DIAGRAM: NPP16 D EFP

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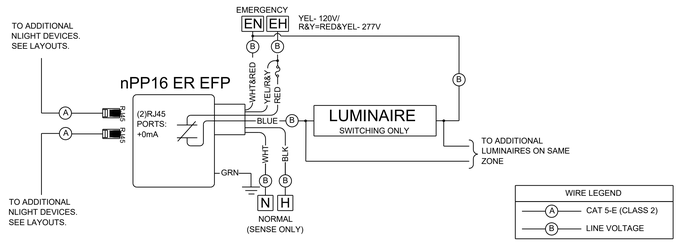

TYPICAL WIRING DIAGRAM: NPP16 ER EFP

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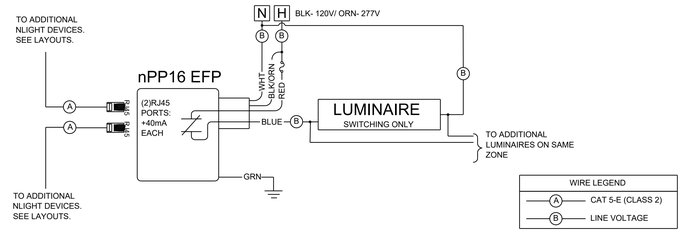
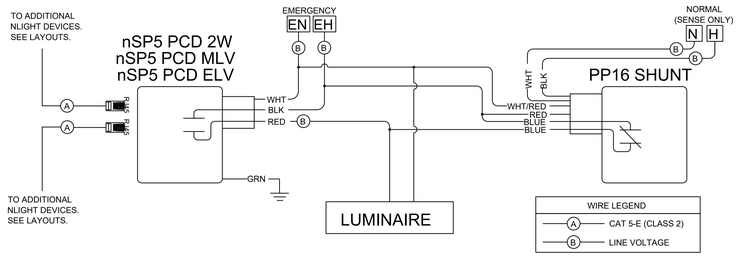


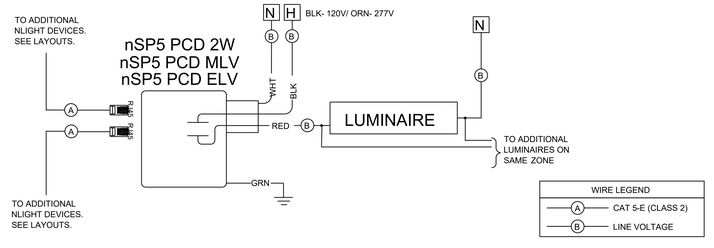
TYPICAL WIRING DIAGRAM: NPP16 EFP

N.T.S.



TYPICAL WIRING DIAGRAM: SHUNTING 2-WIRE NSP5 PCD (2W/MLV/ELV)

NTS

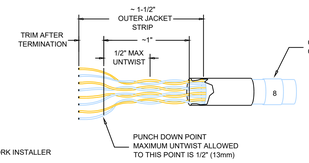


TYPICAL WIRING DIAGRAM: 2-WIRE NSP5 PCD (2W/MLV/ELV)

NTS

TIA / EIA-568-B CABLING STANDARD TERMINATION

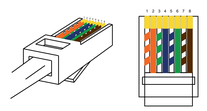
Function	PAIR #	PIN OUT (T568B)	Wire Color
(T1)	1	5	WHITE w/ BLUE
(R1)		4	BLUE
Tx + (T2)	2	1	WHITE w/ ORANGE
Tx - (R2)		2	ORANGE
Rx + (T3)	3	3	WHITE w/ GREEN
Rx - (R3)		6	GREEN
(T4)	4	7	WHITE w/ BROWN
(R4)		8	BROWN



TERMINATION & TESTING OF CAT5 CABLES MUST BE DONE BY A QUALIFIED NETWORK INSTALLER

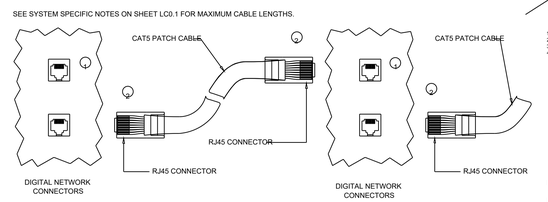
Cable termination requirements :

1. Strip off outer jacket - approximately 1-1/2" (37.6 mm)
2. Terminate approximately 1/2" (12.2 mm) from end of conductors on type 110 punch down block or connector per schedule (T568B) - maximum untwist of conductors to terminations is 1/2" (12.2 mm) - trim excess leads



1. WHITE w/ ORANGE
2. ORANGE
3. WHITE w/ GREEN
4. BLUE
5. WHITE w/ BLUE
6. GREEN
7. WHITE w/ BROWN
8. BROWN

SEE SYSTEM SPECIFIC NOTES ON SHEET LC0.1 FOR MAXIMUM CABLE LENGTHS.



(1) RJ45 FEMALE CONNECTOR

(2) RJ45 MALE CONNECTORS. ALL CABLES SUPPLIED BY CONTRACTOR.

Notes:

Daisy-chain CAT5 patch cable with RJ45 connectors from digital device to digital device.

Refer to manufacturers instructions for long distance runs between digital devices.

Crimp and test each cable with a LAN circuit tester prior to installation.

CAT5E/6 CABLE TERMINATION

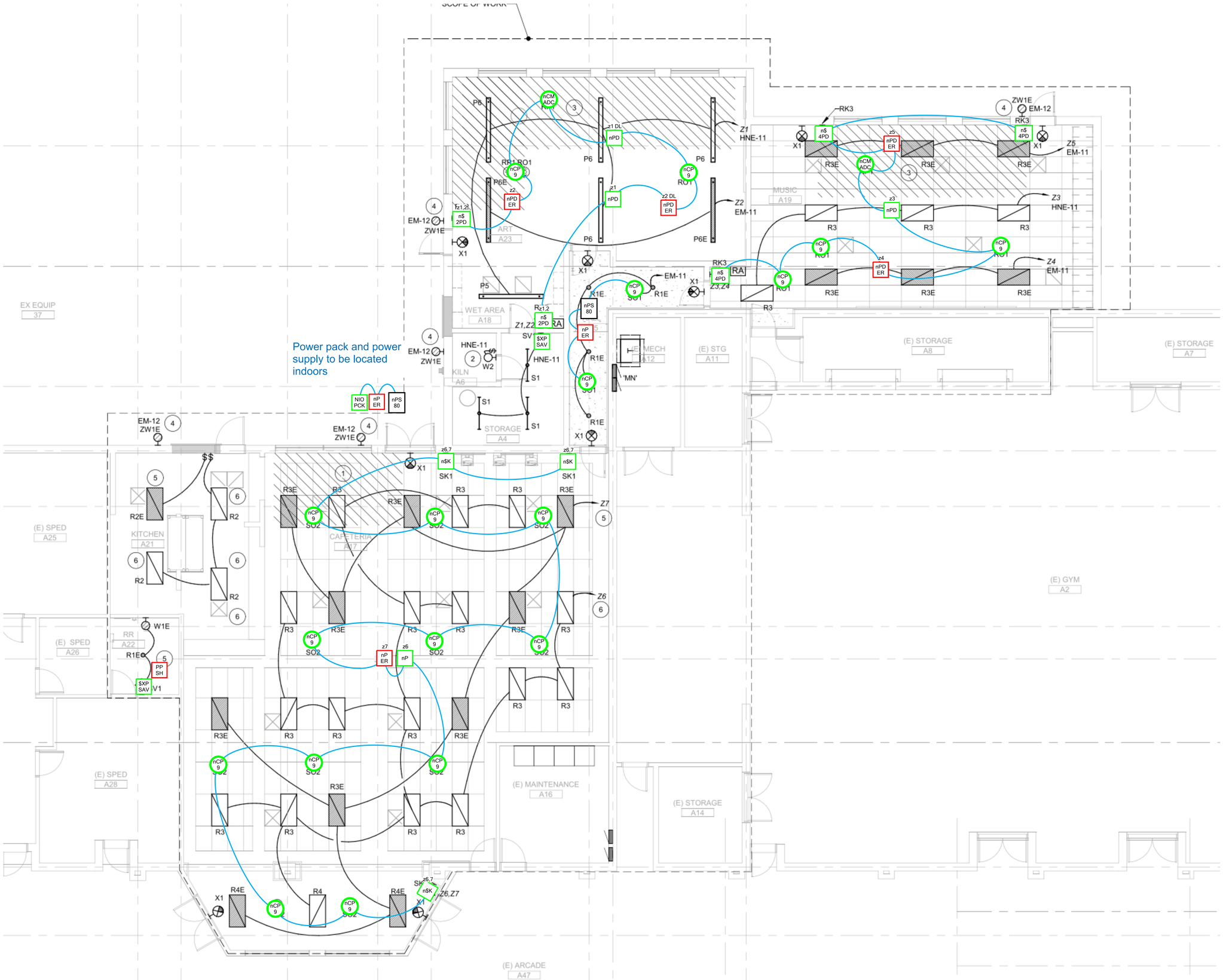
N.T.S.

AcuityBrands

Strawberry Park Elementary
Steamboat Springs, CO

Drawing Type: Details
Prepared For: CED

Date: 03/04/2020
Scale: NOT TO SCALE
Drawn By: rcosenza
Project #: 134479
DWG Ref: NONE
Sheet: LC0.2



1 LC1.0 (E2.11)
1/4" = 1'

Disclaimer

THIS CONTROLS SYSTEM LAYOUT DIAGRAM IS NOT A PROFESSIONAL ENGINEERING DRAWING, AND IS PROVIDED ONLY FOR INFORMATIONAL PURPOSES AND TO HELP THE CUSTOMER OR END-USER (AS APPLICABLE) UNDERSTAND HOW VARIOUS CONTROLS DEVICES ARE ARRANGED AND CONNECT TO EACH OTHER. THIS CONTROLS SYSTEM LAYOUT DIAGRAM IS STRICTLY BASED ON THE INFORMATION PROVIDED TO ACUITY BRANDS, AND IS PROVIDED WITHOUT WARRANTY AS TO ACCURACY, COMPLETENESS, RELIABILITY OR OTHERWISE. IF THE INFORMATION (INCLUDING BUT NOT LIMITED TO FLOOR-PLANS, REFLECTED CEILING PLANS, ELECTRICAL PLANS AND SPECIFICATIONS) PROVIDED TO ACUITY BRANDS IS INCOMPLETE OR NOT CURRENT (I.E., NEWER VERSIONS EXIST), THE ACCURACY OF THE LAYOUT DIAGRAM MAY BE ADVERSELY AFFECTED. ONCE THIS CONTROLS SYSTEM LAYOUT DIAGRAM IS RECEIVED BY THE CUSTOMER OR END-USER (AS APPLICABLE), IT IS THE OBLIGATION OF THE CUSTOMER OR END-USER (AS APPLICABLE) TO CONSULT WITH A PROFESSIONAL ENGINEERING ADVISOR TO DETERMINE WHETHER THE PROPOSED DESIGN MEETS THE APPLICABLE PROJECT REQUIREMENTS FOR THE CONTROLS SYSTEM'S PERFORMANCE, CODE COMPLIANCE, SAFETY, SUITABILITY AND EFFECTIVENESS FOR USE IN A PARTICULAR APPLICATION. IN NO EVENT WILL ACUITY BRANDS BE RESPONSIBLE FOR ANY LOSS RESULTING FROM ANY USE OF THIS CONTROLS SYSTEM LAYOUT DIAGRAM.

AcuityControls™

LC1.0 (E2.11)
Project: Strawberry Park Elementary

2	$XP SAV	$XP SAV WSX PDT SA VLP XX Wall Switch Sensor, Passive Dual Technology, Vacancy (default), VLP Programmable
2	n$ 2PD	n$ 2PD NPODM 2P DX XX Low Voltage Push-Button Wallpod, 2-Pole, Raise/Lower Dimming Without Wires
3	n$ 4PD	n$ 4PD NPODM 4P DX XX Low Voltage Push-Button Wallpod, Four Pole, Raise/Lower Dimming Without Wires
3	n$K	n$K NPOD KEY XX Low Voltage Wallpod, Digital keyswitch
2	nCM ADC	nCM ADC NCM ADCX Low Voltage Ceiling Mount Sensor, Photocontrol w/ Auto Dimming; No Wires
18	nCP 9	nCP 9 NCM PDT 9 Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Small Motion / Standard Range 360° Lens
1	NIO PCK	NIO PCK NIO PC KIT nLight Device, On/off photocell, Kit
1	nP	nP NPP16 EFP Power/Relay Pack, External Fault Protection
3	nP ER	nP ER NPP16 ER EFP Power/Relay Pack, UL924 Emergency Operation, External Fault Protection
3	nPD	nPD NPP16 D EFP Power/Relay Pack, Occupancy Controlled Dimming, External Fault Protection
4	nPD ER	nPD ER NPP16 D ER EFP Power/Relay Pack, Occupancy Controlled Dimming, UL924 Emergency Operation, External Fault Protection
2	nPS 80	nPS 80 NPS 80 Power Supply, 80 mA
1	PP SH	PP SH PP16 SHUNT Bypass Relay Pack, Shunt

WIRE LEGEND - LC1.0 (E2.11)

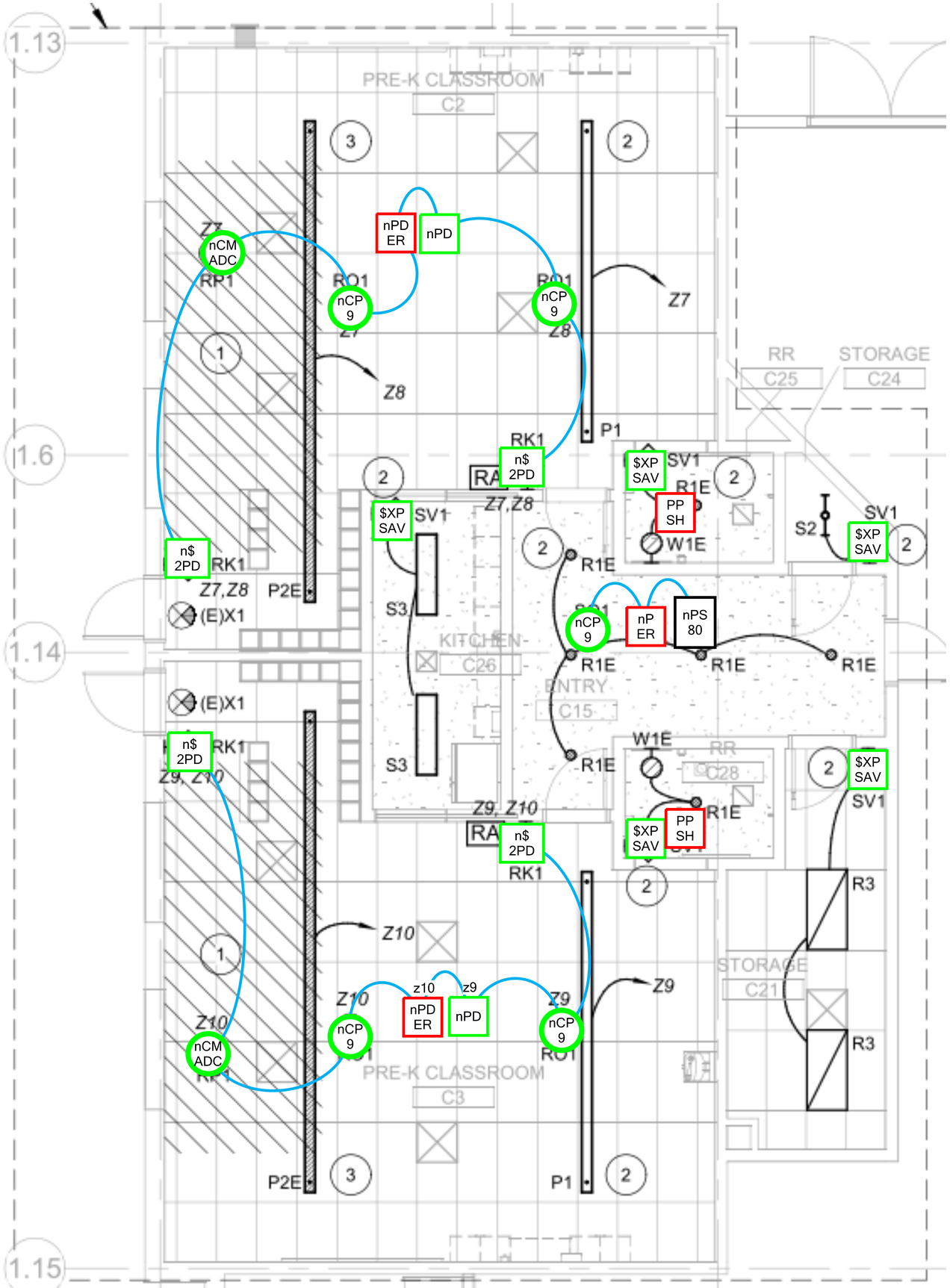
CAT5e
Pre-terminated CAT5e cable

RO1=nCP9/nCP10
SO1, SO2, SO3, SO4=nCP9/nCP10
SK1=n$, n$K
RK1=n$ 2PD
RK3=n$ 4PD
RP1=nCM ADC
RP1=nCMADC
SV1=$XPSAV

AcuityBrands

Strawberry Park Elementary
Steamboat Springs, CO

Drawing Type:	Control Layout
Prepared For:	CED
Date:	03/04/2020
Scale:	1/4" = 1'
Drawn By:	rcosenza
Project #:	134479
DWG Ref:	unknown
Sheet:	LC1.0



1 LC1.1 (E2.12)
1/2" = 1'

AcuityControls™

LC1.1 (E2.12)
Project: Strawberry Park Elementary

5	$XP SAV	$XP SAV WSX PDT SA VLP XX Wall Switch Sensor, Passive Dual Technology, Vacancy (default), VLP Programmable
4	n$ 2PD	n$ 2PD NPODM 2P DX XX Low Voltage Push-Button Wallpod, 2-Pole, Raise/Lower Dimming Without Wires
2	nCM ADC	nCM ADC NCM ADCX Low Voltage Ceiling Mount Sensor, Photocontrol w/ Auto Dimming; No Wires
5	nCP 9	nCP 9 NCM PDT 9 Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Small Motion / Standard Range 360° Lens
1	nP ER	nP ER NPP16 ER EFP Power/Relay Pack, UL924 Emergency Operation, External Fault Protection
2	nPD	nPD NPP16 D EFP Power/Relay Pack, Occupancy Controlled Dimming, External Fault Protection
2	nPD ER	nPD ER NPP16 D ER EFP Power/Relay Pack, Occupancy Controlled Dimming, UL924 Emergency Operation, External Fault Protection
1	nPS 80	nPS 80 NPS 80 Power Supply, 80 mA
2	PP SH	PP SH PP16 SHUNT Bypass Relay Pack, Shunt

WIRE LEGEND - LC1.1 (E2.12)	
	CAT5e Pre-terminated CAT5e cable

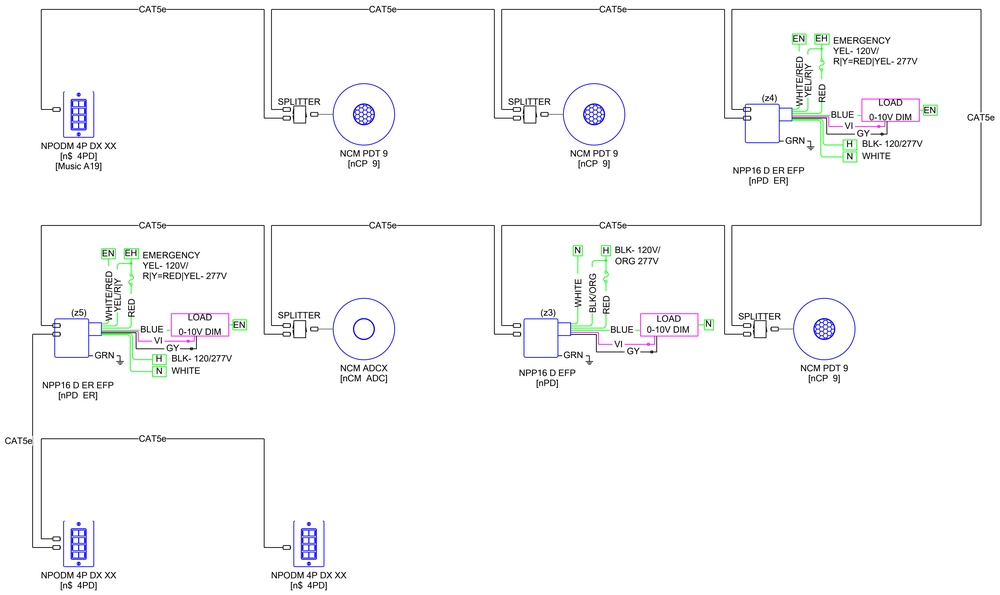
RO1=nCP9/nCP10
SO1, SO2, SO3, SO4=nCP9/nCP10
SK1=n$, n$K
RK1=n$ 2PD
RK3=n$ 4PD
RP1=nCM ADC
RP1=nCMADC
SV1=$XPSAV

AcuityBrands

Strawberry Park Elementary
Steamboat Springs, CO

Drawing Type: Control Layout	Prepared For: CED
Date:	03/04/2020
Scale:	1/2" = 1'
Drawn By:	rcosenza
Project #:	134479
DWG Ref:	unknown
Sheet:	LC1.1

1 LC1.0 (E2.11) - Cafeteria A17
NOT TO SCALE



4 LC1.0 (E2.11) - Music A19
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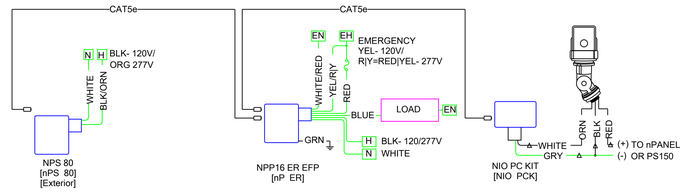

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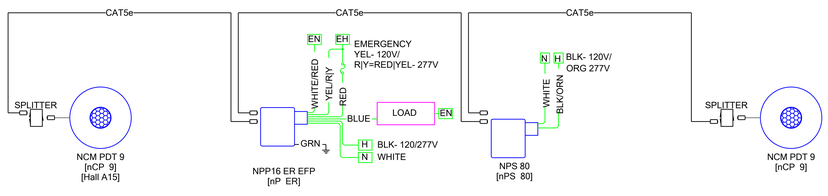

2 LC1.0 (E2.11) - Hall A15
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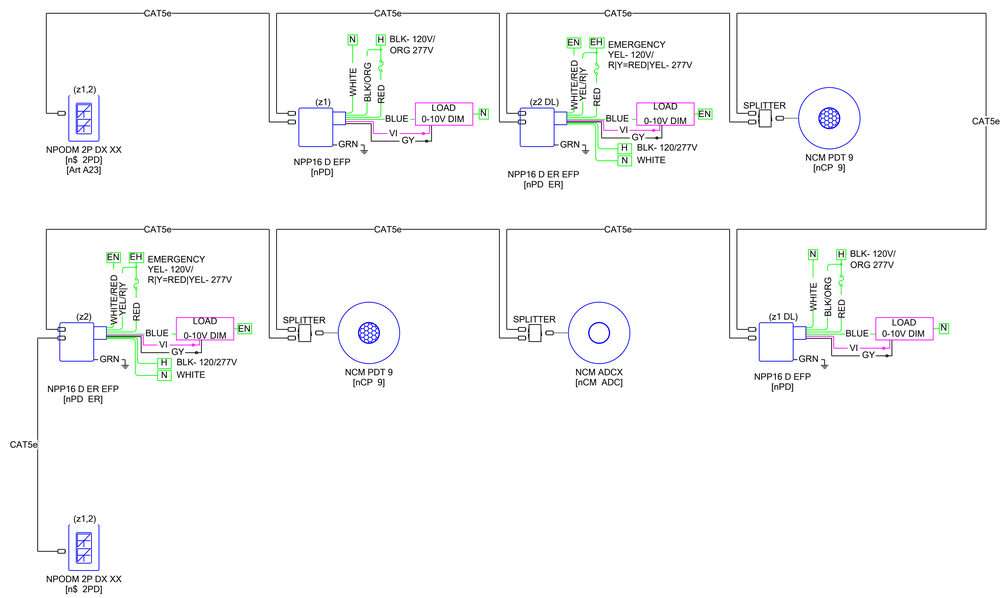

3 LC1.0 (E2.11) - Art A23
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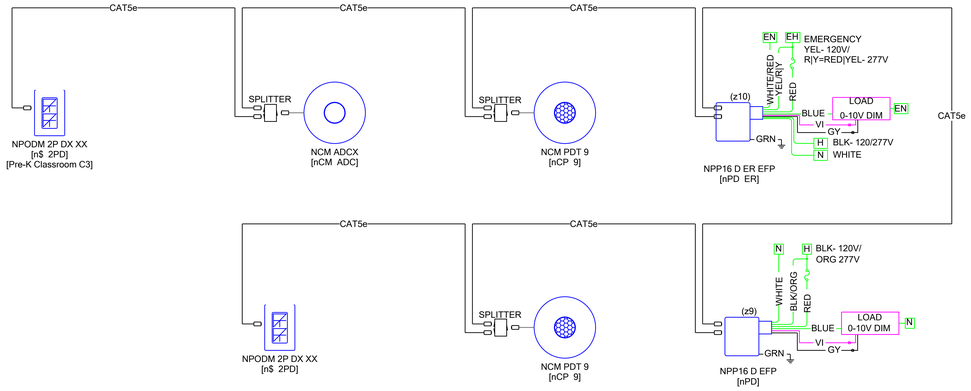
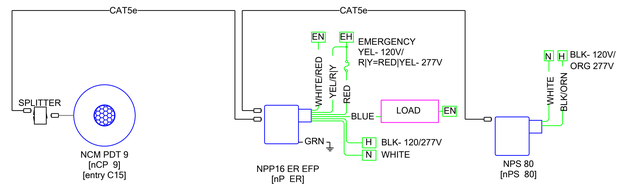


6 LC1.1 (E2.12) - Pre-K Classroom C3
NOT TO SCALE



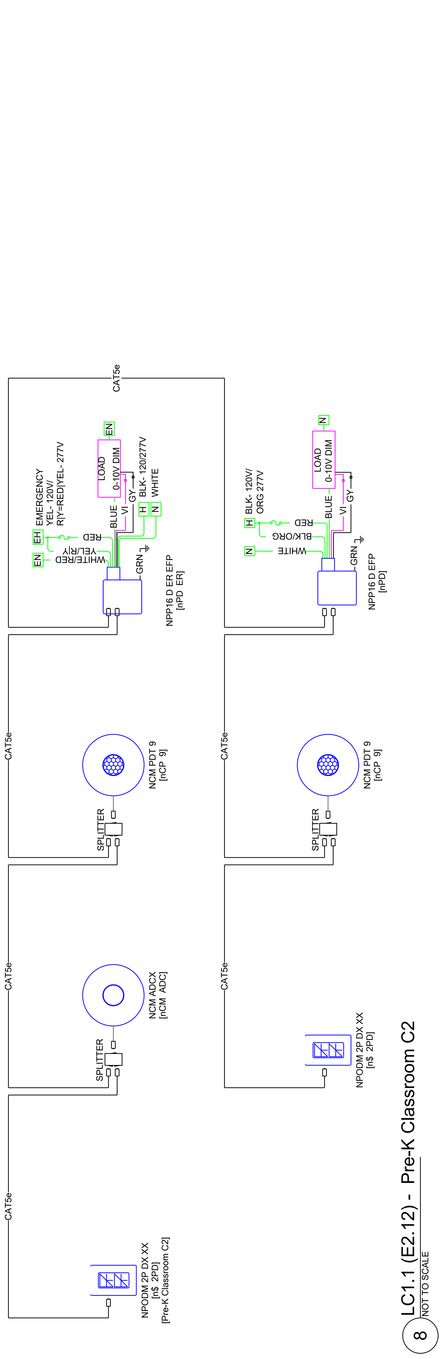
7 LC1.1 (E2.12) - entry C15
NOT TO SCALE

AcuityBrands

Strawberry Park Elementary
Steamboat Springs, CO

Drawing Type: Riser	Prepared For: CED
Date:	03/04/2020
Scale:	NOT TO SCALE
Drawn By:	rcosenza
Project #:	134479
DWG Ref:	
Sheet:	LC 2.0

Prepared For:	CED
Drawing Type:	Riser
Date:	03/04/2020
Scale:	NOT TO SCALE
Drawn By:	rosenza
Project #:	134479
DWG Ref:	
Sheet:	LC.2.1



8 LC1.1 (E2.12) - Pre-K Classroom C2
NOT TO SCALE

Tab 8:
Test Adjust and Balance (TAB) Report

CERTIFIED BALANCING AND COMMISSIONING, LLC.

TESTING, ADJUSTING AND BALANCING BUREAU
THE PROFESSIONAL'S CHOICE™

Testing, Adjusting and Balancing

Project	**Strawberry Park Elementary School-Revised**
Address	39620 Amethyst Dr. Steamboat Springs, CO
Architect	Tab Associates
Mechanical Engineer	BG Building Works
Contractor	R&H Mechanical
Balancing Supervisors	Greg Barnes // Daniel Takacs
Date	December 18, 2020
Job Number	3500

ABBREVIATION INDEX

AHU: Air Handling Unit
Motor FLA: Full Load Amperage
RTU: Roof Top Unit
S.F.: Service Factor
MAU: Make Up Air Unit
P.F.: Power Factor
FCU: Fan Coil Unit
Nom. Eff.: Nominal Efficiency
CRAC: Computer Room Air Conditioning Unit
RPM: Revolutions per Minute
VAV: Variable Air Volume
FPB: Fan Powered Box
K Factor: Correction Factor
T1: Terminal 1
T2: Terminal 2
T3: Terminal 3
AK: Area Correction
OD: Outside Diameter
CUH: Cabinet Unit Heater
UH: Unit Heater
ERV: Energy Recovery Ventilator
TDH: Total Dynamic Head
ERU: Energy Recovery Unit
PSI: Pounds per Square Inch
EF: Exhaust Fan
BV: Balance Valve
KEF: Kitchen Exhaust Fan
CS: Circuit Setter
SF: Supply Fan
Valve D.P.: Discharge Pressure
RF: Return Fan
Valve S.P.: Suction Pressure
TF: Transfer Fan
Diff.: Differential
SEF: Smoke Exhaust Fan
Design D.P.: Design Differential Pressure
SPF: Stairwell Pressurization Fan
Actual D.P.: Recorded Differential Pressure
SP: Static Pressure
Ind.Imp.Dia.: Indicated Impeller Diameter
TSP: Total Static Pressure
in.wc.: Inches of Water
ESP: External Static Pressure
HW: Heating Water
VP: Velocity Pressure
CHW: Cooling Water
SA: Supply Air
CW: Condenser Water
RA: Return Air
HX: Heat Exchanger
OSA: Outside Air
DX: Direct Expansion
OA: Outside Air
EAT: Entering Air Temperature
MA: Mixed Air
LAT: Leaving Air Temperature
SD: Supply Diffuser
EWT: Entering Water Temperature
CD: Ceiling Diffuser
LWT: Leaving Water Temperature
SWD: Sidewall Diffuser
ER: Exhaust Register
MVD: Manual Volume Damper
RG: Return Grille
OBD: Opposed Blade Damper
CFM: Cubic Feet Per Minute
NAC: No Access
FPM: Feet Per Minute
NG: Not Given
NIC: Not in Contract
E: Existing

CERTIFIED BALANCING AND COMMISSIONING, LLC.

TESTING, ADJUSTING AND BALANCING BUREAU
THE PROFESSIONAL'S CHOICE℠

Method of Balancing:

Supply, Return and Exhaust diffusers, grilles and registers were measured with an Alnor Balometer EBT-721, which includes the flow hood, velgrid, pitot tube and airfoil. Heating and Chilled water flow rates were measured with an Alnor Hydronic Manometer HM-680 by obtaining pressure measurements. RPM was measured with a Shimpo tachometer. Amperage and Voltage readings were taken with a Fluke 930 meter.

Instrumentation:

Digital Manometer	Alnor Balometer EBT-721
Flow hood	Alnor Balometer EBT-721
Digital Pressure Gage	Alnor Hydronic Manometer HM-680
Tachometer	Shimpo
Digital Volt-Amp Meter	Fluke 930
Thermometer	Alnor Balometer EBT-721

Warranty Information:

This project was completed per TABB Procedural Standards.
The data presented in this report is a record of system measurements and final adjustments that have been obtained in accordance with the current edition of the TABB Procedural Standards for testing, adjusting, and balancing environmental systems. Any variances from design quantities, which exceed TABB tolerances, are noted in the Test-Adjust-Balance Report Project Summary. If a Test-Adjust-Balance Report Project Summary is not issued directly following this cover page, all measurements met the design requirements as specified by the design mechanical engineer.

This project has a one-year guarantee on all Testing, Adjusting & Balancing from the date listed on this cover page.

Greg Barnes
Owner/ TABB Supervisor
greg@certtab.com
720-201-6274

Project Summary

1. **Individual Notes, Explanations, and Deficiencies, if exist, are shown underneath the associated equipment.**

Table Of Contents

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500
DATE: 12/18/2020
CONTACT: Brandon Wilson

Table Of Contents

Roof Top Unit

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

SYSTEM/UNIT: AHU-02

Tested By: Brandon Wilson
Date: 11/19/2020

Unit Data	
Unit Manufacturer	CARRIER
Unit Model Number	NO TAG

Test Data	
Design Airflow	6500 CFM
Actual Airflow	5375 CFM
Design Outside Airflow	4800 CFM
Actual Outside Airflow	4850 CFM
AHU-02/Supply Fan	
Motor Volts T1-T2	285 @ VFD Volts
Motor Amps T1	7.2 @ VFD Amps

Motor Data	
AHU-02/Supply Fan	
Motor Manufacturer	No Motor Tag
Motor Hertz	60 Hz

Sheave Data	
AHU-02/Supply Fan	
Motor Sheave Model	No ACCESS

Test Pressures	
Filter SP Out	-0.13 in. WC
Cooling SP In	-0.13 in. WC
Cooling SP Out	-0.17 in. WC
Fan SP In	-0.29 in. WC
Fan SP Out	1.21 in. WC
Heating SP In	-0.17 in. WC
Heating SP Out	0.29 in. WC

SYSTEM/UNIT: AHU-02/VAV-01

Tested By: Brandon Wilson
Date: 11/19/2020

Unit Data	
VAV Address	5
Box Inlet Size	8 in
K Factor	1009.00

Term Box Test Data	
Design Max Airflow	600 CFM
Actual Max Airflow	575 CFM
Design Min Airflow	100 CFM
Actual Min Airflow	110 CFM

AHU-02/VAV-01 Supply Outlet Summary

System/Unit	Outlet Type	Size LxW / D	AK Factor	Design Airflow	Prelim Airflow	% Prelim Diff.	Final Airflow	% Final Diff.
Outlet-01	CD	24X24	1	300	275	92	290	97
Outlet-02	CD	24X24	1	300	150	50	285	95
Totals:	**-**	**-**	**-**	**600**	**425**	**71**	**575**	**96**

Roof Top Unit

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

SYSTEM/UNIT: AHU-02/VAV-02

Tested By: Brandon Wilson
Date: 11/19/2020

Unit Data	
VAV Address	6
Box Inlet Size	16 in
K Factor	4790.00

Term Box Test Data	
Design Max Airflow	3500 CFM
Actual Max Airflow	2400 CFM
Design Min Airflow	1050 CFM
Actual Min Airflow	1065 CFM

Log:

AHU-02/VAV-02	11/19/2020	Brandon Wilson	0.75 SP @ INLET.
AHU-02/VAV-02	11/19/2020	Brandon Wilson	VAV UNDERSIZED FOR DESIGN. OUTLETS PROPORTIONED AT 100% DAMPER POSITION WITH THE RTU RUNNING AT 97% FAN SPEED.

AHU-02/VAV-02 Supply Outlet Summary

System/Unit	Outlet Type	Size LxW / D	AK Factor	Design Airflow	Prelim Airflow	% Prelim Diff.	Final Airflow	% Final Diff.
Outlet-01	CD	24X24	1	350	200	57	235	67
Outlet-02	CD	24X24	1	350	195	56	235	67
Outlet-03	CD	24X24	1	350	245	70	230	66
Outlet-04	CD	24X24	1	350	210	60	240	69
Outlet-05	CD	24X24	1	350	295	84	245	70
Outlet-06	CD	24X24	1	350	225	64	245	70
Outlet-07	CD	24X24	1	350	230	66	255	73
Outlet-08	CD	24X24	1	350	330	94	240	69
Outlet-09	CD	24X24	1	350	280	80	240	69
Outlet-10	CD	24X24	1	350	230	66	235	67
Totals:	**-**	**-**	**-**	**3500**	**2440**	**70**	**2400**	**69**

SYSTEM/UNIT: AHU-02/VAV-03

Tested By: Brandon Wilson
Date: 11/19/2020

Unit Data	
VAV Address	7
Box Inlet Size	5 in
K Factor	585.00

Term Box Test Data	
Design Max Airflow	200 CFM
Actual Max Airflow	205 CFM
Design Min Airflow	50 CFM
Actual Min Airflow	60 CFM

AHU-02/VAV-03 Supply Outlet Summary

System/Unit	Outlet Type	Size LxW / D	AK Factor	Design Airflow	Prelim Airflow	% Prelim Diff.	Final Airflow	% Final Diff.
Outlet-01	CD	12X12	1	200	130	65	205	103
Totals:	**-**	**-**	**-**	**200**	**130**	**65**	**205**	**103**

Roof Top Unit

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

SYSTEM/UNIT: AHU-02/VAV-04

Tested By: Brandon Wilson
Date: 11/12/2020

Unit Data	
VAV Address	8
Box Inlet Size	12 in
K Factor	2457.00

Term Box Test Data	
Design Max Airflow	1100 CFM
Actual Max Airflow	1125 CFM
Design Min Airflow	330 CFM
Actual Min Airflow	335 CFM

AHU-02/VAV-04 Supply Outlet Summary

System/Unit	Outlet Type	Size LxW / D	AK Factor	Design Airflow	Prelim Airflow	% Prelim Diff.	Final Airflow	% Final Diff.
Outlet-01	SR			275	150	55	285	104
Outlet-02	SR			275	130	47	285	104
Outlet-03	SR			275	140	51	280	102
Outlet-04	SR			275	170	62	275	100
Totals:	**-**	**-**	**-**	**1100**	**590**	**54**	**1125**	**102**

SYSTEM/UNIT: AHU-02/VAV-05

Tested By: Brandon Wilson
Date: 11/12/2020

Unit Data	
VAV Address	9
Box Inlet Size	12 in
K Factor	2480.00

Term Box Test Data	
Design Max Airflow	1100 CFM
Actual Max Airflow	1070 CFM
Design Min Airflow	350 CFM
Actual Min Airflow	360 CFM

AHU-02/VAV-05 Supply Outlet Summary

System/Unit	Outlet Type	Size LxW / D	AK Factor	Design Airflow	Prelim Airflow	% Prelim Diff.	Final Airflow	% Final Diff.
Outlet-01	CD	24X24	1	220	70	32	215	98
Outlet-02	CD	24X24	1	220	385	175	210	95
Outlet-03	CD	24X24	1	220	75	34	215	98
Outlet-04	CD	24X24	1	220	435	198	210	95
Outlet-05	CD	24X24	1	220	60	27	220	100
Totals:	**-**	**-**	**-**	**1100**	**1025**	**93**	**1070**	**97**

Fan Unit

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

SYSTEM/UNIT: EF-01

Tested By: Pat Handley
Date: 12/17/2020

Unit Data	
Fan Manufacturer	GREENHECK
Fan Model Number	CSP-A1750

Starter Data	
Starter Manufacturer	NONE

Test Data	
Design Airflow	800 CFM
Actual Airflow	1190 CFM
Motor Volts T1-T2	119 Volts
Motor Amps T1	1.40 Amps
Fan SP In	-0.26 in. wc
Fan SP Out	0.06 in. wc
Design ESP	0.50 in. wc

Motor Data	
Rated Design Airflow	800 CFM
Motor Manufacturer	NO ACCESS
Motor HP	260 WATT HP
Motor Rated Volts	120 Volts
Motor Hertz	60 Hz

Sheave Data	
Motor Sheave Model	DIRECT DRIVE

Log:

EF-01	12/17/2020	Pat Handley	NO SPEED CONTROLER
EF-01	12/17/2020	Pat Handley	NO ACCESS TO MOTOR ALL INFO TAKEN OFF OF SCHEDULE

EF-01 Exhaust Inlet Summary

System/Unit	Inlet Type	Size LxW / D	AK Factor	Design Airflow	Prelim Airflow	% Prelim Diff.	Final Airflow	% Final Diff.
Inlet-01	ER	11.25 X 17.5	1.37	400	630	158	630	158
Inlet-02	ER	11.25 X17.5	1.37	400	560	140	560	140
Totals:	-	-	-	**800**	**1190**	**149**	**1190**	**149**

SYSTEM/UNIT: EF-03

Tested By: Pat Handley
Date: 12/17/2020

Unit Data	
Fan Manufacturer	ACME
Fan Model Number	VQ400
Fan Serial Number	02D27H

Starter Data	
Starter Manufacturer	NONE

Test Data	
Design Airflow	400 CFM
Actual Airflow	435 CFM
Actual RPM	DD
Motor Volts T1-T2	119 Volts
Motor Amps T1	2.10 Amps
Fan SP In	ATMOS in. wc
Fan SP Out	NAC in. wc

Motor Data	
Rated Design Airflow	400 CFM
Motor Manufacturer	BROAN
Motor HP	19 WATT
Motor RPM	640 RPM
Motor Rated Volts	120 Volts
Motor Phase	1
Motor Hertz	60 Hz
Motor FL Amps	5.00 Amps

Sheave Data	
Motor Sheave Model	DIRECT DRIVE

Fan Unit

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

SYSTEM/UNIT: EF-04

Tested By: Pat Handley
Date: 12/17/2020

Unit Data	
Fan Manufacturer	GREENHECK
Fan Model Number	SP-A90

Starter Data	
Starter Manufacturer	NONE

Test Data	
Design Airflow	80 CFM
Actual Airflow	110 CFM
Actual RPM	DD
Motor Volts T1-T2	121 Volts
Motor Amps T1	0.50 Amps
Fan SP In	ATMOS in. wc
Fan SP Out	NAC in. wc

Motor Data	
Rated Design Airflow	80 CFM
Motor HP	13 WATT
Motor Rated Volts	120 Volts
Motor Phase	1
Motor Hertz	60 Hz

Sheave Data	
Motor Sheave Model	DIRECT DRIVE

Log:

EF-04	12/17/2020	Pat Handley	FAN TESTED ON LOWEST AVAILABLE SPEED
EF-04	12/17/2020	Pat Handley	NO TAG ON UNIT INFO TAKEN OFF OF SCHEDULE

SYSTEM/UNIT: KEF-01

Tested By: Brandon Wilson
Date: 11/19/2020

Unit Data	
Fan Manufacturer	Acme Engineering & MFG
Fan Model Number	PNU150RF
Fan Serial Number	20L1230-1

Test Data	
Design Airflow	1648 CFM
Actual Airflow	1760 CFM
Motor Volts T1-T2	NO ACCESS Volts
Motor Amps T1	NO ACCESS Amps
Fan SP In	NO ACCESS in. wc
Fan SP Out	NO ACCESS in. wc

Motor Data	
Rated Design Airflow	1516 CFM
Motor Manufacturer	Marathon
Motor Frame	56Z
Motor HP	1/2 HP
Motor RPM	1725/1425 RPM
Motor Rated Volts	115/230 Volts
Motor Phase	1
Motor Hertz	60 Hz
Motor FL Amps	7.8/3.9 Amps
Motor Service Factor	1.25

Sheave Data	
Motor Sheave Model	MA43
Motor Sheave Bore	5/8 in.
Fan Sheave Model	MVL40B
Fan Sheave Bore	1/2 in.
Number of Belts	1
Belt Size	A24 OR 4L260

Log:

KEF-01	11/19/2020	Brandon Wilson	1262 FPM/1.396 SQ FT/ 1762 CFM.

Fan Unit

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

SYSTEM/UNIT: KEF-02

Tested By: Brandon Wilson
Date: 11/19/2020

Unit Data	
Fan Manufacturer	Acme Engineering & MFG
Fan Model Number	PDU110RF
Fan Serial Number	20G1651

Test Data	
Design Airflow	600 CFM
Actual Airflow	605 CFM
Actual RPM	DIRECT DRIVE
Motor Volts T1-T2	NO ACCESS Volts
Motor Amps T1	NO ACCESS Amps
Fan SP In	NO ACCESS in. wc
Fan SP Out	NO ACCESS in. wc

Motor Data	
Rated Design Airflow	600 CFM
Motor Manufacturer	US MOTORS
Motor Frame	42Y
Motor HP	1/10 HP
Motor RPM	1550 RPM
Motor Rated Volts	115 Volts
Motor Phase	1
Motor Hertz	60 Hz
Motor FL Amps	1.70 Amps

Sheave Data	
Motor Sheave Model	Direct Drive

Log:				
	KEF-02	11/19/2020	Brandon Wilson	1110 FPM/ 0.545 SQ FT/ 605 CFM.

Hydronic Pump

PROJECT: STRAWBERRY PARK ELEMENTARY SCHOOL
LOCATION: STEAMBOAT SPRINGS, CO
PROJECT #: 3500

DATE: 12/18/2020
CONTACT: Brandon Wilson

(E)-HWP-01 Balance Valve Summary

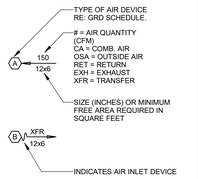
System/Unit	Manufacturer	Model Number	Valve Size	d.GPM	Design D.P.	p.GPM	a.GPM	Final D.P.	%D Des/Final	Valve Position
VAV-01	Griswold	AUTOFLOW		1.6	2-32		1.66	3.1		
VAV-02*	Griswold	AUTOFLOW		9.4	2-32					
VAV-03	Griswold	AUTOFLOW		0.5	2-32		0.55	21.7		
VAV-04	Griswold	AUTOFLOW		3	2-32		3	18.3		
VAV-05	Griswold	AUTOFLOW		3	2-32		3	31.2		
Totals:	-	-	-	**17.5**	-	-	**8.21**	-	-	-

Log:

(E)-HWP-01/VAV-02	11/20/2020	Brandon Wilson	UNABLE TO PLUG INTO VALVE PORTS.

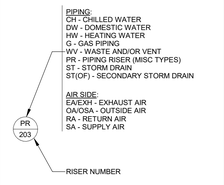
MECHANICAL SYSTEMS LEGEND

AIR DEVICE DESIGNATION KEY

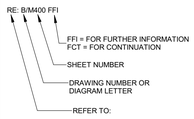


NOTE:
FOR STANDARD MODULE SIZE REGISTERS, SIZE GIVEN IS NECK SIZE. REFER TO GRD SCHEDULE FOR MODULE SIZE.

DUCT/PIPE RISER DESIGNATION KEY



REFERENCE SAMPLE



NOTES

1. ALL SYMBOLS, ABBREVIATIONS, AND DESIGNATIONS ON LEGEND SHEET ARE NOT NECESSARILY USED ON THIS PROJECT.
2. THIS DRAWING SET CONSISTS OF DATA GENERATED, IN PART, BY OTHER PARTIES. NOT ALL SYMBOLOGIES AND NOTATION CONVENTIONS OCCURRING IN THIS DRAWING SET ARE NECESSARILY DEFINED ON THESE LEGENDS. CONSULT THE ENGINEER IN THE EVENT SYMBOLOGY OR NOTATION INTERPRETATION IS REQUIRED.

DUCTWORK LEGEND

ROUND 3D	ROUND PLAN	DESCRIPTION	RECTANGULAR PLAN	RECTANGULAR 3D
		DUCT RISER		
		DUCT DROP		
		90° ELBOW DN. (NEGATIVE PRESSURE)		
		90° ELBOW DN. (POSITIVE PRESSURE)		
		90° ELBOW UP (NEGATIVE PRESSURE)		
		90° ELBOW UP (POSITIVE PRESSURE)		
		SIZE OR SHAPE TRANSITION		
		ROUND FLEXIBLE DUCT CONNECTION		
		90° RADIUS ELBOW		
-	-	90° MITERED ELBOW W/ TURNING VANES		
		90° STRAIGHT TEE		
		90° CONICAL TEE		
		45° BRANCH		
		45° CONICAL BRANCH		
	F/S	COMBINATION FIRE AND SMOKE DAMPER	F/S	
		FIRE DAMPER		
		SMOKE DAMPER		
		MANUAL BALANCING DAMPER		
		MOTORIZED DAMPER		
	BDD	BACKDRAFT DAMPER	BDD	
	D	OFFSET TO CHANGE ELEVATION D = DROP R=RISE	R	
-	14ø	DUCT SIZE TAG; FIRST NUMBER = PLAN WIDTH	14x12	-

FIXTURE CONNECTION SCHEDULE

DESCRIPTION	TAG	HW	CW	WASTE	VENT
WATER CLOSET (FLUSH VALVE)	WC	-	1"	4"	2"
WATER CLOSET (FLUSH TANK)	WC	-	1/2"	4"	2"
URINAL (BLOWOUT)	UR	-	1"	2"	1-1/2"
URINAL (WASHDOWN)	UR	-	3/4"	2"	1-1/2"
URINAL (WATERLESS)	UR	-	-	2"	1-1/2"
LAVATORY	LAV	1/2"	1/2"	1-1/2"	1-1/2"
HAND SINK	HS	1/2"	1/2"	1-1/2"	1-1/2"
SERVICE SINK	SS	1/2"	1/2"	3"	2"
MOP SERVICE BASIN	MSB	3/4"	3/4"	3"	2"
DRINKING FOUNTAIN/WATER COOLER	DF	-	1/2"	1-1/2"	1-1/2"
KITCHEN SINK W/ OR W/O DISPOSAL	KS	1/2"	1/2"	2"	1-1/2"
SHOWER	SH/SHWR	3/4"	3/4"	2"	1-1/2"
SHOWER/BATHTUB	SH/TUB	3/4"	3/4"	2"	1-1/2"
BATHTUB	TUB	3/4"	3/4"	2"	1-1/2"
CLOTHES WASHER OUTLET BOX	CW	1/2"	1/2"	2"	1-1/2"
DISH MACHINE ROUGH-IN	DM	3/4"	3/4"	2"	1-1/2"
DISHWASHER ROUGH-IN	DW	1/2"	-	2"	1-1/2"
BAR SINK	BS	1/2"	1/2"	1-1/2"	1-1/2"
FLOOR SINK	FS	-	-	2"	1-1/2"
REFRIG/ICE MAKER BOX	FRIG	-	1/2"	-	-
FLOOR DRAIN	FD	-	-	2"	1-1/2"
TRENCH DRAIN	TD	-	-	3"	2"
WORK SINK	WS	3/4"	3/4"	2"	1-1/2"
HOSE BIB	HB	-	3/4"	-	-

NOTES:

1. SIZES SHOWN ARE MINIMUM PIPE SIZES TO A SINGLE FIXTURE. LARGER SIZES MAY BE INDICATED ON PLANS WHERE REQUIRED.
2. MINIMUM DOMESTIC PIPE SIZE TO 2 OR MORE FIXTURES IS 3/4".
3. RE: MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR INDIRECT WASTE SIZES.
4. WASTE AND VENT SIZES SHOWN ABOVE APPLY TO INDIVIDUAL VENTING ONLY. WHERE ALLOWED, INDIVIDUAL VENT CONNECTIONS MAY BE OMITTED OR SIZES MAY VARY WHEN CIRCUIT VENTS, COMMON VENTS, WASTE STACK VENTS, WET VENTS, OR COMBINATION DRAIN AND VENT SYSTEMS ARE USED. PRIOR APPROVAL FROM THE ENGINEER IS REQUIRED TO USE THESE ALTERNATIVE VENTING METHODS.
5. PROVIDE TRAP PRIMER FOR ALL FLOOR DRAINS AND FLOOR SINKS NOT LOCATED IN FOOD SERVICE AREAS.
6. MINIMUM SIZE FOR WASTE AND VENT PIPING BENEATH SLAB IS 2".
7. ALL FIXTURES LISTED ARE NOT NECESSARILY USED ON THIS PROJECT.
8. REFER TO APPLIANCE SCHEDULES (BY OTHERS) FOR ADDITIONAL PLUMBING FIXTURE CONNECTIONS SUCH AS INSTA-HOTS, COFFEE MAKERS, AND GARBAGE DISPOSALS.
9. PROVIDE ICE MAKER BOX ROUGH IN W/ 1/2"CW CONNECTION FOR ALL REFRIGERATOR LOCATIONS.
10. DESIGNER TO CONFIRM FLOW RATE OF FLOOR DRAINS, FLOOR SINKS, ETC. WITH ACTUAL SIZE REQUIRED.

EQUIPMENT ABBREVIATIONS

AHU	AIR HANDLING UNIT
AS	AIR SEPARATOR
B	BOILER (HOT WATER)
BB	BASE BOARD
BT	BUFFER TANK
CC	COOLING COIL
CH	CHILLER
CP OR P	CIRC PUMP
CT	COOLING TOWER
CUH	CABINET UNIT HEATER
CV	CONSTANT VOLUME BOX
DC	DUCT COIL
DEF	DISHWASHER EXHAUST FAN
EBH	ELECTRIC BASEBOARD HEATER
ECU	EVAPORATIVE COOLING UNIT
EF	EXHAUST FAN
ERU	ENERGY RECOVERY UNIT
ET	EXPANSION TANK
EWH	ELECTRIC WATER HEATER
F	FURNACE
FC	FAN COIL
FP	FAN POWERED BOX
GF	GLYCOL FEEDER
H	HUMIDIFIER
HC	HEATING COIL
HP	HEAT PUMP
HX	HEAT EXCHANGER
KEF	KITCHEN EXHAUST FAN
MAU	MAKE-UP AIR UNIT
MCC	MOTOR CONTROL CENTER
MV	MIXING VALVE
P	PUMP (SEE PIPING LEGEND FOR DETAILS)
RF	RETURN (OR RELIEF) AIR FAN
RZ	RADIANT ZONE
SA	SNOWMELT AREA
SB	SUMP BASIN
SF	SUPPLY FAN
ST	STORAGE TANK
TMV	THERMOSTATIC MIXING VALVE
UH	UNIT HEATER
VR	VARIABLE VOLUME BOX W/ REHEAT
VV	VARIABLE VOLUME BOX
WH	WATER HEATER

PIPING SYMBOLS

	90° ELBOW DN
	90° ELBOW UP
	TEE DOWN
	TEE UP
	BUTTERFLY VALVE
	SHUT OFF (BALL, GATE, BUTTERFLY)
	GLOBE VALVE
	CHECK VALVE
	FLOW CONTROL VALVE
	BALL VALVE
	PLUG OR BALANCING VALVE
	FLOW BALANCING VALVE
	PLUG VALVE IN RISER
	GATE OR GLOBE VALVE IN RISER
	DRAIN VALVE W/ HOSE END
	TEMPERATURE CONTROL VALVE (2-WAY)
	TEMPERATURE CONTROL VALVE (3-WAY)
	PRESSURE REDUCING VALVE
	SOLENOID VALVE
	VENTURI/FLOW INDICATOR
	PUMP & EQUIPMENT CONNECTOR
	PIPE UNION
	DOUBLE CHECK BACKFLOW PREVENTER
	PIPE ANCHOR
	PIPE EXPANSION JOINT
	FLEXIBLE CONNECTOR
	SAFETY RELIEF VALVE
	AIR VENT
	PRESSURE - TEMP. TAP
	PRESSURE GAUGE W/ PIG TAIL & COCK
	THERMOMETER
	VACUUM BREAKER
	HORIZONTAL CLEANOUT
	VERTICAL CLEANOUT
	FLOOR DRAIN
	FLOOR SINK
	ROOF DRAIN
	STRAINER W/ BLOW-OFF VALVE
	SHOCK ABSORBER
	FLOW SWITCH
H B W H	HOSE BIBB or WALL HYDRANT
	STEAM TRAP: FT-FLOAT & THERMOSTATIC; TD-THERMODYNAMIC; IB-INVERTED BUCKET; TS-THERMOSTATIC; BP-BALANCED PRESSURE
	STEAM TRAP TEST CHAMBER
TC	TEMPERATURE CONTROLLER OR SENSOR

ABBREVIATIONS

AAV	AIR ADMITTANCE VALVE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AUTO	AUTOMATIC
ABV	ABOVE
BCS	BUILDING CONTROL SYSTEM
BDD	BACK DRAFT DAMPER
BLDG	BUILDING
BFG	BELOW FINISHED GRADE
BOP	BOTTOM OF PIPE FROM FINISHED FLOOR
B/N	BETWEEN
C	COMMON
CA	COMBUSTION AIR
CC	CONTROLS CONTRACTOR
CFM	CUBIC FEET PER MINUTE (AIR FLOW RATE)
CIP	CAST IN PLACE
CLG	CEILING (OR COOLING)
CONC	CONCRETE
COND	CONDENSATE
CONN	CONNECT (OR CONNECTION)
CONTR'R	CONTRACTOR
CO	CLEANOUT
COTG	CLEANOUT TO GRADE
CW	DOMESTIC COLD WATER
DN	DOWN
(E)	EXISTING
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
EXH	EXHAUST
EWT	ENTERING WATER TEMPERATURE
FA	FREE AREA
FACP	FIRE ALARM CONTROL PANEL
FBO	FURNISHED BY OWNER
FCO	FLOOR CLEANOUT
FCT	FOR CONTINUATION
FFI	FOR FURTHER INFORMATION
FSD	COMBINATION FIRE/SMOKE DAMPER
GC	GENERAL CONTRACTOR
GHX	GROUND HEAT EXCHANGER
GPM	GALLONS PER MINUTE (WATER FLOW RATE)
HP	HORSE POWER
HW	DOMESTIC HOT WATER
HWC	HOT WATER RECIRCULATION
KW	KILOWATTS
LAT	LEAVING AIR TEMPERATURE
LF	LINEAR FOOT
LWT	LEAVING WATER TEMPERATURE
MC	MECHANICAL CONTRACTOR
MFR	MANUFACTURER
MOD	MOTOR OPERATED DAMPER
(N)	NEW
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
OA	OUTSIDE AIR
OBD	OPPOSED BLADE VOLUME DAMPER
OC	ON CENTER
OSA	OUTSIDE AIR
RA	RETURN AIR
REQ'D	REQUIRED
RE:	REFER TO:
REQ'MTS	REQUIREMENTS
SA	SUPPLY AIR
SF	SQUARE FOOT (FEET)
SP	STATIC PRESSURE
SS	STAINLESS STEEL
TA	THROW-AWAY (OR TRANSFER AIR)
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VTR	VENT THROUGH ROOF
W/	WITH
W/O	WITHOUT
WCO	WALL CLEANOUT
XFR	TRANSFER

PLAN SYMBOLS

	CONTROL PANEL/RADIANT MANIFOLD
CO2	CARBON DIOXIDE SENSOR
	CARBON MONOXIDE SENSOR
T	THERMOSTAT
R	REMOTE TEMPERATURE SENSOR
H	HUMIDISTAT
DSP	DUCT STATIC PRESSURE SENSOR
P	ROOM PRESSURE SENSOR
EPO	EMERGENCY POWER OFF SWITCH
	PLUMBING RISER
	HEATING WATER RISER
	FIRE RISER
	HVAC RISER
	DIAGRAM CONTINUATION REFERENCE
	SECTION CUT LETTER/SHEET SHOWN ON
	POINT OF DISCONNECTION
	POINT OF NEW CONNECTION
	ACCESS PANEL
	SNOWMELT MANIFOLD

PIPING DESIGNATIONS

HYDRONIC PIPING	
CS	CONDENSER SUPPLY
CR	CONDENSER RETURN
CHS	CHILLED WATER SUPPLY
CHS	CHILLED WATER SUPPLY
CCS	CLOSED CONDENSER SUPPLY
CCR	CLOSED CONDENSER RETURN
FCS	FLOOR COOLING SUPPLY
FCR	FLOOR COOLING RETURN
GF	GLYCOL FEED
GLS	GEOTHERMAL (OR GROUND) LOOP SUPPLY
GLR	GEOTHERMAL (OR GROUND) LOOP RETURN
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
HWS(LT)	HEATING WATER SUPPLY (LOW TEMP)
HWR(LT)	HEATING WATER RETURN (LOW TEMP)
HWS(HT)	HEATING WATER SUPPLY (HIGH TEMP)
HWR(HT)	HEATING WATER RETURN (HIGH TEMP)
HWS(HP)	HEATING WATER SUPPLY (HEAT PUMP)
HWR(HP)	HEATING WATER RETURN (HEAT PUMP)
RFS	RADIANT FLOOR SUPPLY
RFR	RADIANT FLOOR RETURN
SHWS	SOLAR HEATING WATER SUPPLY
SHWR	SOLAR HEATING WATER RETURN
SMS	SNOWMELT SUPPLY
SMR	SNOWMELT RETURN
STEAM & CONDENSATE PIPING	
HPS	HIGH PRESURE STEAM
HPR	HIGH PRESURE CONDENSATE RETURN
LPS	LOW PRESURE STEAM
LPR	LOW PRESURE CONDENSATE RETURN
MPS	MEDIUM PRESURE STEAM
MPR	MEDIUM PRESURE CONDENSATE RETURN
PC	PUMPED CONDENSATE
PLUMBING PIPING	
G	NATURAL GAS
MG	MEDIUM PRESSURE GAS
PG	PROPANE GAS
LPG	LIQUID PROPANE GAS
PD	PROPANE DRAIN
D	DRAIN PIPE
FOS	FUEL OIL SUPPLY
FOR	FUEL OIL RETURN
FOV	FUEL OIL VENT
FOF	FUEL OIL FILL
RS	REFRIGERANT SUCTION
RL	REFRIGERANT LIQUID
CW	DOMESTIC COLD WATER (CW)
HW	DOMESTIC HOT WATER (HW)
HWC	HOT WATER RECIRCULATION (HWC)
NS	NON-SOFTENED DOMESTIC WATER
F	FIRE LINE
AW	ACID WASTE
AV	ACID VENT
GW	GREASE WASTE
GV	GREASE VENT
PW	PUMPED WASTE
W	WASTE
V	VENT
SD	SECONDARY DRAIN
SO	SAND AND OIL WASTE
ST	STORM DRAIN
ST(OF)	STORM DRAIN OVERFLOW
CA	COMPRESSED AIR
MA	MEDICAL AIR
O2	OXGEN
VAC	VACUUM
CO2	CARBON DIOXIDE
N2O	NITROUS OXIDE
N2	NITROGEN
IA	INSTRUMENT AIR
WAGD	WASTE ANESTHETIC GAS DISPOSAL

PROJECT ALTITUDE

6730' ABOVE SEA LEVEL

MECHANICAL EQUIPMENT WIRING AND CONNECTIONS

	ITEM	FURNISHED UNDER	SET IN PLACE OR MTD. UNDER	WIRED/ CONNECTED UNDER
1	EQUIPMENT MOTORS AND THERMAL OVERLOADS, RESISTANCE HEATERS.	MD	MD	ED
2	VFD'S, MOTOR CONTROLLERS; MAGNETIC STARTERS, REDUCED VOLTAGE STARTERS AND OVERLOAD RELAYS.	MD	ED(a)	ED
3	DISCONNECT SWITCHES (FUSED OR NON-FUSED), HP RATED SWITCHES, THERMAL OVERLOAD SWITCHES AND FUSES AND MANUAL OPERATING SWITCHES.	ED(a)	ED(a)	ED
4	PUSHBUTTON STATIONS, PILOT LIGHTS, MULTI-SPEED SWITCHES, FLOAT SWITCHES, THERMOSTATS, CONTROL RELAYS, TIMECLOCKS, CONTROL TRANSFORMERS, CONTROL PANELS, MOTOR VALVES, DAMPER ACTUATORS, SOLENOID VALVES, EP AND PE SWITCHES AND INTERLOCKS.	MD	MD	MD(b)
5	120 VOLT POWER FOR BAS PANELS, FIRE PROTECTION AND BOILER CONTROLS.	ED	ED	ED
6	FIRE/SMOKE DAMPERS AND ELEVATOR VENT DAMPERS.	MD	MD	ED(c)

MECHANICAL SHEET INDEX

#	TITLE	DD - 02.20.2020	2020.03.13 - CD PROGRESS	2020.03.30 - 95% CD	2020.04.06 - PERMIT SET						
		ISSUE LOG									
M0.0	MECHANICAL COVER SHEET	√	√	√	√						
M0.1	MECHANICAL SCHEDULES	√	√	√	√						
M1.1	SNOWMELT PLAN	√	√	√	√						
MD2.1	MAIN LEVEL AREA A DEMO MECHANICAL PLAN	√	√	√	√						
MD2.2	PRE-K PLAN AREA B DEMO MECHANICAL PLAN	√	√	√	√						
MD3.1	ROOF AREA A DEMO MECHANICAL PLAN	√	√	√	√						
M2.1	MAIN LEVEL AREA A MECHANICAL PLAN	√	√	√	√						
M2.2	PRE-K PLAN AREA B MECHANICAL PLAN	√	√	√	√						
M3.1	ROOF AREA A MECHANICAL PLAN	√	√	√	√						
MC2.1	MAIN LEVEL AREA A MECHANICAL COORDINATION CEILING PLAN			√	√						
MC2.2	PRE-K PLAN AREA B MECHANICAL COORDINATION CEILING PLAN			√	√						
MPD2.1	MAIN LEVEL AREA A DEMO PLUMBING PLAN	√	√	√	√						
MPD2.2	PRE-K PLAN AREA B DEMO PLUMBING PLAN	√	√	√	√						
MP2.1	MAIN LEVEL AREA A PLUMBING PLAN	√	√	√	√						
MP2.2	PRE-K PLAN AREA B PLUMBING PLAN	√	√	√	√						
MP3.1	ROOF AREA A PLUMBING PLAN	√	√	√	√						
M4.1	MECHANICAL DIAGRAMS	√	√	√	√						
M4.2	MECHANICAL DIAGRAMS	√	√	√	√						
M4.3	MECHANICAL DIAGRAMS	√	√	√	√						

ISSUE LOG KEY:
'√' ISSUED AS PART OF SET
' ' NOT PART OF SET
'*' ISSUED FOR INFORMATION ONLY

REMODEL/RENOVATION NOTE:

CONTRACTOR MUST KEEP IN MIND THAT THIS IS A REMODEL PROJECT. READ GENERAL NOTES CAREFULLY. CONTRACTORS MUST COORDINATE NEW AND EXISTING CONDITIONS FOR INSTALLATION OF THE WORK.

CONTRACTOR SHALL NOTIFY ENGINEER IMMEDIATELY OF FIELD CONDITIONS DISCOVERED DURING DEMOLITION THAT VARY FROM THOSE INDICATED HEREIN.

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 210
Edwards, CO 81632
(970) 766-1470
fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

Seal

Revisions:

No	Description	Date

Issue Dates:
PERMIT SET
04.06.2020

Sheet Title:
MECHANICAL COVER SHEET

Project No:
10182.00

Sheet No:
M0.0

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HYDRONIC AIR HANDLING UNIT SCHEDULE

NOTES:
A. FAN RPM SHALL NOT EXCEED 110% OF SCHEDULE VALUE.
B. NO EQUIPMENT SHALL BE SELECTED ABOVE 90% OF MOTOR NAME PLATE RATING.
C. LAT IS AT DISCHARGE OF RTU.
D. MOTORS SHALL BE EQUIPPED WITH AN ALTERNATE DISCHARGE PATH TO DIVERT ADVERSE SHAFT CURRENTS FROM MOTOR BEARINGS ON THE...
E. SUPPLY FAN EXTERNAL STATIC PRESSURE INCLUDES 0.5" WC FOR DIRTY FILTER ALLOWANCES.
F. PROVIDE UNIT WITH SINGLE POINT POWER CONNECTION AND CONVENIENCE RECEPTACLE,
G. PROVIDE SA AND RA DUCT DETECTOR, REFER TO CONTROL DIAGRAMS FOR ADDITIONAL INFORMATION.
H. CUSTOM 8" BASE RAIL. CONTRACTOR TO FIELD COORDINATE DEPTH WITH ROOF INSULATION THICKNESS.
J. PROVIDE INSULATED CABINET, AND INSULATED CABINET FOR HWS/R CONNECTIONS.

				SUPPLY FAN						COOLING				HEATING								ELECTRICAL							
MARK	SERVICE	TYPE	OUTSIDE AIR (CFM)	CFM	MIN. CFM	ESP @ SL (IN WC)	ESP @ ALT (IN WC)	BHP	HP	EAT DB/WB (°F)	LAT DB/WB (°F)	SENSIBLE MBH	TOTAL MBH	EAT DB (°F)	LAT DB (°F)	SENSIBLE MBH	EWT (°F)	LWT (°F)	GPM	MAX WTR PD (FT HEAD)	FILTER	VOLTAGE	PHASE	FLA	MCA	MOCP	OPER. WEIGHT (LBS)	MANUFACTURER & MODEL #	REMARKS
AHU-2	CAFETERIA, ART, MUSIC	INDOOR	4600	6500	1880	1.80	1.50	3.4	5	84	55	156	175	8	55	263	140	115	22	3.00	MERV 8	208	3	14.0	17.5	30	2560	CARRIER 39M 14W	DEMAND CONTROLLED VENTILATION; .NOTE A, B, C, D, E, F, G

FAN POWERED BOX SCHEDULE (HYDRONIC REHEAT)

NOTES:
A:

							HYDRONIC REHEAT COIL							FAN						
MARK	SERVICE	TYPE	INLET DIA. (IN.)	MAX. COOLING CFM	PLENUM FAN CFM	HEATING CFM	EAT DB (°F)	LAT DB (°F)	SENSIBLE MBH	EWT (°F)	LWT (°F)	GPM	MAX WATER P.D. (IN WC)	HP	VOLT	PHASE	MIN. INLET S.F. @ SP (IN. W.C.)	MANUFACTURER & MODEL #	ACCESSORIES	REMARKS
(E)FPB-1-9	PRE-K EAST	HYDRONIC	12	1600	1600	480	55	85	40.1	140	100	2.4	0.50	3/4	3	480	1.0	TITUS DTQ5	2- WAY VALVE	EXISTING FPB TO REMAIN FOR REUSE
(E)FPB-1-10	PRE-K WEST	HYDRONIC	12	1500	1500	450	55	85	38.6	140	100	2.3	0.50	3/4	3	480	1.0	TITUS DTQ5	2-WAY VALVE	EXISTING FPB TO REMAIN FOR REUSE

MULTI ZONE VENTILATION SCHEDULE

VENTILATION EQUATION VARIABLE DEFINITIONS:
BREATHING ZONE OUTDOOR AIRFLOW, Vbz
ZONE FLOOR AREA, Az
ZONE POPULATION, Pz
AREA OUTDOOR AIR RATE, Ra
PEOPLE OUTDOOR AIR RATE, Rp
ZONE AIR DISTRIBUTION EFFECTIVENESS, Ez
ZONE OUTDOOR AIRFLOW, Voz
SYSTEM OUTDOOR AIR INTAKE FLOW RATE, Vot
ZONE PRIMARY OUTDOOR AIR FRACTION, Zp
ZONE PRIMARY AIRFLOW, Vpz
SYSTEM VENTILATION EFFICIENCY, SYSTEM Ev
ZONE VENITALION EFFICIENCY, ZONE Ev

VENTILATION EQUATIONS:
$V_{bz} = R_p * P_z + R_a * A_z$ (EQUATION 4-1)
$V_{oz} = V_{bz} / E_z$ (EQUATION 4-2)
$Z_p = V_{oz} / V_{pz}$ (EQUATION 4-5)
Ev = (Table 403.3.1.1.2.3.2)
$V_{ou} = \sum (V_{bz})$, ASSUMING D=1 (EQUATION 4-6)
$V_{ot} = V_{ou} /(\text{SYSTEM } E_v)$ (EQUATION 4-8)

VAV-01 SUMMARY

SPACE NAME	SPACE TYPE	Az [SQ.FT.]	Rp [CFM/ PERSON]	Ra [CMF/SQ.FT.]	PEOPLE DENSITY [#/1000SQ.F...	Pz [PEOPLE]	Vbz [CFM]	Ez	Voz [CFM]	Vpz [CFM]	ZONE Zp
KITCHEN	F&B - KITCHENS (COOKING)	360	-	-	-	-	0	0.8	0	800	0%

VAV-02 SUMMARY

SPACE NAME	SPACE TYPE	Az [SQ.FT.]	Rp [CFM/ PERSON]	Ra [CMF/SQ.FT.]	PEOPLE DENSITY [#/1000SQ.F...	Pz [PEOPLE]	Vbz [CFM]	Ez	Voz [CFM]	Vpz [CFM]	ZONE Zp
CAFETERIA	F&B - CAFETERIA, FAST FOOD	2580	7.5	0.18	100	190	1890	0.8	2363	3500	68%

VAV-03 SUMMARY

SPACE NAME	SPACE TYPE	Az [SQ.FT.]	Rp [CFM/ PERSON]	Ra [CMF/SQ.FT.]	PEOPLE DENSITY [#/1000SQ.F...	Pz [PEOPLE]	Vbz [CFM]	Ez	Voz [CFM]	Vpz [CFM]	ZONE Zp
ART STORAGE	STORAGE - GENERAL STORAGE	170	-	0.12	-	-	21	0.8	27	200	14%
KILN	-	20	-	-	-	-	0	-	-	0	

VAV-04 SUMMARY

SPACE NAME	SPACE TYPE	Az [SQ.FT.]	Rp [CFM/ PERSON]	Ra [CMF/SQ.FT.]	PEOPLE DENSITY [#/1000SQ.F...	Pz [PEOPLE]	Vbz [CFM]	Ez	Voz [CFM]	Vpz [CFM]	ZONE Zp
ART CLASSROOM	EDUCATION - ART CLASSROOM	960	10	0.18	20	20	373	0.8	467	1100	42%

VAV-05 SUMMARY

SPACE NAME	SPACE TYPE	Az [SQ.FT.]	Rp [CFM/ PERSON]	Ra [CMF/SQ.FT.]	PEOPLE DENSITY...	Pz [PEOPLE]	Vbz [CFM]	Ez	Voz [CFM]	Vpz [CFM]	ZONE Zp
MUSIC CLASSROOM	EDUCATION - MUSIC/THEATRE/DANCE	1020	10	0.06	35	36	422	0.8	528	1100	48%

AHU-1 TOTAL SYSTEM SUMMARY

SYSTEM Ev	47%
Vot [CFM]	4600

GENERAL NOTES:

A:	-
B:	-

Comments

TERMINAL BOX SCHEDULE

NOTES:
A: RADIATED AND DISCHARGE SOUND LEVELS SHALL NOT EXCEED NC 35 AT 1.5" INLET STATIC PRESSURE WHEN TESTED PER ARI STANDARD 885-98.
B: TOTAL AIR PRESSURE DROP OF TAB AND REHEAT COIL SHALL NOT EXCEED 0.5" CW.
C: WATER PRESSURE DROP OF REHEAT COILS SHALL NOT EXCEED 5 FT. PROVIDE REHEAT COILS SEPARATE FROM BOXES IF REQUIRED TO MEET WATER PRESSURE DROP REQUIREMENTS.

						HEATING COIL (HYDRONIC)											
MARK	SERVICE	INLET DIA. (IN.)	COOLING CFM	MIN HEATING CFM	MIN. INLET S.P. @ S.L. (IN. W.C.)	EAT DB (°F)	LAT DB (°F)	SENSIBLE MBH	EWT (°F)	LWT (°F)	GPM	MAX. WATER P.D. (FT.)	MAX. AIR P.D. (IN. WC)	MANUFACTURER & MODEL #	CONTROL TYPE	ACCESSORIES	REMARKS
VAV-01	SERVING	8	600	100	1.0	55	85	15.5	140	120	1.6	2.00	0.25	TITUS DESV	DIGITAL	SPACE MOUNTED THERMOSTAT, CO2 SENSOR	2-ROW HEATING COIL, DEMAND CONTROLLED VENTILATION
VAV-02	CAFETERIA	16	3500	1050	1.0	55	85	90.3	140	120	9.4	2.00	0.25	TITUS DESV	DIGITAL	SPACE MOUNTED THERMOSTAT, CO2 SENSOR	2-ROW HEATING COIL, DEMAND CONTROLLED VENTILATION
VAV-03	ART STORAGE	5	200	50	1.0	55	85	5.1	140	120	0.5	2.00	0.25	TITUS DESV	DIGITAL	SPACE MOUNTED THERMOSTAT, CO2 SENSOR	2-ROW HEATING COIL, DEMAND CONTROLLED VENTILATION
VAV-04	ART ROOM	12	1100	330	1.0	55	85	28.3	140	120	3.0	2.00	0.25	TITUS DESV	DIGITAL	SPACE MOUNTED THERMOSTAT, CO2 SENSOR	2-ROW HEATING COIL, DEMAND CONTROLLED VENTILATION
VAV-05	MUSIC ROOM	12	1100	350	1.0	55	85	28.3	140	120	3.0	2.00	0.25	TITUS DESV	DIGITAL	SPACE MOUNTED THERMOSTAT, CO2 SENSOR	2-ROW HEATING COIL, DEMAND CONTROLLED VENTILATION

PLUMBING FIXTURE SCHEDULE

MARK	TYPE	ADA	FINISH	MANUFACTURER* & MODEL #	FAUCET TRIM MFR* & MODEL #	INSTALLATION	REMARKS
P1a	PRE-K WATER CLOSET	YES	WHITE/CHROME	AMERICAN STANDARD BABY DEVORO	SLOAN G2 8111-1.6 3250400	FLOOR MOUNT	PROVIDE FLUSH VALVE WITH MANUAL OVERRIDE. PROVIDE ANTI-MICROBIAL OPEN FRONT SEAT WITH HEAVY DUTY STAINLESS STEEL CHECK HINGE.
P1b	WALL-HUNG WATER CLOSET	YES	WHITE/CHROME	AMERICAN STANDARD 2856.111.020	SLOAN G2 8111-1.6 3250400	WALL-HUNG	PROVIDE FLUSH VALVE WITH MANUAL OVERRIDE. PROVIDE ANTI-MICROBIAL OPEN FRONT SEAT WITH HEAVY DUTY STAINLESS STEEL CHECK HINGE. PROVIDE CONCEALED ARM WALL CARRIER.
P2a	PRE-K LAVATORY	YES	WHITE/CHROME	AMERICAN STANDARD LUCERNE #0356.028	DELTA 2529LF-HDF	WALL-HUNG	SEE ARCHITECTURAL ELEVATIONS FOR MOUNTING HEIGHT. PROVIDE UNDERCOUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.ASSE 1070 COMPLIANT TEMPERING VALVE
P2b	WALL-HUNG LAVATORY	YES	WHITE/CHROME	AMERICAN STANDARD LUCERNE #0356.028	DELTA 2529LF-HDF	WALL-HUNG	PROVIDE UNDERCOUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.ASSE 1070 COMPLIANT TEMPERING VALVE
P3	PRE-K UNDERMOUNT KITCHEN SINK DOUBLE BASIN	YES	STAINLESS	DAYTON DCFU31189	T & S BRASS B-0867-04	COUNTER MOUNT, OFF CENTER DRAIN	PROVIDE WITH BADGER 5 INSINKERATOR, 1/2 HP. PROVIDE UNDER-COUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS, SUPPLIES, ASSE 1070 COMPLIANT TEMPERING VALVE. PROVIDE ELKAY DRAIN MODEL #LK18B.
P4	PRE-K DRINKING FOUNTAIN	YES	GRAY	ELKAY LZS8WSLK	-	INTEGRAL BOTTLE FILL	SEE ARCHITECTURAL ELEVATIONS FOR MOUNTING HEIGHT. PROVIDE 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.
P5a	DRINKING FOUNTAIN AND BOTTLE FILLER	YES	GRAY	ELKAY LZS8WSLK	-	INTEGRAL BOTTLE FILL	SEE ARCHITECTURAL ELEVATIONS FOR MOUNTING HEIGHT. PROVIDE 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.
P5b	DRINKING FOUNTAIN	YES	GRAY	ELKAY EZS8L	-	WALL HUNG	SEE ARCHITECTURAL ELEVATIONS FOR MOUNTING HEIGHT. PROVIDE 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.
P6	PRE-K CLASSROOM SINK	YES	RE: ARCH	CORIAN #859P	DELTA 2529LF-HDF	SOLID SURFACE SINK	PROVIDE UNDER-COUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS, SUPPLIES, ASSE 1070 COMPLIANT TEMPERING VALVE. PROVIDE ELKAY DRAIN MODEL #LK18B.
P7a	ART CLASSROOM SINK DOUBLE BASIN	YES	STAINLESS	GRIFFIN WC.288.00	T & S BRASS B-0290	STAND ALONE	PROVIDE UNDER-COUNTER ZURN PLASTER TRAP, UNDER-COUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.
P7b	ART CLASSROOM SINK SINGLE BASIN	YES	STAINLESS	GRIFFIN LT.118.228	T & S BRASS B-0290	STAND ALONE	PROVIDE UNDER-COUNTER ZURN PLASTER TRAP, UNDER-COUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.
P8	HAND WASH TROUGH	YES	RE: ARCH	BRADLEY ELX-2	KOHLER K-13462, QTY. 2	SOLID SURFACE SINK	PROVIDE UNDER-COUNTER ZURN PLASTER TRAP, UNDER-COUNTER PROTECTION, STRAINER, 17 GAUGE P-TRAP, QUARTER TURN ANGLE STOPS AND SUPPLIES.
P9	MOP SINK BASIN	N/A	TERRAZO	FLORESTONE 92 36X36	T & S BRASS B-0665-BSTP	FLOOR MOUNT, 36"X36" DROP FRONT MOP RECEPTOR	PROVIDED WITH STAINLESS STEEL PROTECTIVE CAP TO BE CAST INTEGRAL. DRAIN BODY SHALL BE BRASS CAST INTEGRAL AND SHALL PROVIDE FOR A NO CAULK CONNECTION, 3" DRAIN SIZE. PROVIDE VACUUM BREAKER, HOSE, HOSE BRACKET, MOP HANGER, BASIN GUARDS AND WALL GUARDS.
~~P10~~	~~PENTHOUSE ROOF DRAIN~~	~~N/A~~	~~CAST IRON~~	~~ZURN Z121~~	~~-~~	~~FLUSH GRATE (FC)~~	~~12" PIMARY ROOF DRAIN ROUTED TO BUILDING SANITARY SYSTEM~~
P11	FLOOR SINK	N/A	DURA-COATED CAST IRON	ZURN Z1902	-	HALF GRATE; ALUMINUM DOME STRAINER	12"x12"x10"
P12	WATER CLOSET FLUSH VALVE ONLY	EXISTING	CHROME	-	SLOAN G2 8111-1.6 3250400	-	EXISTING FWATER CLOSET TO REMAIN. REPLACE FLUSH VALVE ONLY
P13	URINAL FLUSH VALVE ONLY	EXISTING	CHROME		SLOAN G2 8111-1.6 3250400	-	EXISTING URINAL TO REMAIN. REPACE FLUSH VALVE ONLY
P14	LAVATORY FAUCET ONLY	EXISTING	CHROME	-	DELTA 2529LF-HDF	-	EXISTING SINK AND DRAIN TO REMAIN. REPLACE FAUCET ONLY
P15	FLOOR DRAIN	N/A	STAINLESS	ZURN Z415S	-	PROVIDE WITH SURE-SEAL TRAP GUARD AND P-TRAP	-

1 RFI C-17/C-26 6/25/20

EXHAUST FAN SCHEDULE

NOTES:
A: PROVIDE DIRECT DRIVE FANS WITH FAN SPEED CONTROL.
B: NO EQUIPMENT SHALL BE SELECTED ABOVE 90% OF MOTOR NAMEPLATE RATING.
C: PROVIDE ROOF CURB WITH INTEGRAL DAMPER.

			FAN				MOTOR					
					ESP							
MARK	SERVICE	TYPE	CFM	SONES	@ SL (IN WC)	@ ALT (IN WC)	HP (W)	VOLT	PHASE	MANUFACTURER & MODEL #	ACCESSORIES	REMARKS
EF-1	ART CLASSROOM	INLINE	800	3.8	0.60	0.50	(260)	120	1	GREENHECK CSP-A1750	INTEGRAL BACKDRAFT DAMPER	-
EF-2	PRE-K BATHROOMS AND KITCHEN	INLINE	300	5.7	0.60	0.50	(103)	120	1	GREENHECK CSP-A390	INTEGRAL BACKDRAFT DAMPER	-
EF-3	KILN ROOM GENERAL EXHAUST	CEILING	400	1.5	0.24	0.20	(101)	120	1	GREENHECK CSP-A510	INTEGRAL BACKDRAFT DAMPER	-
EF-4	SPED BATHROOM EXH	CEILING	80	0.4	0.17	0.15	(13)	120	1	GREENHECK SP-A90	INTEGRAL BACKDRAFT DAMPER	-
KEF-1	TYPE II KITCHEN HOOD	ROOF-MOUNTED UPBLAST	1648	9.2	1.20	1.00	3/4	208	1	GREENHECK CUBE-141	24" ROOF CURB, INTEGRAL BACKDRAFT DAMPER	-
KEF-2	TYPE II DISHWASH HOOD	ROOF-MOUNTED UPBLAST	675	7.4	0.60	0.50	1/4	120	1	GREENHECK CUBE-099	24" ROOF CURB, INTEGRAL BACKDRAFT DAMPER	-

AIR COOLED CONDENSING UNIT SCHEDULE

NOTES:
A: SOUND POWER REQUIREMENTS ARE BASED ON ARI STANDARD CONDITIONS.

					ELECTRICAL							
MARK	MATCHED SYSTEM COMPONENT	DUTY CAPACITY (TONS)	EER	REFRIGERANT	VOLT	PHASE	MCA	MOCP (A)	OPER. WEIGHT (LBS)	MANUFACTURER & MODEL #	ACCESSORIES	REMARKS
CU-1	AHU-1	15	13.4	410A	208	3	65.6	90	731	CARRIER 39AUD	HOT GAS BYPASS, LOW AB=MBIENT CONTROL	-

GRILLE, REGISTER, DIFFUSER & LOUVER SCHEDULE

MARK	USE	PATTERN	FINISH	MANUFACTURER* & MODEL#	ACCESSORIES	REMARKS
-	-	-	-	-	-	-
A	LAY-IN CEILING SUPPLY	4-WAY, 3-WAY	WHITE	TITUS TDC-AA	LAY-IN CEILING MODULE	ROUND NECK
B						
C	LAY-IN CEILING RETURN	EGG CRATE	WHITE	TITUS 50F	LAY-IN CEILING MODULE	RECTANGULAR NECK
D	SIDEWALL RETURN/TRANSFER	LOUVERED	WHITE	TITUS 350RL	-	-
E	EXTERIOR LOUVER	STATIONARY LOUVER	MATCH EXISTING	RUSKIN ELF675	-	-
F	LAY-IN CEILING EXHAUST	EGG CRATE	WHITE	TITUS 50F	LAY-IN CEILING MODULE	ROUND NECK

NOTES:

1. ALL STARTERS FOR MECHANICAL EQUIPMENT SHALL BE FURNISHED UNDER THIS CONTRACT AND SET IN PLACE AND WIRED BY EC. VFD'S NOT INCLUDED AS PART OF THE EQUIPMENT WIRING PACKAGE SHALL BE FURNISHED BY THE MC, AND SET IN PLACE AND WIRED BY THE EC, U.N.O.
2. NOT ALL EQUIPMENT REQUIRED UNDER THIS CONTRACT IS NECESSARILY SPECIFIED ON THE SCHEDULE SHEETS. PLAN & DIAGRAM NOTATIONS AND PROJECT MANUAL CONTAIN EQUIPMENT SPECIFICATIONS AS WELL.
3. (ASHRAE 90.1-2004 & 2007) MECHANICAL EQUIPMENT THAT IS NOT COVERED BY THE U.S. NATIONAL APPLIANCE ENERGY CONSERVATION ACT (NAECA) OF 1987 SHALL CARRY A PERMANENT LABEL INSTALLED BY THE MANUFACTURER STATING THAT THE EQUIPMENT COMPLIES WITH THE REQUIREMENTS OF STANDARD 90.1.
4. (ASHRAE 62.1) ALL AIR MOVING EQUIPMENT SUBJECT TO THE SCOPE OF ASHRAE 62.1 AND SHALL COMPLY WITH CONSTRUCTION REQ'MTS THEREIN.
5. NOT ALL CAPACITIES, CHARACTERISTICS, AND CONSTRUCTION FEATURES REQUIRED ARE NECESSARILY INDICATED IN THE EQUIPMENT SCHEDULES. RE: PLANS AND SPECIFICATIONS FOR ADDITIONAL REQ'MTS.
6. CAPACITIES, CHARACTERISTICS, AND CONSTRUCTION FEATURES OF THE SCHEDULED EQUIPMENT ARE HEREBY INCORPORATED INTO THE PROJECT REQUIREMENTS. EQUIVALENT PRODUCTS PERFORMANCE AND CONSTRUCTION FEATURES SHALL MEET OR EXCEED THAT OF THE SPECIFIED EQUIPMENT WHETHER SCHEDULED OR NOT.
7. NOT ALL EQUIPMENT AVAILABLE FROM LISTED "EQUIVALENT" MANUFACTURERS LISTED IS NECESSARILY EQUIVALENT TO THE BASIS OF DESIGN EQUIPMENT SPECIFIED. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ANY COSTS, RESULTANT CHANGES TO OTHER DIVISIONS, AND SPATIAL REQ'MTS FOR EQUIPMENT OTHER THAN SCHEDULED.
8. ALL MANUFACTURERS REPRESENTATIVES SHALL READ AND UNDERSTAND THE CONTROL DIAGRAMS AND COORDINATE WITH TCC TO PROVIDE A FULLY FUNCTIONING SYSTEM AS DESCRIBED IN THE CONTROL DIAGRAMS.

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 210
Edwards, CO 8132
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fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

Seal

STRAWBERRY PARK ELEMENTARY
39620 AMETHYST DRIVE
Steamboat Springs, CO

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1	RFI C-17/C-26	6/25/20

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MECHANICAL SCHEDULES

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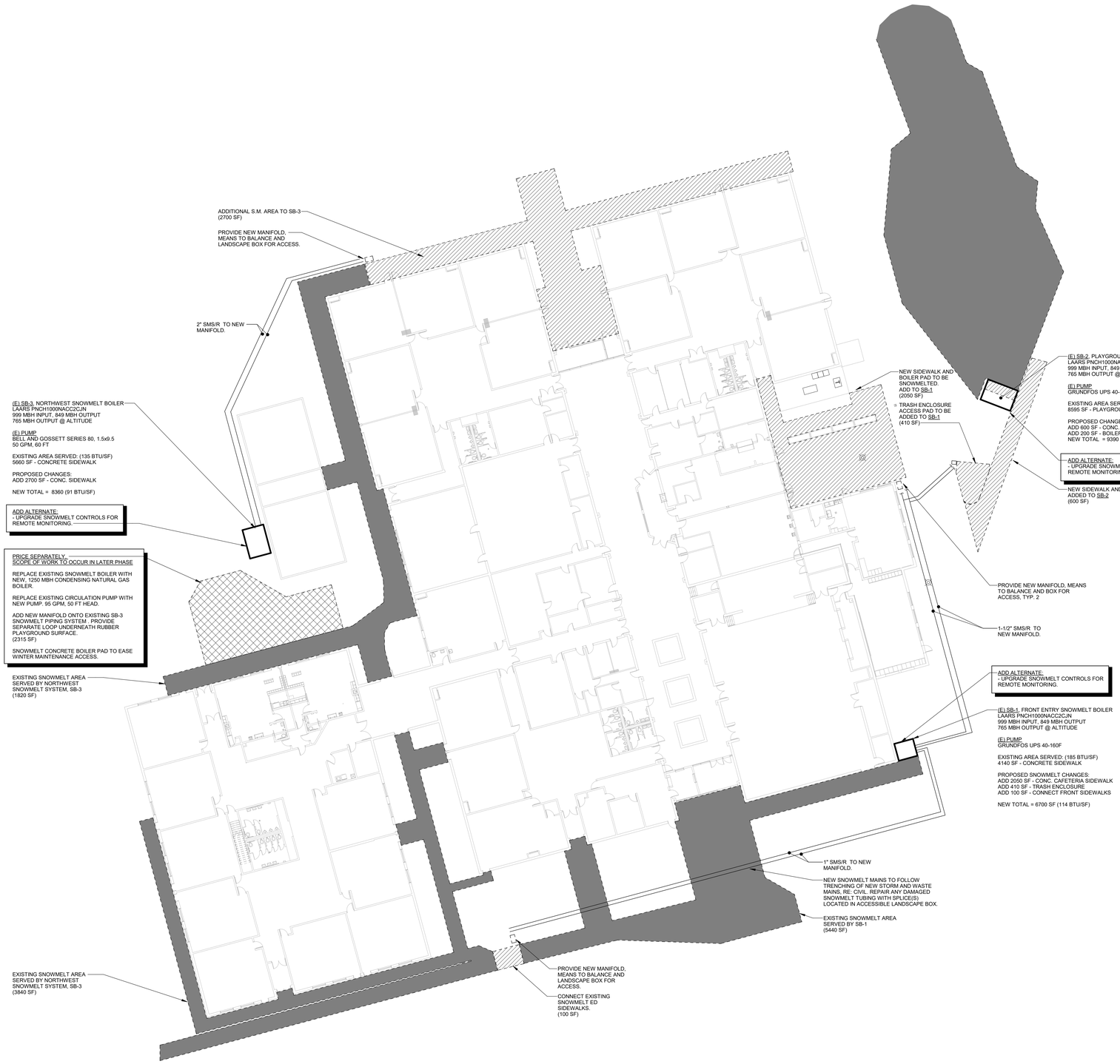

1 MECHANICAL SNOWMELT PLAN
SCALE: 1" = 20'-0"

LEGEND:

- EXISTING SNOWMELT
- BASE SCOPE
- SCOPE TO BE PRICED SEPARATELYFOR COMPLETION AT A LATER DATE

REFER TO CIVIL AND LANDSCAPE DOCUMENTS FOR DETAILS AND EXTENTS OF SNOWMELTED AREAS

TAB Associates
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Seal

STRAWBERRY PARK ELEMENTARY
39620 AMETHYST DRIVE
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SNOWMELT PLAN

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NOTES:

1. RE: M4.0 SERIES FOR MECHANICAL DIAGRAMS.
2. COORDINATE ROUTING OF CONDENSATE DRAIN LINES WITH ARCHITECT PRIOR TO INSTALLATION.
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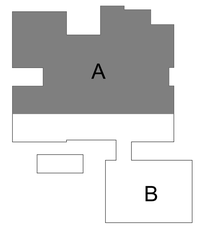
Sheet Title:
MAIN LEVEL AREA A MECHANICAL PLAN



KEY PLAN

Project No:
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1 MAIN LEVEL AREA A MECHANICAL PLAN
SCALE: 1/8" = 1'-0"

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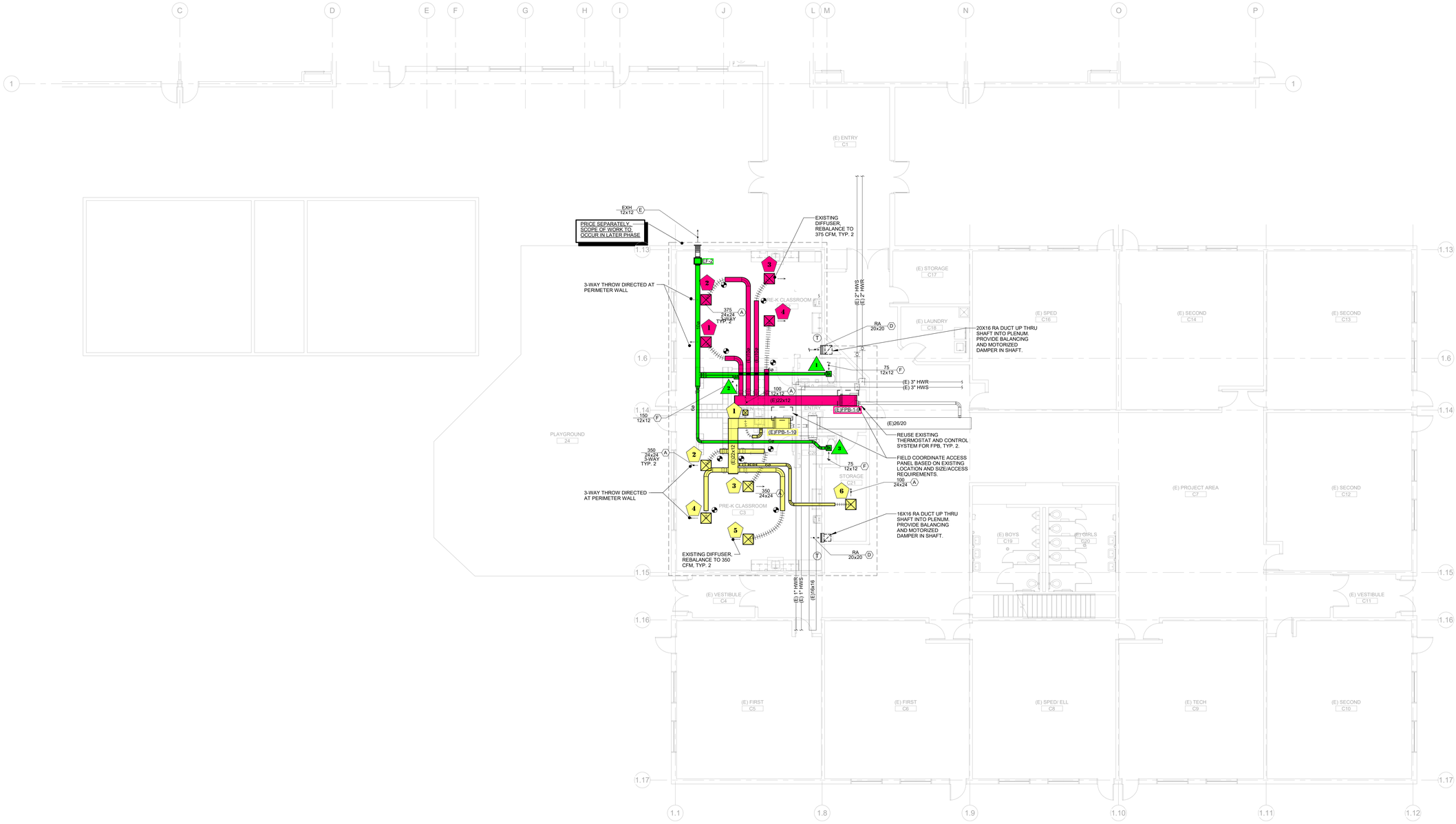
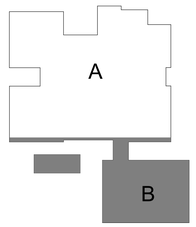


1 PRE-K PLAN AREA B MECHANICAL PLAN
SCALE: 1/8" = 1'-0"



KEY PLAN

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 210
Edwards, CO 8132
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STRAWBERRY PARK ELEMENTARY
39620 AMETHYST DRIVE
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PRE-K PLAN AREA B MECHANICAL PLAN

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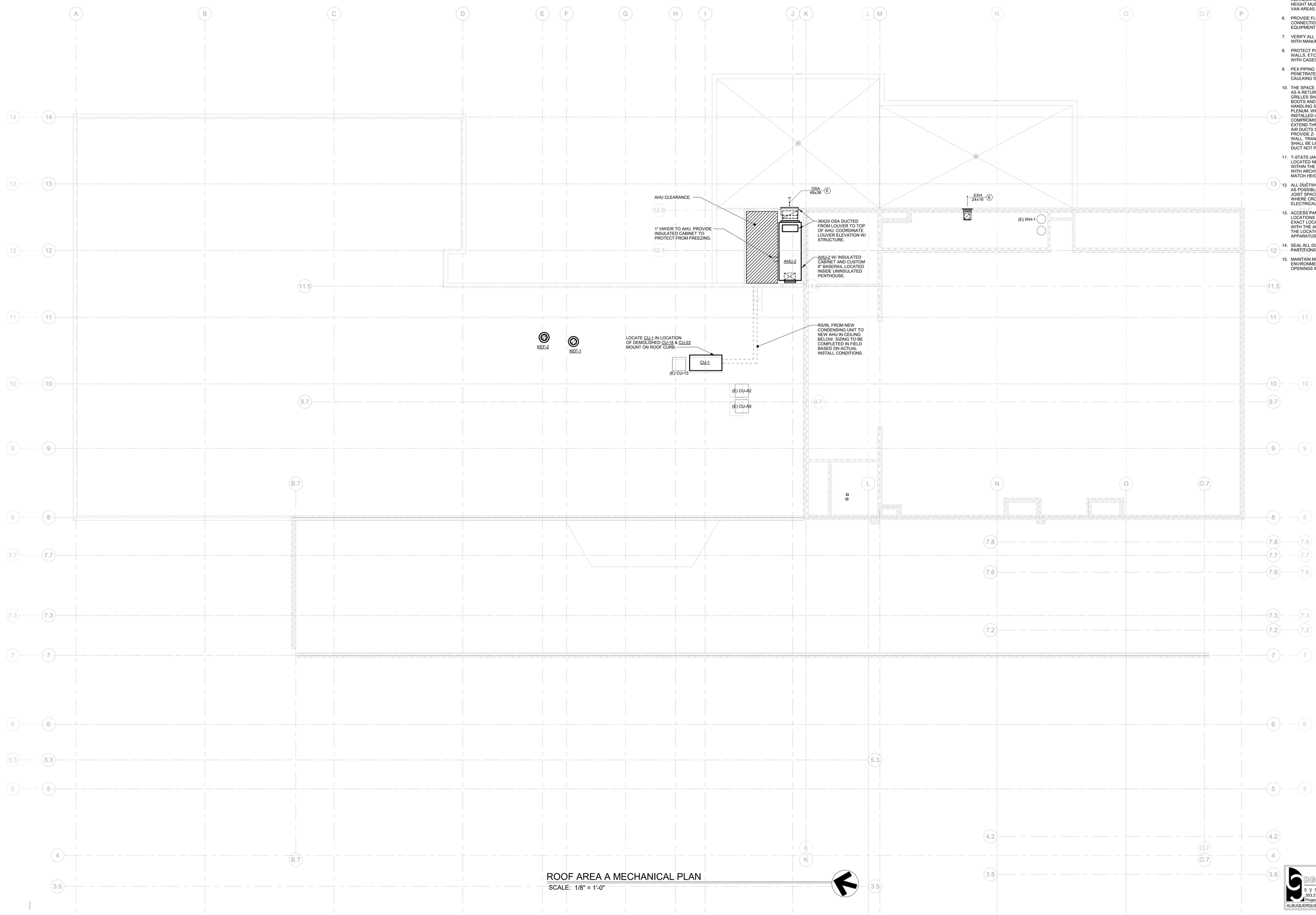

ROOF AREA A MECHANICAL PLAN
SCALE: 1/8" = 1'-0"

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39620 AMETHYST DRIVE
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ROOF AREA A MECHANICAL PLAN

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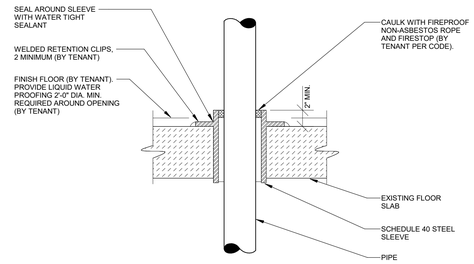
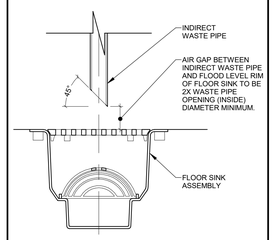
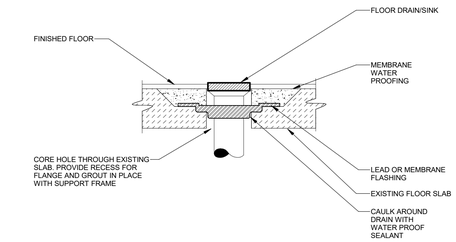


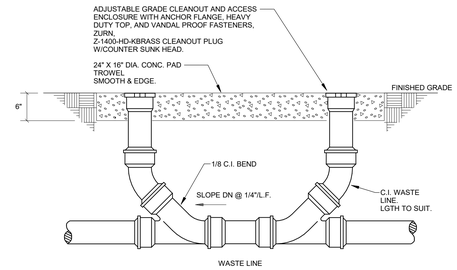
TYPICAL PIPE PENETRATION DIAGRAM
NO SCALE



INDIRECT WASTE LINE TERMINATION DETAIL
NO SCALE



TYPICAL FLOOR DRAIN/SINK AT EXISTING FLOOR DIAGRAM
NO SCALE



TWO-WAY CLEANOUT TO GRADE DIAGRAMS
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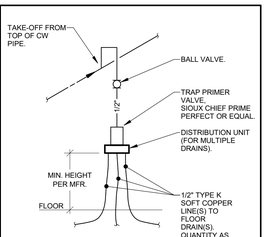
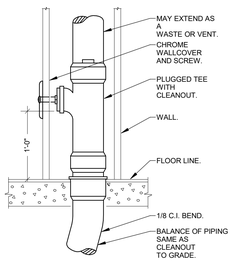
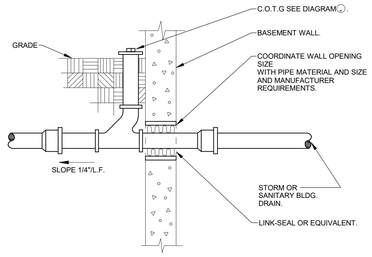


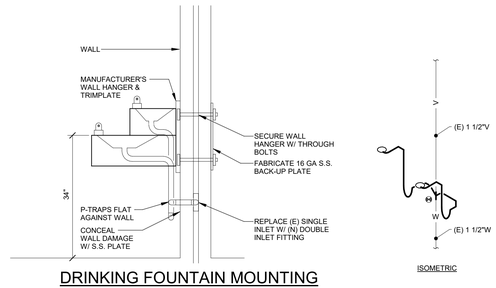
TRAP PRIMER CONNECTION DIAGRAM
NO SCALE



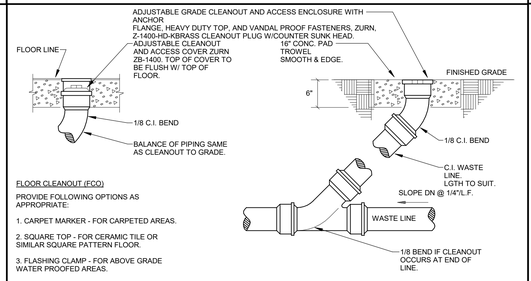
WALL CLEANOUT DIAGRAM
NO SCALE



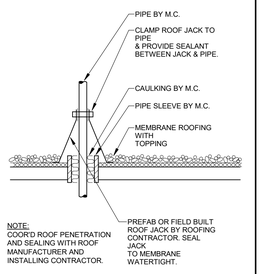
SANITARY OR STORM BLDG. DRAIN THRU WALL DIAGRAM
NO SCALE



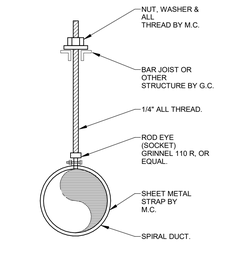
DRINKING FOUNTAIN MOUNTING DIAGRAM & ISOMETRIC
NO SCALE



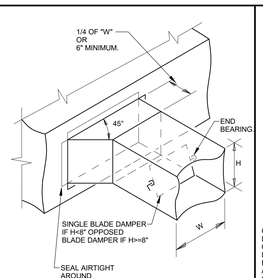
CLEANOUT DIAGRAMS
NO SCALE



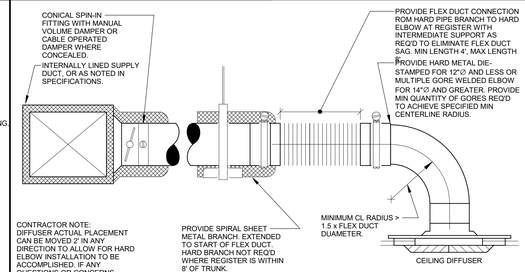
PIPE THRU ROOF DIAGRAM
NO SCALE (MEMBRANE ROOF)



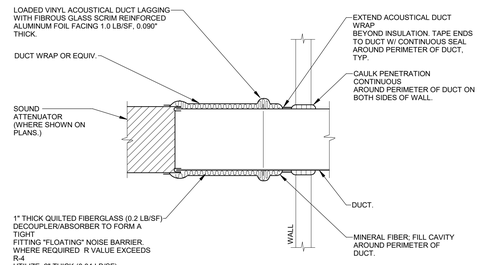
DUCT HANGER DIAGRAM
NO SCALE



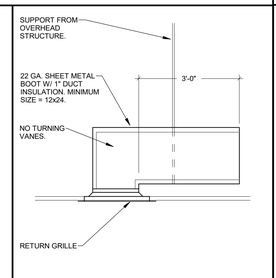
45° DUCT TAKE-OFF DIAGRAM
NO SCALE



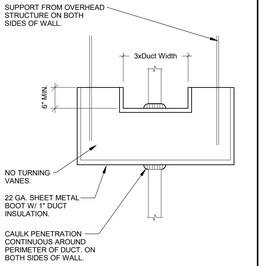
SPIRAL ELBOW DIFFUSER CONNECTION DIAGRAM
NO SCALE



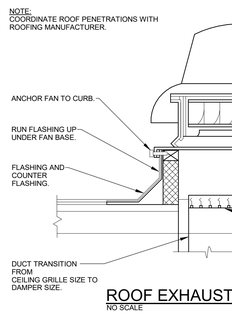
DUCT SOUND CONTROL DIAGRAM
NO SCALE (DUCT THRU WALL)



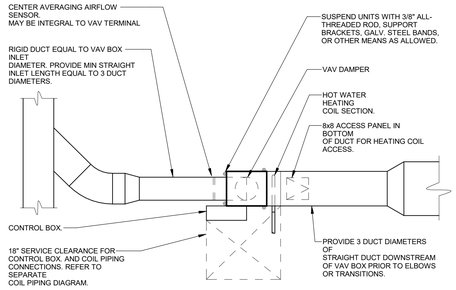
RETURN AIR GRILLE SOUND BOOT DIAGRAM
NO SCALE



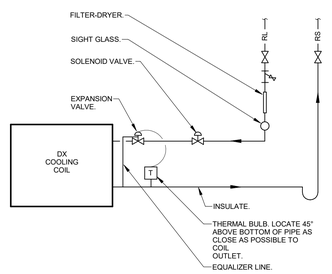
RETURN AIR GRILLE SOUND BOOT DIAGRAM
NO SCALE



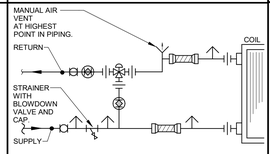
ROOF EXHAUST FAN DIAGRAM
NO SCALE (FLAT ROOF)



VAV BOX DIAGRAM (PRESSURE INDEPENDENT)
NO SCALE

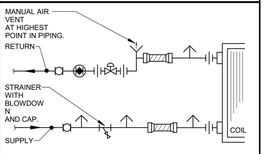


DX COIL PIPING DIAGRAM
NO SCALE



NOTES:
1. FLEXIBLE PIPE CONNECTOR REQ'D FOR EQUIPMENT CONTAINING FANS OR COMPRESSORS. NOT REQ'D FOR EQUIPMENT SUCH AS DUCT COILS.
2. PIPE ALL MULTI-ROW COILS FOR COUNTERFLOW (WATER ENTERS MOST DOWNSTREAM COIL, LEAVES MOST UPSTREAM COIL).
3. REFER TO CONTROLS DRAWINGS FOR ADDITIONAL INFORMATION.
4. 3-WAY VALVE WITH COIL RETURN PIPED TO NORMALLY OPEN PORT FOR HEATING AND NORMALLY CLOSED PORT FOR COOLING.

3-WAY (DIVERTING VALVE) COIL PIPING DIAGRAM
NO SCALE



NOTES:
1. FLEXIBLE PIPE CONNECTOR REQ'D FOR EQUIPMENT CONTAINING FANS OR COMPRESSORS. NOT REQ'D FOR EQUIPMENT SUCH AS DUCT COILS.
2. PIPE ALL MULTI-ROW COILS FOR COUNTERFLOW (WATER ENTERS MOST DOWNSTREAM COIL, LEAVES MOST UPSTREAM COIL).
3. REFER TO CONTROLS DRAWINGS FOR ADDITIONAL INFORMATIO.
4. 2-WAY VALVE NORMALLY OPEN FOR HEATING AND NORMALLY CLOSED FOR COOLING.

2-WAY COIL PIPING DIAGRAM
NO SCALE

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 210
Edwards, CO 8132
(970) 766-1470
fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

Seal

STRAWBERRY PARK ELEMENTARY
39620 AMETHYST DRIVE
Steamboat Springs, CO

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No	Description	Date

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MECHANICAL DIAGRAMS

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Sheet No:
M4.1

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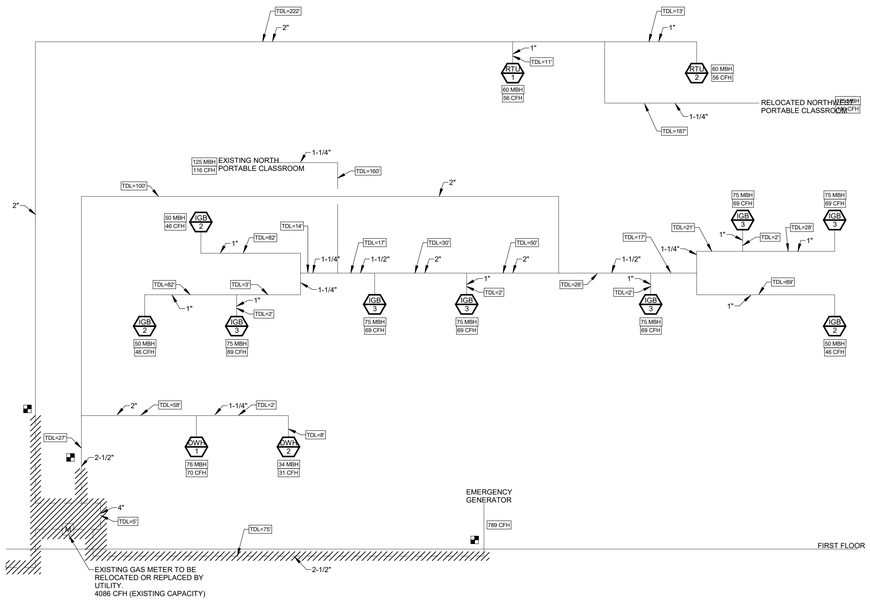
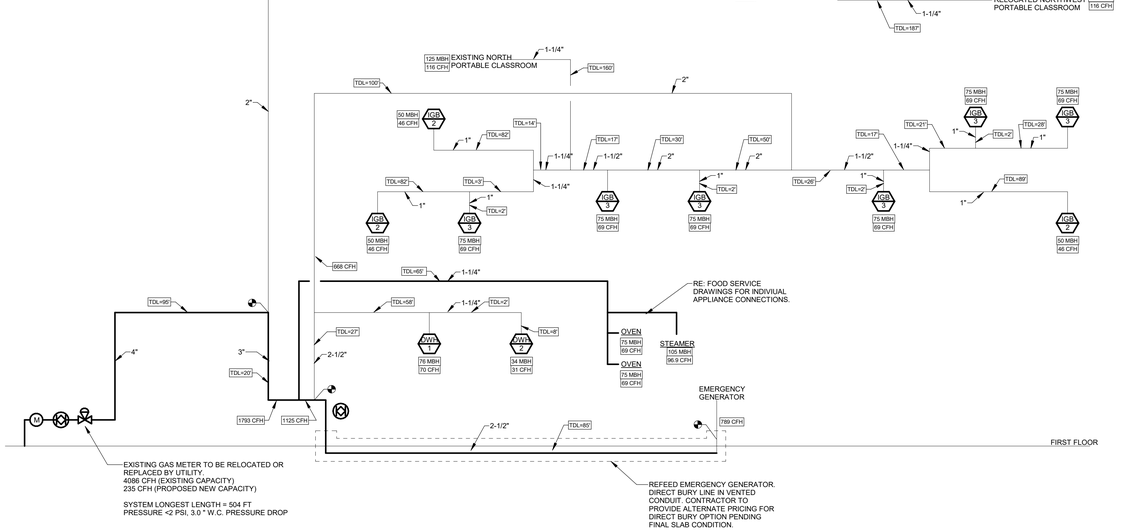


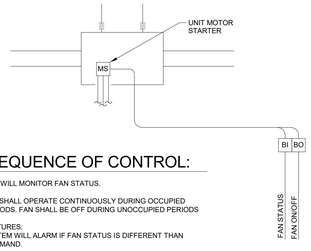
2 GAS PIPING DEMO DIAGRAM

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



3 GAS PIPING PROPOSED DIAGRAM

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



SEQUENCE OF CONTROL:

DDC WILL MONITOR FAN STATUS.

FAN SHALL OPERATE CONTINUOUSLY DURING OCCUPIED PERIODS. FAN SHALL BE OFF DURING UNOCCUPIED PERIODS

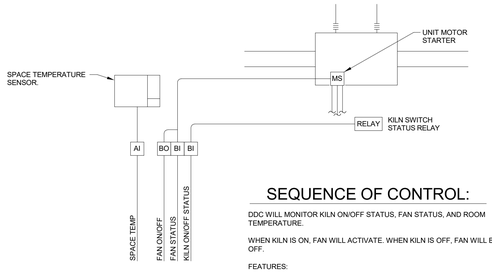
FEATURES:
SYSTEM WILL ALARM IF FAN STATUS IS DIFFERENT THAN COMMAND.

5 EF-2 - PRE-K RESTROOM AND KITCHEN EXHAUST CONTROL DIAGRAM

SCALE: NONE

CONTROLS GENERAL NOTES:

1. CONTROLS CONTRACTOR TO COVER ALL COSTS OF ELECTRICAL POWER REQUIREMENTS, IF ANY, AND LINE VOLTAGE WIRING, IF ANY, BY LICENSED ELECTRICIAN.
2. SEQUENCES OF OPERATION DEFINED HEREIN DESCRIBE GENERAL INTENT AND DO NOT INCLUDE ALL NECESSARY PROCEDURES/STEPS REQUIRED. ANTICIPATE FINE TUNING OF SEQUENCES (INCLUDING, BUT NOT LIMITED TO, SETPOINT ADJUSTMENTS, DEADBAND REFINEMENT, RESET CURVES ENDPOINTS, TIME DELAYS, OFFSETS, AND ACTUAL SEQUENCING OF EQUIPMENT), MAY BE REQUIRED AND SHALL BE PERFORMED AS REQUIRED DURING FUNCTIONAL PERFORMANCE TESTING OF THE SYSTEMS. CONTROLS CONTRACTOR SHALL BE RESPONSIBLE TO MAKE ANY AND ALL FINE TUNING ADJUSTMENTS TO PROVIDE A COMPLETE AND OPERABLE SYSTEM.
3. CONTROLS SHALL BE FIELD INSTALLED. CONTROLS CONTRACTOR SHALL BE RESPONSIBLE FOR WIRING AND INSTALLING ALL DEVICES REQUIRED FOR A FULLY FUNCTIONAL CONTROL SYSTEM FOR THIS PROJECT, REGARDLESS OF VOLTAGE. IF THE CONTRACTOR CANNOT SELF-PERFORM WORK REQUIRING LINE VOLTAGE THEN THE CONTRACTOR SHALL COORDINATE WITH AND COMPENSATE THE ELECTRICAL CONTRACTOR AS REQUIRED. CONTROLS CONTRACTOR SHALL COORDINATE WITH EQUIPMENT SUPPLIERS TO ENSURE THAT ALL DEVICES ARE COMPATIBLE WITH THE EXISTING CONTROLS SYSTEM AND EXISTING MECHANICAL EQUIPMENT.
4. ALL CONTROL WIRING TO BE INSTALLED IN PLENUM RATED CONDUIT.
5. NO NETWORKED CONTROL POINTS ARE ALLOWED. ALL SENSORS TO BE HARDWIRED DIRECTLY TO CONTROLLING MODULE.
6. DESCRIPTION - THE BUILDING CONTROL SYSTEM (BCS) SHALL CONSIST OF AN ASHRAE STANDARD 135 COMPLIANT (BACNET COMPATIBLE) DEVICES AND PROTOCOL FOR CONTROL OF HVAC & PLUMBING SYSTEMS. MAJOR COMPONENTS, INCLUDING BOILERS, PUMPS, RTU'S, VAV BOXES, FAN POWERED BOXES, VFDS, WATER HEATERS, AND COMPUTER ROOM COOLING SYSTEMS SHALL BE PROVIDED BY MANUFACTURER WITH BACNET COMPATIBLE CONTROLLERS WITH ALL AVAILABLE INFORMATION WITHIN COMMUNICATED TO AND GRAPHICALLY REPRESENTED IN THE BCS.
7. REMOTE ACCESS - PROVIDE REMOTE ACCESS VIA WEB BASED INTERFACE (WEB ACCESS ITSELF IS NOT PART OF THIS CONTRACT).
8. BUILDING OCCUPANCY - IN ADDITION TO THE OCCUPANCY SCHEDULING FEATURES AVAILABLE THROUGH THE BCS SOFTWARE, PROVIDE MANUAL CONTROLLABILITY OF OCCUPANCY STATUS. MANUAL CONTROL OF OCCUPANCY STATUS SHALL BE ADJUSTABLE THROUGH THE OPERATOR INTERFACE. MANUAL OCCUPANCY OVERRIDE DURATION SHALL BE ADJUSTABLE.
9. GRAPHICS - ALL BCS POINTS SHALL BE REPRESENTED BY GRAPHIC DISPLAY ON THE WEB BASED INTERFACE. ITEMS SUCH AS PUMPS, FANS, CONTROL VALVES, AND DAMPER MOTORS SHALL BE REPRESENTED BY GRAPHIC DISPLAYS. GRAPHICAL FLOOR PLANS SHALL INDICATE ANIMATED ZONE DESIGNATIONS AS WELL AS THEIR SPACE TEMPERATURE SETPOINT, SPACE TEMPERATURE, AND MODE OF OPERATION "HEATING," "COOLING" OR "INACTIVE". BACKGROUND COLOR OF ZONES SHALL BE CHANGED AS FOLLOWS: GREEN - SPACE TEMPERATURE WITHIN 3°F OF SETPOINT; RED - SPACE TEMPERATURE GREATER THAN 3°F ABOVE SETPOINT; BLUE -SPACE TEMPERATURE LOWER THAN 3°F BELOW SETPOINT.
10. GRAPHICAL FLOOR PLANS SHALL ALSO INDICATE CENTRALIZED PLANT EQUIPMENT, VAV'S, AHU'S, RTU'S, AND DISTRIBUTED IT ROOM COOLING SYSTEM BY LOCATION. ANIMATED GRAPHICS ARE NOT REQUIRED ON THE GRAPHICAL FLOOR PLAN SCREEN. ADDITIONAL INFORMATION FOR THE EQUIPMENT INDICATED ON THE GRAPHICAL FLOOR PLANS SHALL BE EASILY ACCESSED BY DOUBLE-CLICKING THE ASSOCIATED FLOOR PLAN GRAPHIC. ADDITIONAL INFORMATION FOR THE CENTRAL PLANT AS A WHOLE SHALL BE ACCESSIBLE IN THE SAME MANNER.
11. LOCATIONS SHOWN ON DRAWINGS ARE APPROXIMATE LOCATIONS ONLY. INDICATE EXACT LOCATION OF ALL DEVICES IN THE FIELD WITH CLEARLY MARKED IDENTIFIERS AND OBTAIN ARCHITECT'S AND ENGINEER'S APPROVAL PRIOR TO ROUTING CONDUIT AND PULLING WIRE.
12. VARIABLE FREQUENCY DRIVES (VFDS) TO BE PROVIDED WITH BACNET COMPATIBLE INTERFACE TO MONITOR CURRENT VFD STATUS AND OPERATING CONDITIONS THROUGH ITS COMMUNICATION PORT.
13. ALARMS - PROVIDE THE FOLLOWING SPECIFIC DIAL-OUT ALARMS TO DESTINATION DETERMINED BY THE OWNER: SPACE TEMPERATURE LOW LIMIT; IT (MDF & IDFS) ROOM TEMPERATURE HIGH LIMIT; GENERALIZED EQUIPMENT FAILURE ALARM (FOR EQUIPMENT SUCH AS PUMPS, WATER HEATERS, RTUS, ERVS, VFDS, ETC)
14. ADJUSTABILITY - WITH THE EXCEPTION OF DESIGN TEMPERATURES, ALL SETPOINTS, TIME DELAYS, DURATIONS, RESET SCHEDULES, AND OTHER CONTROL VARIABLES SHALL BE ADJUSTABLE. VARIABLES REQUIRED FOR CONTROLS IMPLEMENTATION THAT ARE NOT DEFINED IN THE SEQUENCES OF CONTROL SHALL BE DEFINED BY CONTROLS CONTRACTOR IN THEIR SHOP DRAWING SUBMITTAL. CONTRACTOR'S SUGGESTED ADJUSTMENTS TO VARIABLES DEFINED IN THE SEQUENCES OF CONTROL, IF ANY, SHALL BE SUBMITTED IN THE CONTROLS DRAWINGS.
15. RESET CURVE GRAPHICS - CERTAIN CONTROLS SEQUENCES IN THIS DRAWING SET CONTAIN RESET CURVES DESCRIPTIONS THAT ARE PROVIDED GRAPHICALLY. THOUGH THESE CURVES REPRESENT PROPORTIONAL CONTROL ONLY IN THE SIMPLEST INTERPRETATION, THE CONTROLS SYSTEM INTENT IS TO UTILIZE PROPORTIONAL-INTEGRAL (PI) AND/OR PROPORTIONAL-INTEGRAL-DERIVATIVE (PID) LOOPS TO PERMIT TUNING OF CONTROLS SYSTEMS RESPONSE, LIMIT OVERSHOOT/UNDERSHOOT, AND IMPROVE SYSTEM STABILITY. RESET CURVE GRAPHICS ARE PROVIDED AS SUGGESTED STARTING POINTS FOR THE PROPORTIONAL COMPONENT ONLY; ALL ENDPOINTS, OFFSETS, SLOPES, ETC ARE FLEXIBLE.
16. CONTROLS RECORD DRAWINGS REQUIRED - CONTRACTOR SHALL MAINTAIN, THROUGH THE COURSE OF THE PROJECT, A COMPREHENSIVE RECORD OF MECHANICAL EQUIPMENT AND CONTROLS RELATED ADDENDA (ASI'S, RFI'S, AND CCD'S), ADJUSTMENTS TO SETPOINTS DEFINED HEREIN, INITIAL SETPOINTS NOT DEFINED HEREIN. ANY SUGGESTIONS FOR ADJUSTMENTS AND/OR MODIFICATION TO THE APPROVED CONTROL SHOP DRAWINGS THAT ARISE DURING THE COURSE OF CONSTRUCTION, STARTUP, AND COMMISSIONING SHALL BE REVIEWED BY THE ENGINEER. APPROVED CHANGES SHALL BE RECORDED ON THE CONTROLS SHOP DRAWINGS BEING USED AS CONTROLS RECORD DRAWINGS. ALL SUCH CHANGES SHALL BE UPDATED ELECTRONICALLY AND SUBMITTED TO THE OWNER DURING PROJECT CLOSEOUT.
17. TRENDING INTERVALS AND STORAGE CAPACITY TO MATCH EXISTING BAS SYSTEM.
18. POINTS LISTS - CONTROLS DRAWING SUBMITTAL SHALL PROVIDE COMPLETE POINTS LISTS AND NAME/ADDRESS OF EACH POINT OCCURRENCE WITHIN THE PROJECT.
19. SPARE CAPACITY - PROVIDE SYSTEM ARCHITECTURE/INFRASTRUCTURE WITH MINIMUM 10% SPARE CAPACITY FOR FUTURE ADDITIONAL POINTS EVENLY DISTRIBUTED ACROSS THE FACILITY.



SEQUENCE OF CONTROL:

DDC WILL MONITOR KILN ON/OFF STATUS, FAN STATUS, AND ROOM TEMPERATURE.

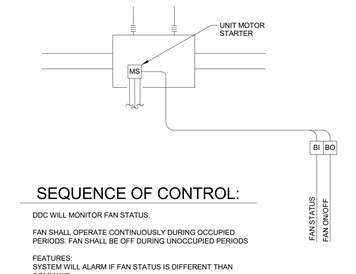
WHEN KILN IS ON, FAN WILL ACTIVATE. WHEN KILN IS OFF, FAN WILL BE OFF.

FEATURES:

PROVIDE ALARM IF FAN STATUS IS DIFFERENT THAN COMMAND. PROVIDE ALARM IF ROOM TEMPERATURE IS OUT OF RANGE. TREND SPACE TEMPERATURE.

2 EF-3 - KILN ROOM EXHAUST FAN CONTROL DIAGRAM

SCALE: NONE



SEQUENCE OF CONTROL:

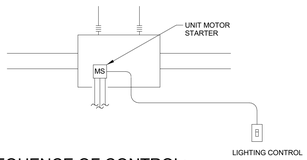
DDC WILL MONITOR FAN STATUS.

FAN SHALL OPERATE CONTINUOUSLY DURING OCCUPIED PERIODS. FAN SHALL BE OFF DURING UNOCCUPIED PERIODS

FEATURES:
SYSTEM WILL ALARM IF FAN STATUS IS DIFFERENT THAN COMMAND.

1 EF-1 - ART ROOM EXHAUST CONTROL DIAGRAM

SCALE: NONE



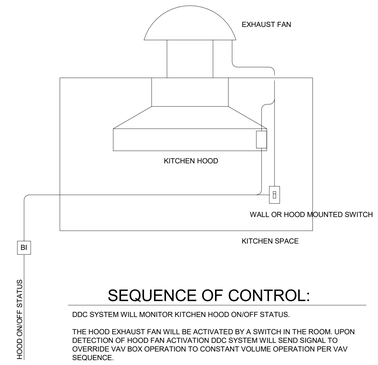
SEQUENCE OF CONTROL:

EXHAUST FAN SYSTEM TO BE INDEPENDENT OF DDC CONTROL..

FAN SHALL BE INTERLOCKED TO RUN WITH RESTROOM LIGHTING CONTROL. WHEN LIGHTING IS ON, FAN WILL RUN. WHEN LIGHTING IS OFF, FAN WILL BE OFF.

4 EF-4 - SPED RESTROOM EXHAUST CONTROL DIAGRAM

SCALE: NONE



SEQUENCE OF CONTROL:

DDC SYSTEM WILL MONITOR KITCHEN HOOD ON/OFF STATUS.

THE HOOD EXHAUST FAN WILL BE ACTIVATED BY A SWITCH IN THE ROOM. UPON DETECTION OF HOOD FAN ACTIVATION DDC SYSTEM WILL SEND SIGNAL TO OVERRIDE VAV BOX OPERATION TO CONSTANT VOLUME OPERATION PER VAV SEQUENCE.

3 KEF-1 AND KEF-2 - KITCHEN HOOD EXHAUST CONTROL DIAGRAM

SCALE: NONE

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 310
Edwards, CO 8132
(970) 766-1470
fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

Seal

STRAWBERRY PARK ELEMENTARY
39620 AMETHYST DRIVE
Steamboat Springs, CO

Revisions:		
No	Description	Date

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MECHANICAL DIAGRAMS

Project No:
10182.00

Sheet No:
M4.2

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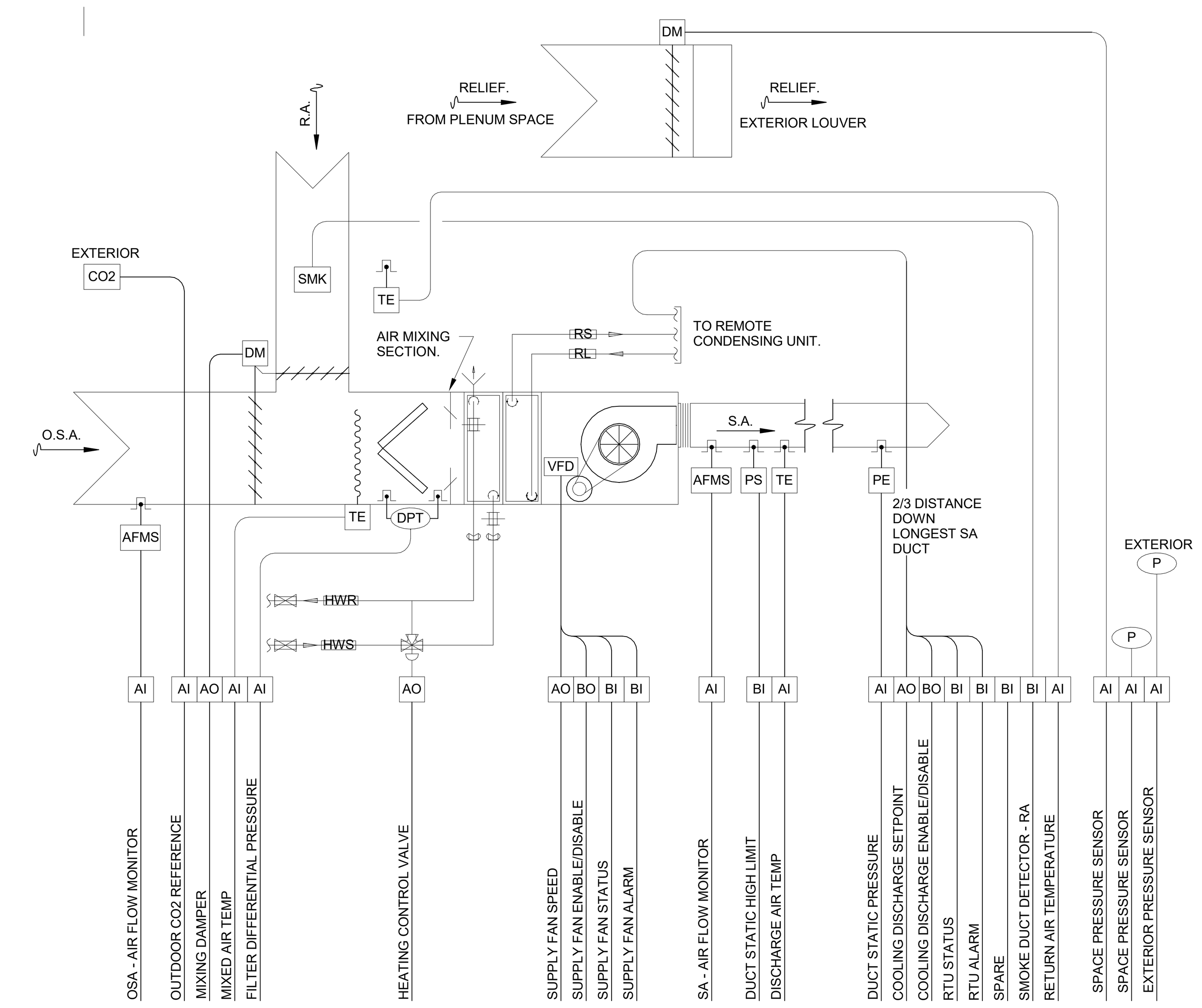


CONTROLS POINTS LIST

POINT DESCRIPTION-	GRAPHIC SCREEN	ANIMATED POINT ON GRAPHIC	TEMPERATURE	PRESSURE	RELATIVE HUMIDITY	CO2 - OUTSIDE AIR REFERENCE	AFMS - OSA	AFMS - SA	GPM	PERCENT	CFM	DDC (4-20 ma, 0-10 vdc)	STATUS	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	TIMED OVERRIDE	HEAT/COOL	ALARM	STOP/START	OPEN/CLOSED	LOCK OUT	ENABLE/DISABLE	HIGH/LOW SPEED	FLOATING CONTROL	OCCUPIED/UNOCC	FAULT RESET	HEAT/COOL	HIGH OR LOW VALUE	OUT OF RANGE	STATUS DIFF. FROM CMD	FREEZESTAT	ALARM	TREND VALUE	TREND STATUS	LEAD/LAG	ROTATIONALLY SEQUNCE	CRITICAL VALVE RESET	ITEMIZED FAULT CODE	PERIODIC HEAT TREATMENT
			ANALOG										BINARY																SYSTEM FEATURE											
			INPUT									OUTPUT	INPUT							OUTPUT									ALARMS					PROGRAMS						
AIR HANDLER UNIT CONTROLS																																								
RELIEF DAMPER POSITION	X									X		X																					X		X					
MIXING DAMPER POSITION	X									X		X																							X					
MIXED AIR TEMPERATURE	X		X																										X	X				X						
FILTER DIFFERENTIAL PRESSURE	X			X																													X	X						
CO2 - OUTDOOR REFERENCE	X					X																																		
HEATING CONTROL VALVE	X									X		X																						X	X					
SUPPLY FAN SPEED	X											X																												
SUPPLY FAN ENABLE/DISABLE	X																						X																	
SUPPLY FAN STATUS	X	X											X																		X									
SUPPLY FAN ALARM	X																		X														X							
DUCT STATIC HIGH LIMIT	X																		X														X							
DISCHARGE AIR TEMPERATURE	X		X																										X	X				X						
AFMS - OSA	X						X																																	
DUCT STATIC PRESSURE	X			X																														X						
COOLING DISCHARGE SETPOINT	X											X																												
COOLING ENABLE/DISABLE	X																						X																	
AHU STATUS	X	X											X																		X									
SMOKE DETECTOR	X																		X														X							
RETURN AIR TEMPERATURE	X		X																										X	X				X						
AFMS - SA	X							X																																
SPACE PRESSURE	X			X																									X	X				X						
OUTDOOR PRESSURE	X			X																									X	X				X						

GENERAL NOTES:

DUPLICATE POINTS MAY EXIST. REFER TO FLOW DIAGRAMS AND PLANS FOR QUANTITIES.

3 AIR HANDLING UNIT AND CONDENSING UNIT CONTROL DIAGRAM

SCALE: NONE

SEQUENCE OF CONTROL

DESCRIPTION - THE SYSTEM CONSISTS OF A NEW AIR HANDLING UNIT COMPLETE WITH MIXING BOX, AIR BLENDER, FILTER SECTION, HOT WATER COIL, DX COIL, SUPPLY FAN WITH VFD, AND REMOTE DX CONDENSING UNIT. DAMPERS, CONTROL VALVES, AND THEIR ACTUATORS, AS WELL AS ALL OTHER CONTROLS REQUIRED SHALL BE NEW EQUIPMENT FURNISHED AND INSTALLED BY THE TEMPERATURE CONTROLS CONTRACTOR. DX CONDENSING UNIT EQUIPMENT CONTROLS SHALL BE INSTALLED BY EQUIPMENT MANUFACTURER WITH HARDWIRED MONITORING AND CONTROL POINTS AVAILABLE AS SHOWN.

SCHEDULING - THE AIR HANDLING UNIT SHALL BE SCHEDULED IN EITHER OCCUPIED OR UNOCCUPIED MODE BASED ON PROGRAM SCHEDULE, FEEDBACK STATUS FROM THE RESPECTIVE TERMINAL BOX ZONES SERVED BY THE AHU, AND OPERATIONAL STATUS OF KITCHEN EXHAUST FANS. WHEN ALL RESPECTIVE ZONES SERVED ARE IN UNOCCUPIED MODE, AND KITCHEN EXHAUST FANS ARE OFF, THE AHU OPERATIONAL MODE SHALL BE UNOCCUPIED. WHEN ANY OF THE RESPECTIVE ZONES ARE IN OCCUPIED MODE, OR EITHER KITCHEN EXHAUST FAN IS ON, THE AHU OPERATIONAL MODE SHALL BE OCCUPIED. WHEN IN OCCUPIED MODE, SUPPLY FAN SHALL OPERATE AND CONTROLLED DEVICES SHALL POSITION WITH RESPECT TO THEIR PI CONTROL LOOP. WHEN IN UNOCCUPIED MODE, FAN SHALL BE OFF, RETURN DAMPER FULLY OPEN, OUTSIDE AIR DAMPER FULLY CLOSED, HOT WATER VALVE 10% (ADJUSTABLE) OPEN TO COIL, AND DX COOLING SYSTEM DISABLED.

MORNING WARM-UP: SHALL BE SCHEDULED TO OCCUR PRIOR TO SCHEDULED OCCUPANCY. PROVIDE ADJUSTABLE DURATION TO PERMIT BUILDING OPERATOR TO TUNE TIME PERIOD REQUIRED TO FULLY EXECUTE WARM-UP EXERCISE PRIOR TO OCCUPANCY. DURING MORNING WARM-UP, FIRST ALL VAV BOXES SHALL OPEN UP TO 100% OF BALANCED MAXIMUM COOLING CFM, AND VAV HEATING COIL CONTROL VALVES WILL BE CLOSED. AFTER A 3 MINUTE (ADJUSTABLE) DELAY THE SUPPLY FAN SHALL START AND THE VFD SHALL MODULATE TO MAINTAIN THE MAXIMUM DUCT STATIC PRESSURE SETPOINT (AS DETERMINED BY BALANCE CONTRACTOR) PLUS 0.10'' WC. AHU SHALL SUPPLY 85°F (ADJ) DAT, OSA DAMPER SHALL BE CLOSED, RA DAMPER SHALL BE OPEN. AS EACH ZONE REACHES OCCUPIED SETPOINT, ASSOCIATED VAV BOX WILL RETURN TO NORMAL OCCUPIED OPERATION. ONCE ALL ZONES REACH OCCUPIED SETPOINT, THE AHU WILL RETURN TO NORMAL OCCUPIED OPERATION.

MORNING COOL-DOWN: SHALL BE BASED UPON TREND DATA COLLECTED OVER THE PREVIOUS 7 DAYS (ADJ) TO DETERMINE WHETHER OR NOT MORNING COOL-DOWN IS WARRANTED. MORNING COOL DOWN SHALL BE DEEMED WARRANTED IF EITHER OF THE FOLLOWING CONDITIONS ARE MET:

1. DEMAND FOR COOLING OCCURRED ON THE MAJORITY OF THE DAYS IN PREVIOUS PERIOD POLLED.
2. DAILY MAXIMUM OUTSIDE AIR TEMPERATURE EXCEEDED SPACE TEMPERATURE SETPOINT FOR A MAJORITY OF THE DAYS THE IN PREVIOUS PERIOD POLLED.

WHEN DEEMED WARRANTED, MORNING COOL-DOWN SHALL BE EXECUTED IN LIEU OF MORNING WARM-UP ROUTINE. THE COOL-DOWN ROUTINE SHALL BE SCHEDULED TO OCCUR PRIOR TO SCHEDULED OCCUPANCY. PROVIDE ADJUSTABLE DURATION TO PERMIT BUILDING OPERATOR TO TUNE TIME PERIOD REQUIRED TO FULLY EXECUTE COOL-DOWN EXERCISE PRIOR TO OCCUPANCY. DURING MORNING COOL-DOWN, FIRST ALL VAV BOXES SHALL OPEN TO 100% OF BALANCED MAXIMUM CFM, AFTER A 3 MINUTE DELAY (ADJ), THE SUPPLY FAN VFD SHALL START AND MODULATE TO MAINTAIN MAINTAIN THE MAXIMUM DUCT STATIC PRESSURE SETPOINT (AS DETERMINED BY BALANCE CONTRACTOR) PLUS 0.10" WC. DURING COOL-DOWN AHU SHALL MODULATE MIXING BOX POSITION TO ACHIEVE COOLING DISCHARGE AIR TEMPERATURE SETPOINT OF 55°F (ADJ). AS VAV ZONES REACH THEIR RESPECTIVE MORNING COOLDOWN SETPOINTS, ASSOCIATED VAV BOX WILL RETURN TO NORMAL OCCUPIED OPERATION. ONCE ALL ZONED REACH OCCUPIED SETPOINT, THE AHU WILL RETURN TO NORMAL OCCUPIED OPERATION.

MIXED AIR CONTROL: MIXING BOX CONTROL IS CONTROLLED BY MULTIPLE CONTROL LOOPS. BCS SHALL HIGH SELECT CONTROL POSITION AMONGST THE FOLLOWING LOOPS:

OCCUPIED/UNOCCUPIED: DAMPER CLOSED WHILE UNOCCUPIED AND OPEN TO MINIMUM POSITION WHILE OCCUPIED. MINIMUM OUTSIDE AIR POSITIONS SHALL BE BASED ON DCV CALCULATION AND KITCHEN EXHAUST OPERATION.

MIXED AIR TEMPERATURE CONTROL LOOP: WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW DISCHARGE AIR SETPOINT BY 1 DEGREE, MIXING DAMPERS SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT.

ECONOMIZER CONTROL LOOP: OPEN OUTSIDE AIR DAMPER, CLOSE RETURN AIR DAMPER, AND OPEN RELIEF DAMPER (WHERE APPLICABLE), DURING ECONOMIZER MODE. COOLING IS VIA ECONOMIZER MODE ONLY, DISABLE ECONOMIZER COOLING WHEN OUTSIDE AIR TEMPERATURES ARE GREATER THAN INDOOR SPACE TEMPERATURE SETPOINT.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL: DAT SETPOINT SHALL BE BASED ON O.S.A. TEMP RESET SCHEDULE BELOW.

MODULATE MIXING BOX POSITION TO MAINTAIN DAT AT SETPOINT DURING ECONOMIZER COOLING. IF THE OSA DAMPERS ARE AT MINIMUM POSITION AND THE MIXED AIR TEMPERATURE IS BELOW DAT SETPOINT, MODULATE HEATING WATER VALVE TO MAINTAIN DAT AT SETPOINT. IF OSA TEMP IS GREATER THAN DAT SETPOINT, MODULATE MIXING DAMPERS TO MINIMUM POSITION. ENABLE DX COOLING SYSTEM FOR AIR HANDLER TO MAINTAIN DAT AT SETPOINT.

SUPPLY FAN CONTROL:
THE SUPPLY FAN VFD SHALL BE MODULATED BASED ON DUCT STATIC PRESSURE FEEDBACK TO MAINTAIN DUCT STATIC PRESSURE AT SETPOINT. EMPLOY CRITICAL VALVE RESET LOGIC TO MAINTAIN THE MOST OPEN PRIMARY AIR VALVE IN THE SYSTEM AT 90% OR GREATER. POLL ALL VALVE POSITIONS TO DETERMINE MOST OPEN (CRITICAL) VALVE. RESET STATIC PRESSURE SETPOINT PER THE SCHEDULE BELOW.

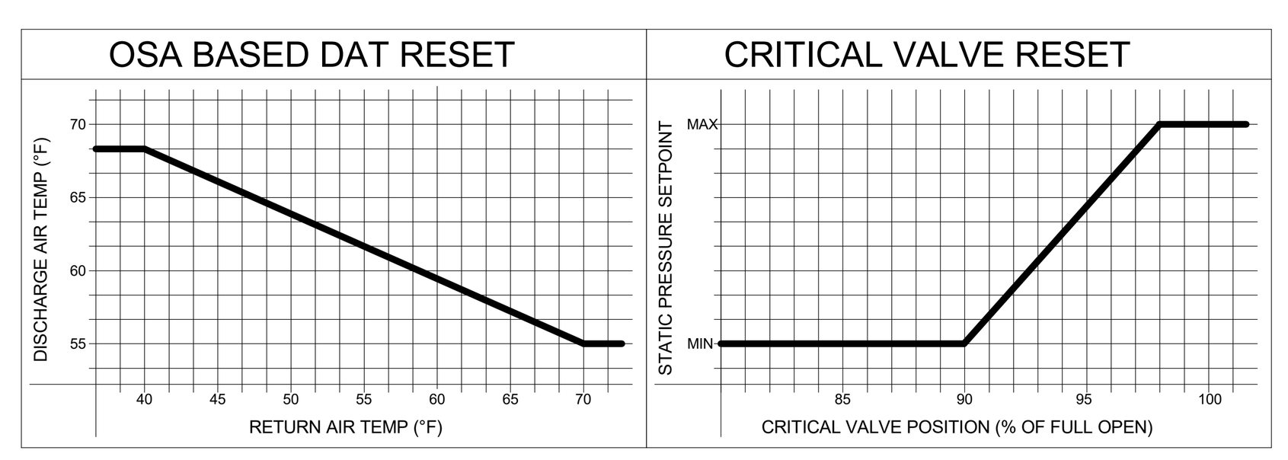
DURING BALANCING/START-UP, CONSULT THE ENGINEER TO DETERMINE WHICH THREE OR FOUR TERMINAL BOXES SHALL BE PROGRAMMED TO REMAIN OPEN UNDER SATISFIED CONDITIONS TO ALLOW FOR A MINIMUM FAN FLOW RATE WITHOUT OVER-PRESSURIZING THE SUPPLY DUCTS.

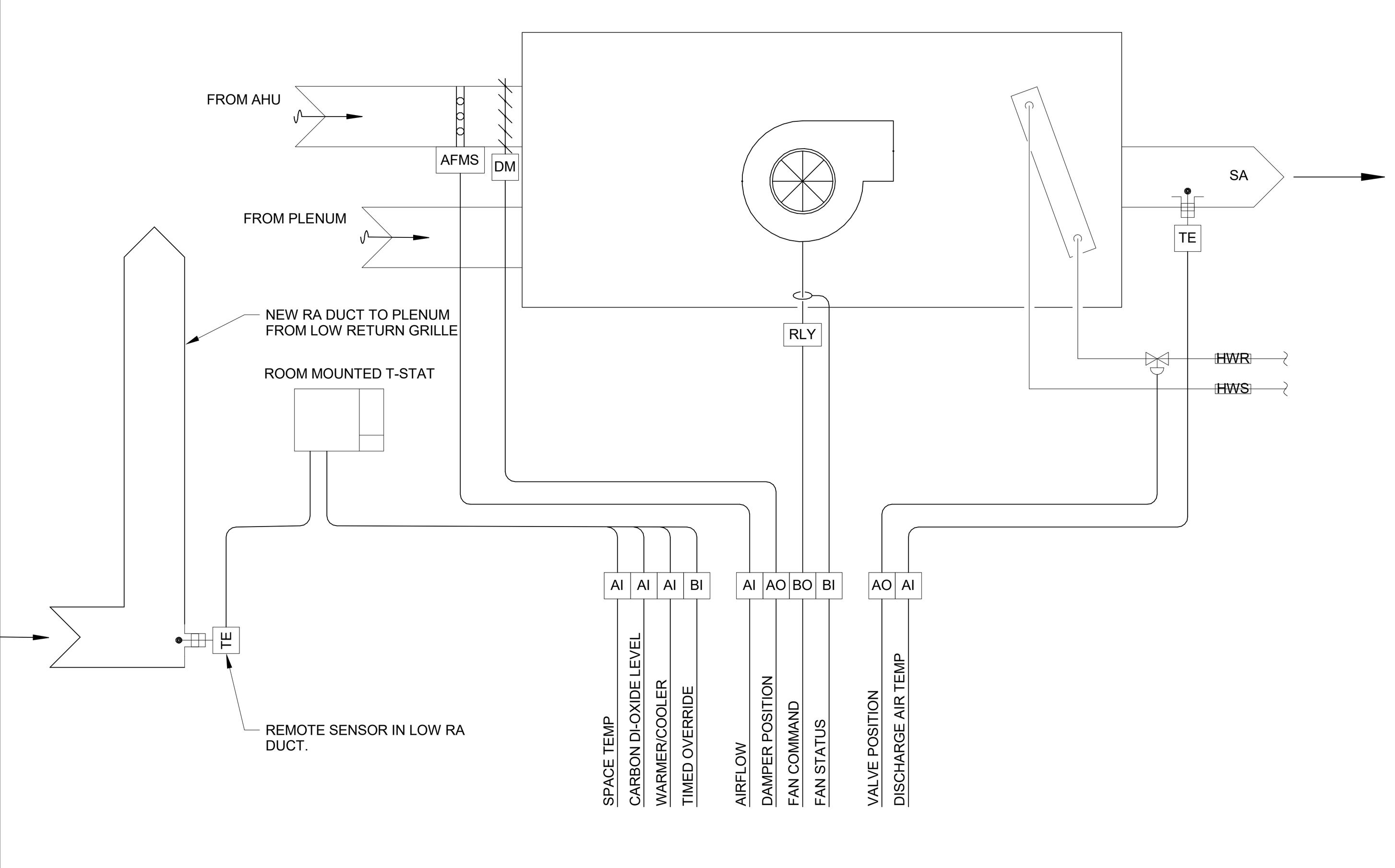
SPACE PRESSURE CONTROL: RELIEF AIR SHALL BE ACCOMPLISHED WITH A MOTORIZED RELIEF DAMPER DUCTED TO AN EXTERIOR LOUVER. BUILDING PRESSURE SHALL BE MAINTAINED AT 0.02" W.C. (ADJ). MODULATE RELIEF DAMPER AND OSA DAMPER TO MAIN TAIN SET POINT.

DEMAND CONTROL VENTILATION (DCV): DURING OCCUPIED MODE THE BUILDING AUTOMATION SYSTEM WILL MONITOR CARBON MONOXIDE CO2 AT EACH ZONE AND FROM OUTSIDE TO DETERMINE OCCUPANCY LEVELS IN EACH ZONE. BASED ON OCCUPANCY, THE DCV PROGRAM WILL RESET THE VAV BOX MINIMUM VENTILATION CFM TO MAINTAIN CODE REQUIRED VENTILATION TO EACH ZONE. AS VAV BOX MINIMUM CFM'S CHANGE, DCV PROGRAM WILL CALCULATE NEW VENTILATION FRACTION FOR AIR HANDLER UNIT AND RESET OSA CFM.

WHEN KITCHEN EXHAUST FANS ARE IN OPERATION, SYSTEM WILL BE IN OCCUPIED MODE AND OSA CFM WILL BE OVERRIDDEN TO A MINIMUM OF 30% (ADJ).

FEATURES -
1. DISCHARGE AIR TEMPERATURE SHALL BE TRENDED HOURLY.
2. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
3. GENERATE FILTER CHANGE ALARM SHOULD FILTER DIFFERENTIAL PRESSURE EXCEED FILTER CHANGE SETPOINT (ADJUSTABLE AT THE OPERATOR INTERFACE).
4. GENERATE AN ALARM SHOULD ANY FAN STATUS NOT MATCH FAN COMMAND.
5. GENERATE AN ALARM AND OPEN HEATING VALVE TO 100% SHOULD FREEZE STAT TRIP AND DAMPERS SHALL GO TO UNOCCUPIED MODE POSITION.
6. GENERATE AN ALARM SHOULD SMOKE DETECTOR TRIP AND SHUT UNIT DOWN, VALVES AND DAMPERS SHALL GO TO UNOCCUPIED MODE.
7. DISABLE SUPPLY FAN AND GENERATE ALARM SHOULD DUCT HIGH STATIC PRESSURE SWITCH TRIP.
8. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.
9. GENERATE ALARMS AS INDICATED IN THE POINTS LIST AND IN THE SEQUENCE OF CONTROL ABOVE.





4 EXISTING FAN POWERED VAV WITH HW REHEAT CONTROL DIAGRAM

SCALE: NONE

SEQUENCE OF CONTROL:

THE EXISTING SYSTEM CONSIST OF A PRESSURE INDEPENDENT VARIABLE AIR VOLUME BOX COMPLETE WITH FAN, MOTORIZED DAMPER, HOT WATER REHEAT COIL, FLOATING OR MODULATING CONTROL VALVE, AND AIR FLOW PRESSURE TRANDUCER. A NEW TEMPERATURE SENSOR SHALL BE PROVIDED WITH REMOTE SENSOR MOUNTED IN THE RETURN AIR DUCT TO PROVIDE AN ACCURATE READING OF FLOOR-LEVEL TEMPERATURE.

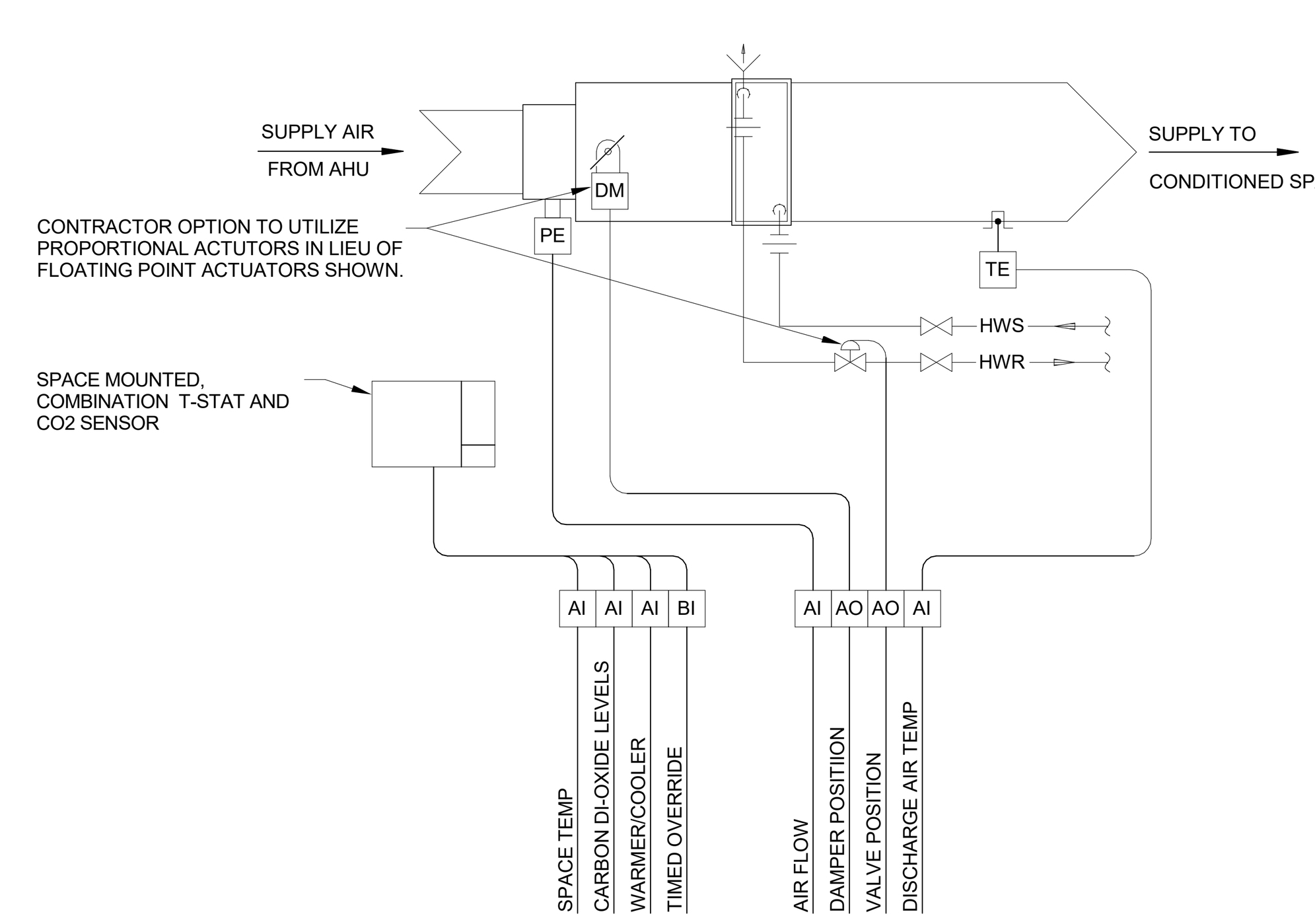
SCHEDULING:
SET POINT SHALL BE MEASURED BY THE RETURN-DUCT MOUNTED TEMPERATURE SENSOR. THE ROOM TEMPERATURE SETPOINT SHALL BE SCHEDULED THROUGH THE OPERATOR WORKSTATION SUCH THAT HEATING ROOM TEMPERATURE SETPOINT AND COOLING ROOM TEMPERATURE SETPOINT ARE SET UP AND SET BACK RESPECTIVELY DURING UNOCCUPIED MODES. A THERMOSTAT MOUNTED TIMED OVERRIDE BUTTON SHALL ALLOW ROOM OCCUPANTS TO OVERRIDE THE VAV BOX INTO AN OCCUPIED MODE FOR A SET TIME DURATION SHOULD OCCUPANTS DESIRE TO USE THE SPACE DURING UNOCCUPIED TIMES. THE RESPECTIVE AIR HANLDING UNIT SHALL BE OPERATIONAL WHENEVER VAV BOX IS IN OCCUPIED MODE. THE VAV BOX FAN IN THE SERIES POSITION SHALL ENERGIZE WHEN ZONE IS SCHEDULED TO BE OCCUPIED, AND SHALL DE-ENERGIZE WHEN ZONE IS IN UNOCCUPIED MODE.

OCCUPIED CONTROL
TERMINAL FAN SHALL RUN CONTINUOUSLY. THE AIRFLOW PRESSURE TRANDUCER SHALL INDICATE TO THE UNIT MOUNTED DDC CONTROLLER MEASURED AIRFLOW. THE DDC CONTROLLER SHALL MODULATE THE VAV BOX DAMPER TO MAINTAIN AIRFLOW AT SETPOINT. AIRFLOW SETPOINT SHALL BE RESET BASED ON THE DIFFERENCE BETWEEN SPACE TEMPERATURE AND SPACE SETPOINT. UPON A RISE IN SPACE TEMPERATURE ABOVE SETPOINT AIRFLOW SHALL MODULATE TO THE MAXIMUM SETPIONT. UPON A FALL IN SPACE TEMPERATURE BELOW SPACE TEMPERATURE SETPOINT AIRFLOW SHALL MODULATE TO THE MINIMUM SETPOINT. SHOULD SPACE TEMPERATURE REMAIN BELOW SPACE SETPOINT PLUS DIFFERENTIAL THE HOT WATER CONTROL VALVE SHALL MODULATE OPEN. A SPACE MOUNTED TEMPERATURE SENSOR SHALL INCORPORATE A WARMER/COOLER ADJUSTMENT ALLOWING ZONE OCCUPANTS TO BIAS THE SPACE TEMPERATURE SETPOINT BY A FIXED AMOUNT IN EITHER DIRECTION.

FEATURES
SPACE TEMPERATURE SHALL BE TRENDED HOURLY
SPACE TEMPERATURE OF 5 DEGREES OR MORE ABOVE OR BELOW SETPOINT SHALL ALARM
FAN STATUS OTHER THAN COMMAND SHALL ALARM
DAT HIGH/LOW OR OUT OF RANGE SHALL ALARM
AIRFLOW OUT OF RANGE SHALL ALARM

SYSTEM POINTS LIST -- SERIES FAN POWERED VAV BOX WITH HW REHEAT

SYSTEM POINT DESCRIPTION	GRAPHIC SCREEN	ANIMATED POINT ON GRAPHIC	TEMPERATURE	PRESSURE	RELATIVE HUMIDITY	KW	KWH	BTU HR	GPM	PERCENT	CFM	DDC (4-20 ma, 0-10 vdc)	STATUS	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	TIMED OVERRIDE	STOP/START	OPEN/CLOSED	LOCK OUT	ENABLE/DISABLE	HIGH/LOW SPEED	FLOATING CONTROL	HIGH OR LOW VALUE	OUT OF RANGE	STATUS DIFF. FROM CMD	TREND VALUE	TREND STATUS	LEAD/LAG	ROTATIONALLY SEQUNCE	NOTES
			ANALOG										BINARY											SYSTEM FEATURE							
			INPUT									OUTPUT	INPUT					OUTPUT						ALARMS			PROGRAMS				
SPACE TEMP	X		X																					X			X				REMOTE DUCT SENSOR
WAMER/COOLER	X		X																												
TIMED OVERRIDE																	X														
AIRFLOW	X			X																				X			X				
CO2 LEVEL	X										X														X	X	X				
DAMPER POSITION	X											X														X	X				
FAN COMMAND																		X								X	X				
FAN STATUS	X	X												X												X	X				
VALVE POSITION	X											X														X	X				
DISCHG AIR TEMP	X		X																				X	X		X				
GENERAL NOTES:																															



SYSTEM POINTS LIST -- VAV BOX WITH HW REHEAT

SYSTEM POINT DESCRIPTION	GRAPHIC SCREEN	ANIMATED POINT ON GRAPHIC	TEMPERATURE	CARBON DI-OXIDE	RELATIVE HUMIDITY	KW	KWH	BTU HR	GPM	PERCENT	CFM	DDC (4-20 ma, 0-10 vdc)	STATUS	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	TIMED OVERRIDE	STOP/START	OPEN/CLOSED	LOCK OUT	ENABLE/DISABLE	HIGH/LOW SPEED	FLOATING CONTROL	HIGH OR LOW VALUE	OUT OF RANGE	STATUS DIFF. FROM CMD	TREND VALUE	TREND STATUS	LEAD/LAG	ROTATIONALLY SEQUNCE	NOTES
			ANALOG										BINARY											SYSTEM FEATURE							
			INPUT									OUTPUT	INPUT					OUTPUT						ALARMS			PROGRAMS				
SPACE TEMP	X		X																					X			X				
WAMER/COOLER	X		X																												
TIMED OVERRIDE																	X														
CO2 LEVEL	X			X																				X			X				
AIRFLOW	X										X														X	X	X				
DAMPER POSITION	X											X														X	X				
VALVE POSITION	X											X														X	X				
DISCHG AIR TEMP	X		X																				X	X		X				
GENERAL NOTES:																															

1 CLASSROOM VAV w/ REHEAT CONTROL DIAGRAM

SCALE: NONE

SEQUENCE OF CONTROL:

DESCRIPTION - THE NEW SYSTEMS CONSIST OF A PRESSURE INDEPENDENT VARIABLE AIR VOLUME BOX COMPLETE WITH MOTORIZED DAMPER, HOT WATER REHEAT COIL, FLOATING POINT OR PROPORTIONAL CONTROL VALVE, AND AIR FLOW PRESSURE TRANSDUCER.

SCHEDULING - OCCUPIED/UNOCUPIED SCHEDULING APPLIES TO THESE SYSTEMS. SCHEDULES TO BE DETERMINED BY OWNER AND SHALL BE AVAILABLE THROUGH THE OPERATOR WORKSTATION INTERFACE.

SCHEDULING CONTROLS SPACE SETPOINT TEMPERATURE. DURING OCCUPIED MODE, TERMINAL UNIT SHALL MAINTAIN SPACE TEMPERATURE AT SETPOINT DICTATED BY SPACE MOUNTED THERMOSTAT (I.E. 68-72°F HEATING, 76-80°F COOLING). DURING UNOCCUPIED MODE, TERMINAL UNIT SHALL MAINTAIN SPACE TEMPERATURE AT SETBACK TEMPERATURE SETPOINT (I.E. 60°F HEATING, N/A COOLING)

OCCUPIED/UNOCCUPIED SCHEDULING ALSO CONTROLS VENTILATION. WHEN SCHEDULED IN THE OCCUPIED MODE, TERMINAL UNIT SHALL PROVIDE MINIMUM VENTILATION CFM CALCULATED BY THE DEMAND CONTROL VENTILATION PROGRAM. WHEN SCHEDULED IN THE UNOCCUPIED MODE, DAMPER SHALL BE SHUT. TERMINAL BOX SHALL BE PERMITTED TO OPEN AS REQUIRED ON DEMAND FOR HEATING ONLY, DURING UNOCCUPIED PERIODS.

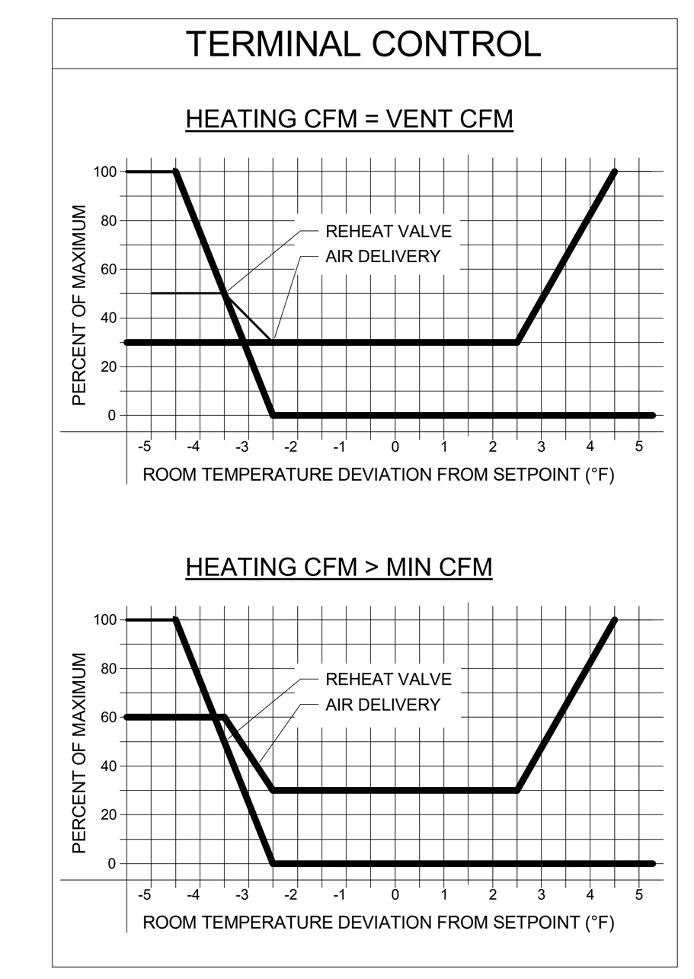
TIMED OVERRIDE - SHOULD THE TIMED OVERRIDE BE SWITCHED TO OCCUPIED DURING UNOCCUPIED MODE, OCCUPIED MODE OPERATION SHALL APPLY FOR THE TIMED OCCUPANCY DURATION.

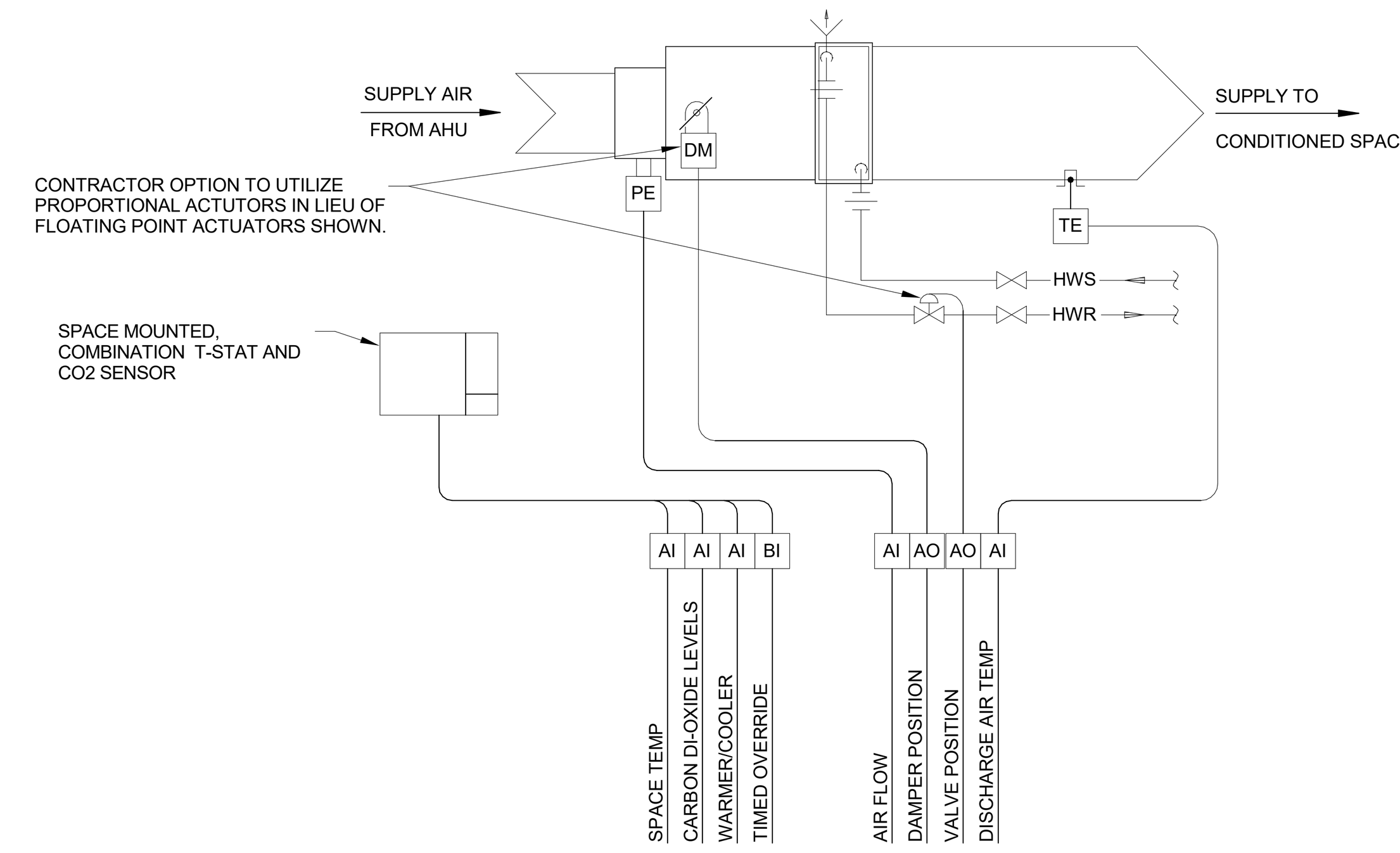
CONTROL - THE AIRFLOW PRESSURE TRANSDUCER SHALL INDICATE TO THE UNIT MOUNTED DDC CONTROLLER MEASURED AIRFLOW. THE DDC CONTROLLER SHALL MODULATE THE VAV BOX DAMPER TO MAINTAIN AIRFLOW AT SETPOINT. AIRFLOW SETPOINT AND REHEAT VALVE SHALL BE MODULATED BASED ON SPACE TEMPERATURE DEVIATION FROM SETPOINT PER THE SAMPLE RESET SCHEDULES BELOW INDICATING DEADBAND, HEATING AND COOLING RAMP-UP RANGES, AND MINIMUM AIRFLOWS.

NOTES:
1. THE ADJACENT GRAPHICS ARE PROVIDED FOR REFERENCE ONLY.
2. EACH TERMINAL BOX IS UNIQUE AND MAY HAVE REQ'MTS THAT VARY FROM THOSE DEPICTED.
3. INCLUDE LOGIC TO OPERATE REHEAT VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (I.E. 85°F MAX AT -2°F AND GREATER DEVIATION FROM SETPOINT)
4. REFER TO EQUIPMENT SCHEDULES FOR INITIAL AIR DELIVERY (CFM) SETTINGS.

THE SPACE MOUNTED TEMPERATURE SENSOR SHALL INCORPORATE A WARMER/COOLER ADJUSTMENT ALLOWING ZONE OCCUPANTS TO BIAS THE SPACE TEMPERATURE SETPOINT BY A FIXED AMOUNT IN EITHER DIRECTION.

FEATURES -
1. COOPERATION WITH NIGHT VENT COOLING, MORNING WARM-UP, AND DCV LOGIC WHERE SPECIFIED IN RESPECTIVE SEQUENCES.
2. SPACE TEMPERATURE SHALL BE TRENDED HOURLY.
3. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
4. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.





SYSTEM POINTS LIST -- VAV BOX WITH HW REHEAT

SYSTEM POINT DESCRIPTION	GRAPHIC SCREEN	ANIMATED POINT ON GRAPHIC	TEMPERATURE	CARBON DI-OXIDE	RELATIVE HUMIDITY	KW	KWH	BTU HR	GPM	PERCENT	CFM	DDC (4-20 ma, 0-10 vdc)	STATUS	STATUS ON/OFF	FILTER STATUS	STATUS OPEN/CLSD.	TIMED OVERRIDE	STOP/START	OPEN/CLOSED	LOCK OUT	ENABLE/DISABLE	HIGH/LOW SPEED	FLOATING CONTROL	HIGH OR LOW VALUE	OUT OF RANGE	STATUS DIFF. FROM CMD	TREND VALUE	TREND STATUS	LEAD/LAG	ROTATIONALLY SEQUNCE	NOTES
			ANALOG										BINARY											SYSTEM FEATURE							
			INPUT									OUTPUT	INPUT					OUTPUT						ALARMS			PROGRAMS				
SPACE TEMP	X		X																					X			X				
WAMER/COOLER	X		X																												
TIMED OVERRIDE																	X														
CO2 LEVEL	X			X																				X			X				
AIRFLOW	X										X														X	X	X				
DAMPER POSITION	X											X														X	X				
VALVE POSITION	X											X														X	X				
DISCHG AIR TEMP	X		X																				X	X		X				
GENERAL NOTES:																															

2 KITCHEN AND CAFETERIA SPACE VAV

SCALE: NONE

SEQUENCE OF CONTROL:

DESCRIPTION - THE NEW SYSTEMS CONSIST OF A PRESSURE INDEPENDENT VARIABLE AIR VOLUME BOX COMPLETE WITH MOTORIZED DAMPER, HOT WATER REHEAT COIL, FLOATING POINT OR PROPORTIONAL CONTROL VALVE, AND AIR FLOW PRESSURE TRANSDUCER.

SCHEDULING - OCCUPIED/UNOCUPIED SCHEDULING APPLIES TO THESE SYSTEMS. SCHEDULES TO BE DETERMINED BY OWNER AND SHALL BE AVAILABLE THROUGH THE OPERATOR WORKSTATION INTERFACE.

SCHEDULING CONTROLS SPACE SETPOINT TEMPERATURE. DURING OCCUPIED MODE, TERMINAL UNIT SHALL MAINTAIN SPACE TEMPERATURE AT SETPOINT DICTATED BY SPACE MOUNTED THERMOSTAT (I.E. 68-72°F HEATING, 76-80°F COOLING). DURING UNOCCUPIED MODE, TERMINAL UNIT SHALL MAINTAIN SPACE TEMPERATURE AT SETBACK TEMPERATURE SETPOINT (I.E. 60°F HEATING, N/A COOLING)

OCCUPIED/UNOCCUPIED SCHEDULING ALSO CONTROLS VENTILATION. WHEN SCHEDULED IN THE OCCUPIED MODE, TERMINAL UNIT SHALL PROVIDE MINIMUM VENTILATION CFM CALCULATED BY THE DEMAND CONTROL VENTILATION PROGRAM. WHEN SCHEDULED IN THE UNOCCUPIED MODE, DAMPER SHALL BE SHUT. TERMINAL BOX SHALL BE PERMITTED TO OPEN AS REQUIRED ON DEMAND FOR HEATING ONLY, DURING UNOCCUPIED PERIODS.

TIMED OVERRIDE - SHOULD THE TIMED OVERRIDE BE SWITCHED TO OCCUPIED DURING UNOCCUPIED MODE, OCCUPIED MODE OPERATION SHALL APPLY FOR THE TIMED OCCUPANCY DURATION.

KITCHEN HOOD VENTILATION MODE. WHEN KITCHEN EXHAUST HOOD IS ACTIVATED, VAV WILL BE OVERRIDDEN TO OCCUPIED MODE AND MAX DESIGN CFM. WHEN KITCHEN EXHAUST IS OFF, VAV WILL RETURN TO NORMAL OPERATION.

CONTROL - THE AIRFLOW PRESSURE TRANSDUCER SHALL INDICATE TO THE UNIT MOUNTED DDC CONTROLLER MEASURED AIRFLOW. THE DDC CONTROLLER SHALL MODULATE THE VAV BOX DAMPER TO MAINTAIN AIRFLOW AT SETPOINT. AIRFLOW SETPOINT AND REHEAT VALVE SHALL BE MODULATED BASED ON SPACE TEMPERATURE DEVIATION FROM SETPOINT PER THE SAMPLE RESET SCHEDULES BELOW INDICATING DEADBAND, HEATING AND COOLING RAMP-UP RANGES, AND MINIMUM AIRFLOWS.

WHEN KITCHEN VENTILATION MODE IS ACTIVATED, THE DDC CONTROLLER SHALL DRIVE THE AIRFLOW TO CONSTANT VOLUME AT MAXIMUM CFM, AND MODULATE THE REHEAT VALVE TO MAINTAIN SPACE TEMPERATURE SETPOINT.

NOTES:
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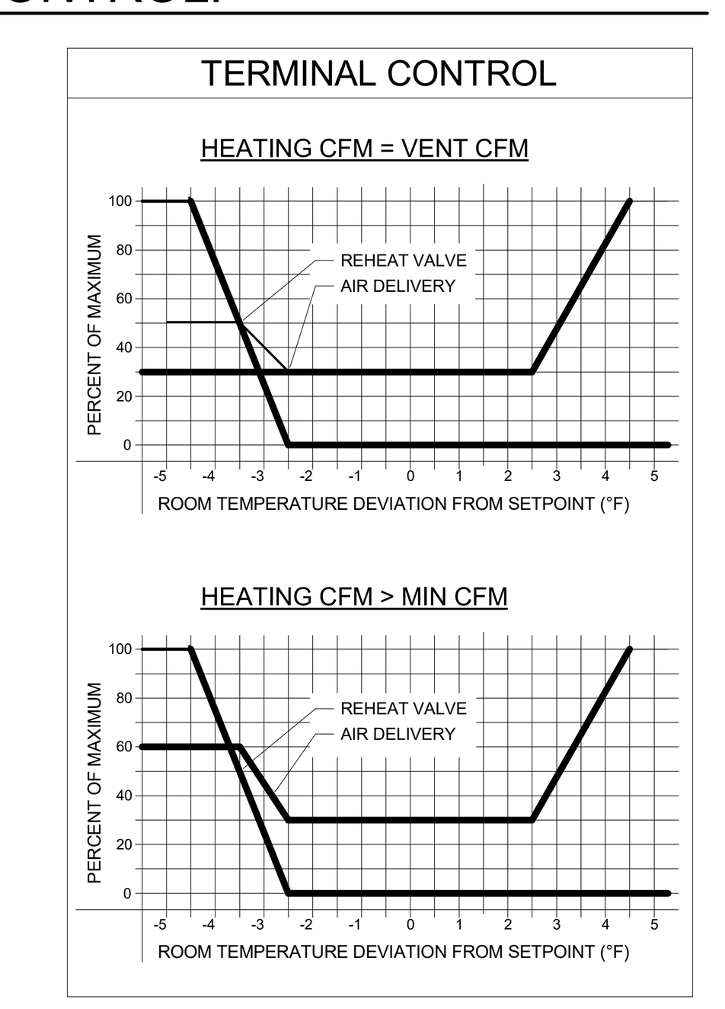
2. EACH TERMINAL BOX IS UNIQUE AND MAY HAVE REQ'MTS THAT VARY FROM THOSE DEPICTED ABOVE.
3. INCLUDE LOGIC TO OPERATE REHEAT VALVE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (I.E. 85°F MAX AT -2°F AND GREATER DEVIATION FROM SETPOINT)
4. REFER TO EQUIPMENT SCHEDULES FOR INITIAL AIR DELIVERY (CFM) SETTINGS.

THE SPACE MOUNTED TEMPERATURE SENSOR SHALL INCORPORATE A WARMER/COOLER ADJUSTMENT ALLOWING ZONE OCCUPANTS TO BIAS THE SPACE TEMPERATURE SETPOINT BY A FIXED AMOUNT IN EITHER DIRECTION.

FEATURES -
1. COOPERATION WITH NIGHT VENT COOLING, MORNING WARM-UP, DCV LOGIC, AND KITCHEN VENTILATION WHERE SPECIFIED IN RESPECTIVE SEQUENCES.
2. SPACE TEMPERATURE SHALL BE TRENDED HOURLY.
3. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
4. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.



TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 210
Edwards, CO 8132
(970) 766-1470
fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

Seal

STRAWBERRY PARK ELEMENTARY
39620 AMETHYST DRIVE
Steamboat Springs, CO

No	Revisions: Description	Date

Issue Dates:
PERMIT SET
04.06.2020

Sheet Title:
MECHANICAL DIAGRAMS

Project No:
10182.00

Sheet No:
M4.3

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Project No. 10182.00

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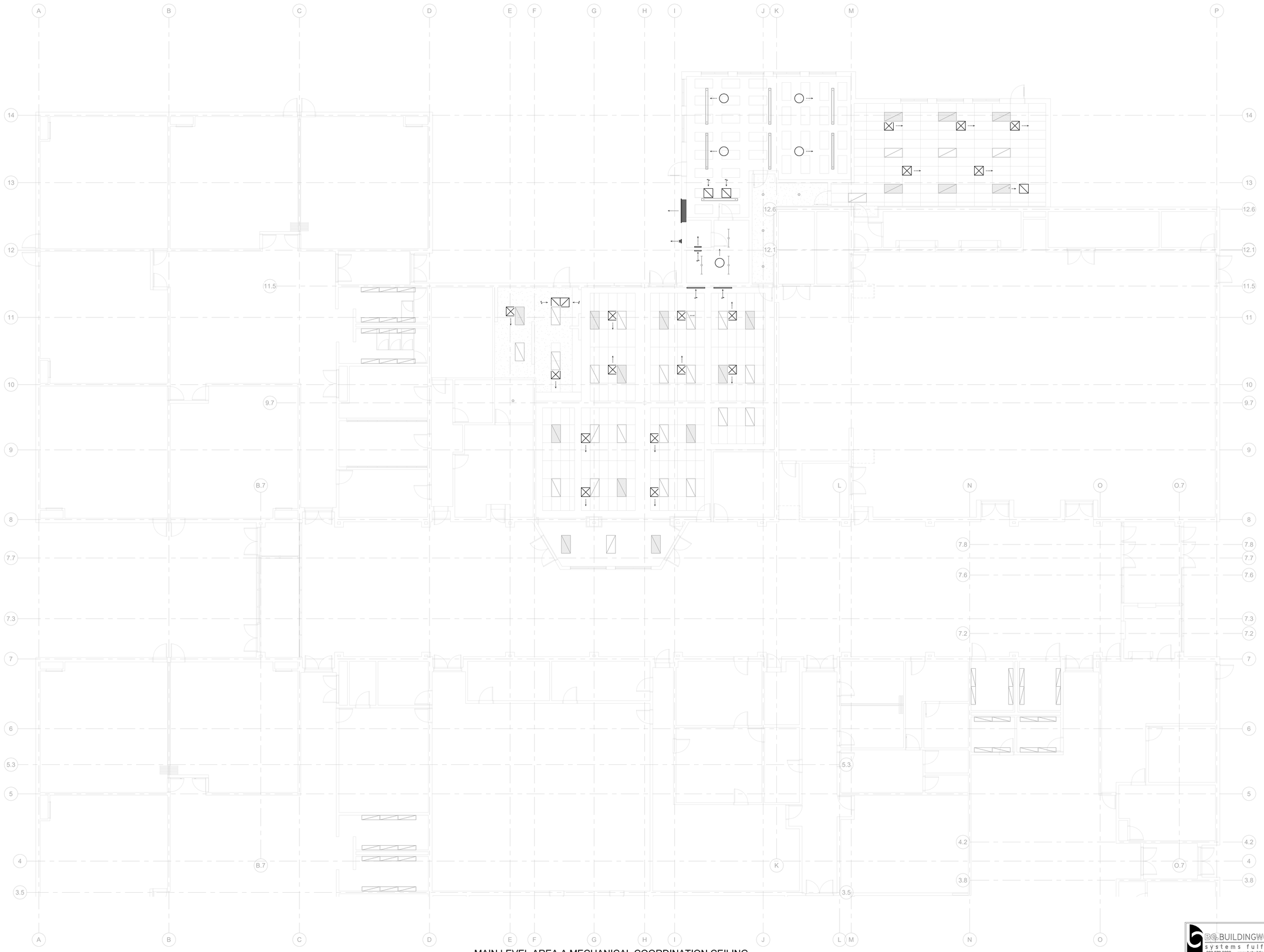

1 MAIN LEVEL AREA A MECHANICAL COORDINATION CEILING PLAN
SCALE: 1/8" = 1'-0"

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 210
Edwards, CO 8132
(970) 766-1470
fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

Seal

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Revisions:

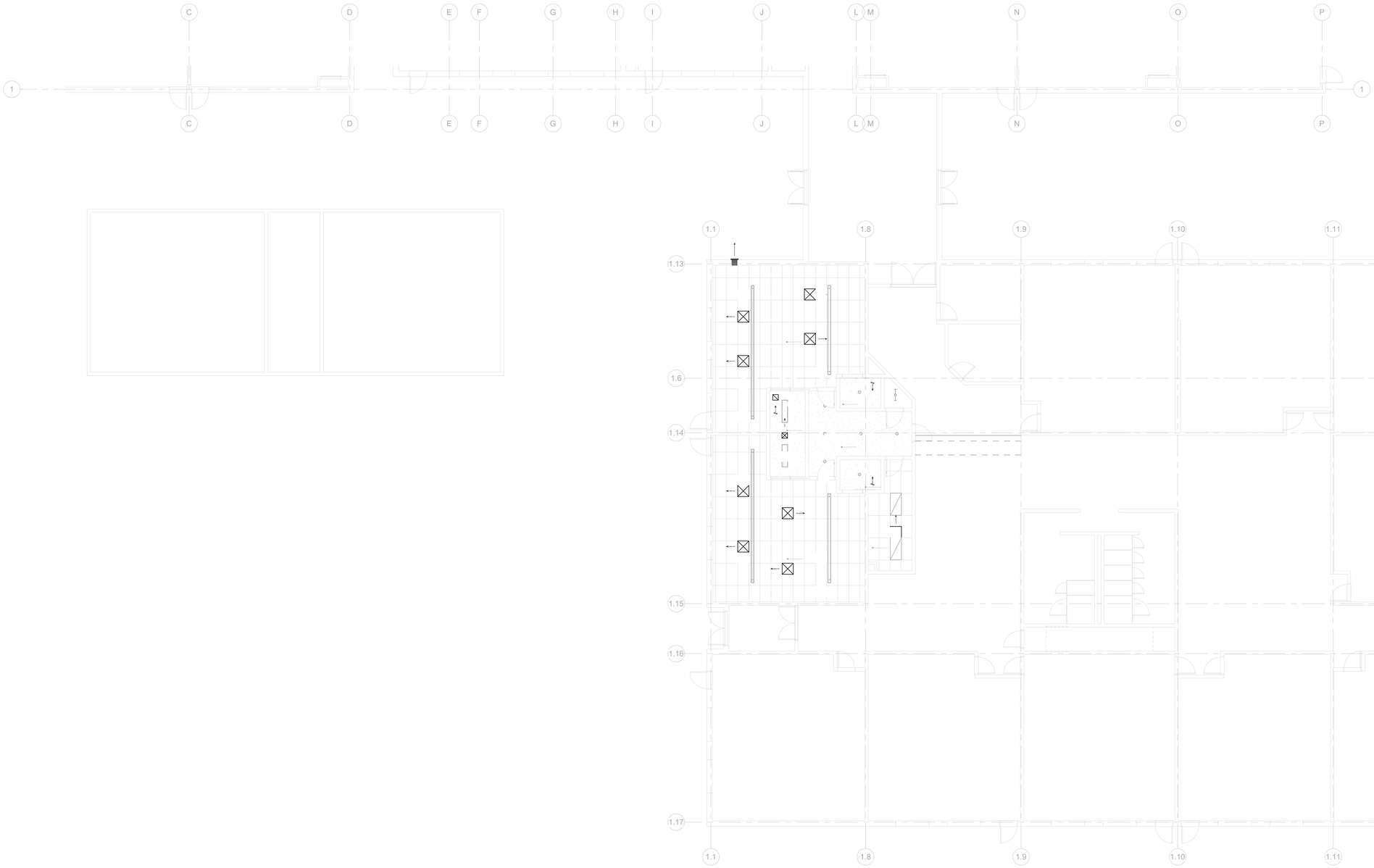
No	Description	Date

Issue Dates:
PERMIT SET
04.06.2020

Sheet Title:
MAIN LEVEL AREA A MECHANICAL COORDINATION CEILING PLAN

Project No:
10182.00

Sheet No:
MC2.1



PRE-K PLAN AREA B MECHANICAL COORDINATION CEILING PLAN

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

TAB Associates
The Architectural Balance
0056 Edwards Village Blvd.
Suite 310
Edwards, CO 8132
(970) 766-1470
fax: (970) 766-1471
email: tab@vail.net
www.tabassociates.com

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Revisions:

No	Description	Date

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PERMIT SET
04.06.2020

Sheet Title:
PRE-K PLAN AREA B MECHANICAL COORDINATION CEILING PLAN

Project No:
10182.00

Sheet No:
MC2.2

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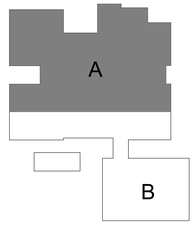
1 MAIN LEVEL AREA A DEMO MECHANICAL PLAN
SCALE: 1/8" = 1'-0"

DEMOLITION NOTES:

1. ADDITIONAL STORM, HYDRONIC, DOMESTIC, WASTE AND VENT PIPING MAY BE ROUTED IN SPACE THAT IS NOT REPRESENTED, BUT IS TO REMAIN. OTHER SYSTEMS MAY EXIST WITHIN THE SPACE THAT ARE NOT REPRESENTED ON THESE DRAWINGS; MODIFICATIONS TO THESE SYSTEMS ARE NOT ANTICIPATED.
2. FIELD VERIFY ALL COMPONENTS PRIOR TO DEMOLITION. THE INFORMATION ON THIS SHEET WAS OBTAINED, IN PART, FROM HISTORIC DESIGN DRAWINGS. ONLY PORTIONS OF THE SYSTEMS WERE ACCESSIBLE FOR VISUAL CONFIRMATION DURING DESIGN PROCESS.
3. PROVIDE PRELIMINARY TESTING OF EXISTING HYDRONIC SYSTEMS. MEASURE CURRENT FLUID FLOW RATE THROUGH ALL EXISTING COILS, RADIANT, AND SNOWMELT ZONES FOR THE CURRENTLY INSTALLED SYSTEMS. SUBMIT REPORT OF MEASURED VALUES TO ENGINEER FOR REVIEW AND CONFIRMATION OF SYSTEM DESIGN ASSUMPTIONS PRIOR TO DEMOLITION.
4. PROVIDE PRELIMINARY TESTING OF EXISTING HVAC DUCTWORK SYSTEMS. MEASURE CURRENT AIR FLOW RATES AT ALL EXISTING SUPPLY, RETURN, AND EXHAUST REGISTERS. MEASURE TOTAL AIR FLOWS AT MAIN DUCT BRANCHES AND ALL FAN SYSTEMS. SUBMIT REPORT OF MEASURED VALUES TO ENGINEER FOR REVIEW AND CONFIRMATION OF SYSTEM DESIGN ASSUMPTIONS PRIOR TO DEMOLITION.
5. (E) WASTE SYSTEM SERVING SPACE IS LOCATED IN THE CEILING OF THE SPACE BELOW.
6. REMOVE ALL MECHANICAL ITEMS INDICATED.
7. TEMPORARILY SEAL OR CAP PIPING TO BE RE-USED FOR LATER CONNECTION.
8. NOTIFY ENGINEER IMMEDIATELY OF ANY DISCREPANCIES OF INFORMATION REPRESENTED IN THE DOCUMENTS VERSUS WHAT IS FOUND IN THE FIELD.
9. COORDINATE PATCHING AND REPAIRS OF WALLS, CEILINGS AND FLOORS WITH ARCHITECT.
10. PATCH STRUCTURAL OPENINGS IN FLOORS, WALLS AND ROOFS THAT WERE PREVIOUSLY OCCUPIED BY SYSTEMS AND EQUIPMENT DEMOLISHED UNDER THIS CONTRACT IN ACCORDANCE WITH STRUCTURAL ENGINEER'S REQUIREMENTS.



KEY PLAN

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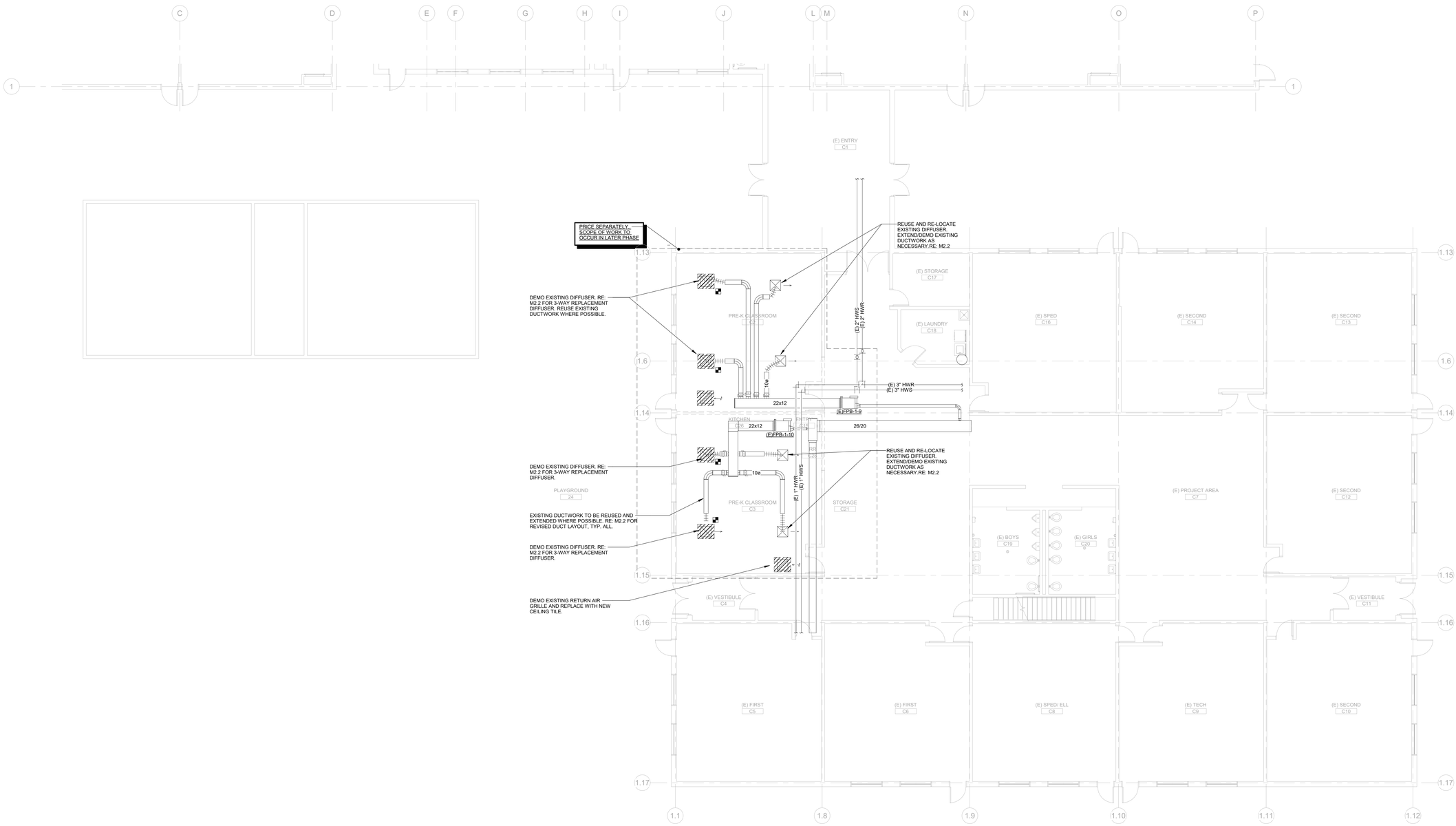
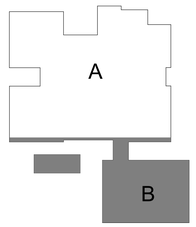


1 PRE-K PLAN AREA B DEMO MECHANICAL PLAN
SCALE: 1/8" = 1'-0"



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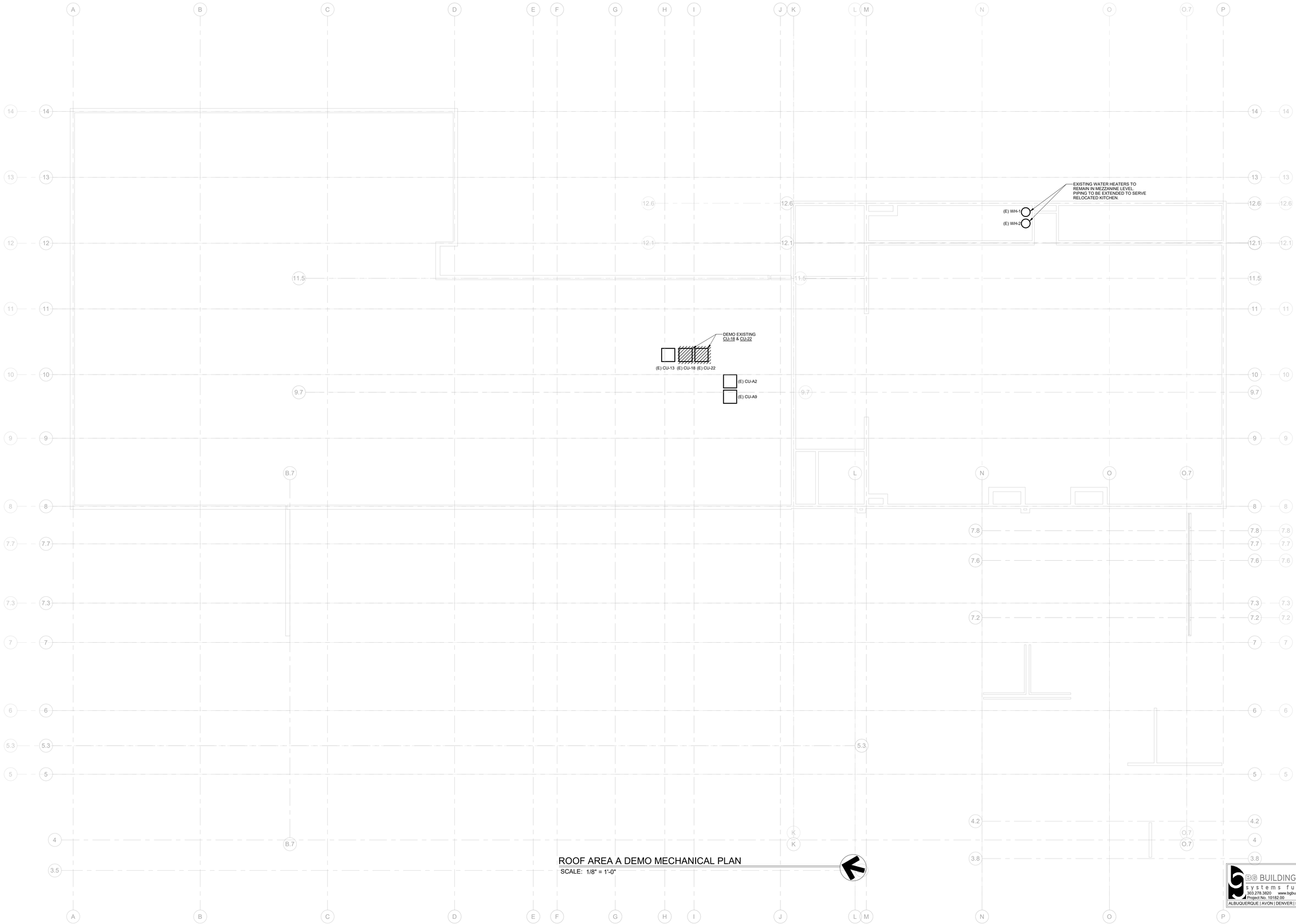

ROOF AREA A DEMO MECHANICAL PLAN

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

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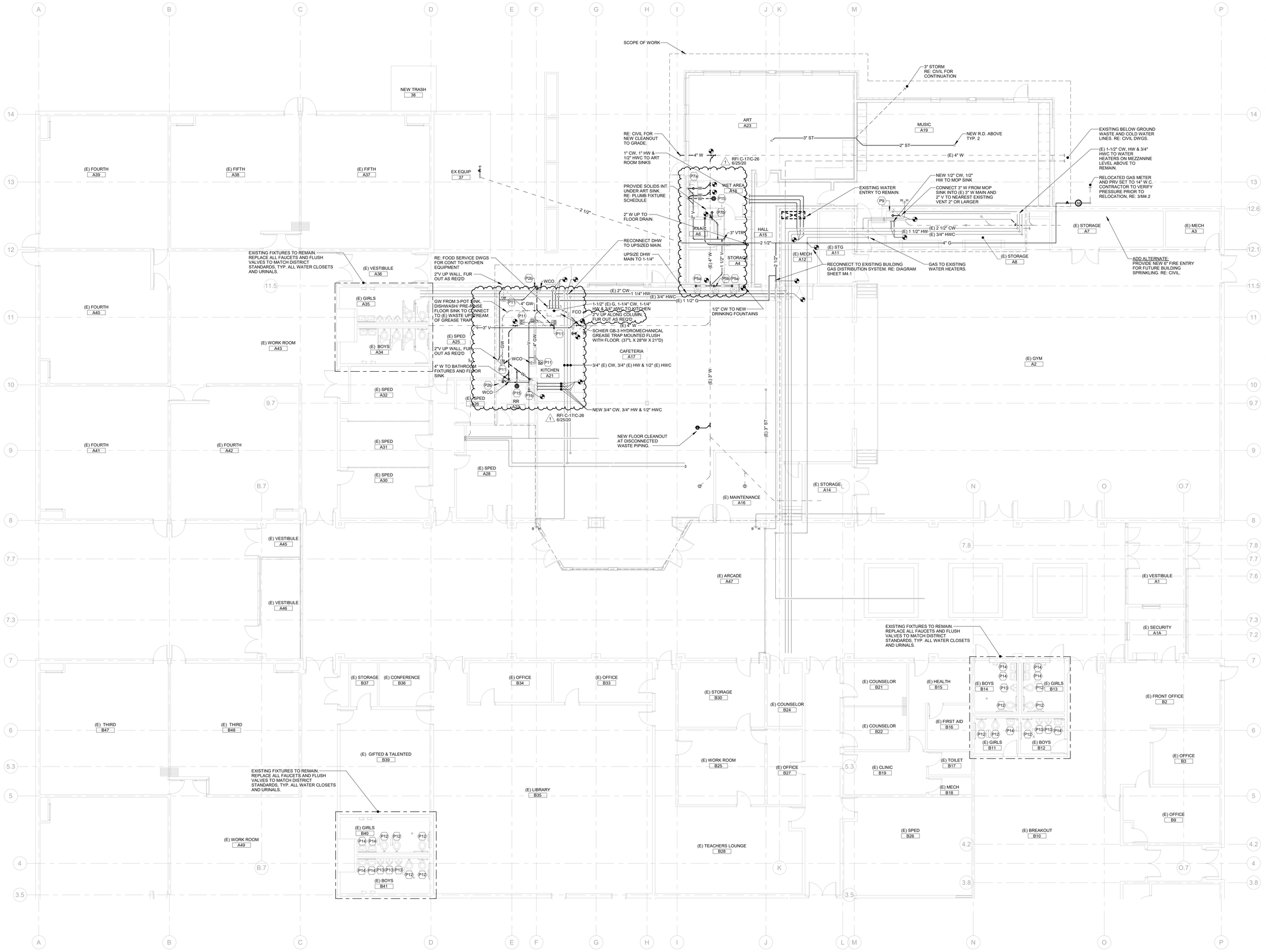

NOTES:

1. RE: _/M_ SERIES FOR MECHANICAL DIAGRAMS.
2. REFER TO THE PLUMBING FIXTURE CONNECTION SCHEDULE FOR PIPE SIZES TO INDIVIDUAL FIXTURES.
3. NOT ALL REQUIRED CLEANOUTS ARE NECESSARILY SHOWN ON THESE PLANS. PROVIDE CLEANOUTS ON WASTE, VENT AND STORM PIPING AS REQUIRED BY CODE AND FOR REASONABLE MAINTENANCE BASED ON ACTUAL FIELD INSTALLATION. COORDINATE LOCATIONS WITH ARCHITECT/ENGINEER.
4. COORDINATE ROUTING OF CONDENSATE DRAIN LINES WITH ARCHITECT PRIOR TO INSTALLATION.
5. PIPING ON EXTERIOR WALLS OR PRE-CAST CONCRETE WALLS TO BE ROUTED IN FRAMED WALL ON INTERIOR SIDE OF INSULATION.
6. ST AND ST(OF) PIPING 3", U.N.O.
7. INSTALL THERMOSTATIC MIXING VALVES, ASSE 1070 LISTED, AT EACH PUBLIC HANDWASHING LAVATORY/SINK. SIZE TO MATCH HW PIPE SIZE.
8. ROOF OVERFLOW DRAINAGE STRATEGY TO BE DETERMINED OR VIA ARCHITECTURAL SCUPPERS U.N.O.
9. TERMINATE PLUMBING VENTS NOT LESS THAN 12" ABOVE ROOF.
10. DO NOT ROUTE PIPING OVER ELECTRICAL ROOMS OR ELECTRICAL PANELS; MAINTAIN N.E.C. CLEARANCES. COORDINATE ROUTINGS WITH DIV. 16 CONTRACTOR.
11. CONTRACTOR TO MAINTAIN 6'-6" CLEAR HEAD HEIGHT IN GARAGE AND INFORM THE ENGINEER AND ARCHITECT OF ANY AREAS THAT MAY NOT MEET 6'-6" PRIOR TO INSTALLATION, MINIMUM 6'-2" CLEAR HEAD HEIGHT MUST BE MAINTAINED IN ACCESSIBLE VEHICLE AREAS.
12. PROVIDE FLEXIBLE PIPE CONNECTIONS TO ALL MOTORIZED EQUIPMENT.
13. ROUTE DOMESTIC HOT WATER RECIRC TO WITHIN 10 FEET OF ALL HOT WATER FIXTURES. CONNECT WITHIN 2 FEET OF PUBLIC LAVATORY FAUCETS.
14. VERIFY ALL EQUIPMENT ACCESS PANELS WITH MANUFACTURER AND ARCHITECT.
15. PROTECT PIPING ROUTED ALONG COLUMNS, WALLS, ETC. FROM DAMAGE AS NECESSARY WITH GAGES. COORDINATE WITH ARCHITECT.
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19. ACCESS PANELS SHALL BE 24x24, U.N.O. LOCATIONS SHOWN ARE APPROXIMATE, EXACT LOCATIONS SHALL BE COORDINATED WITH THE ARCHITECTS DRAWINGS AND WITH THE LOCATIONS OF THE EQUIPMENT OR APPARATUS THAT THEY SERVE.
20. SEAL ALL PIPING PENETRATIONS THROUGH ACOUSTIC PARTITIONS.
21. EXPOSED SOIL OR WASTE PIPING SHALL NOT BE INSTALLED ABOVE ANY WORKING, STORAGE, OR EATING SURFACES IN FOOD SERVICE ESTABLISHMENTS.

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Sheet Title:
MAIN LEVEL AREA A PLUMBING PLAN

Project No:
10182.00

Sheet No:
MP2.1

MAIN LEVEL AREA A PLUMBING PLAN
SCALE: 1/8" = 1'-0"

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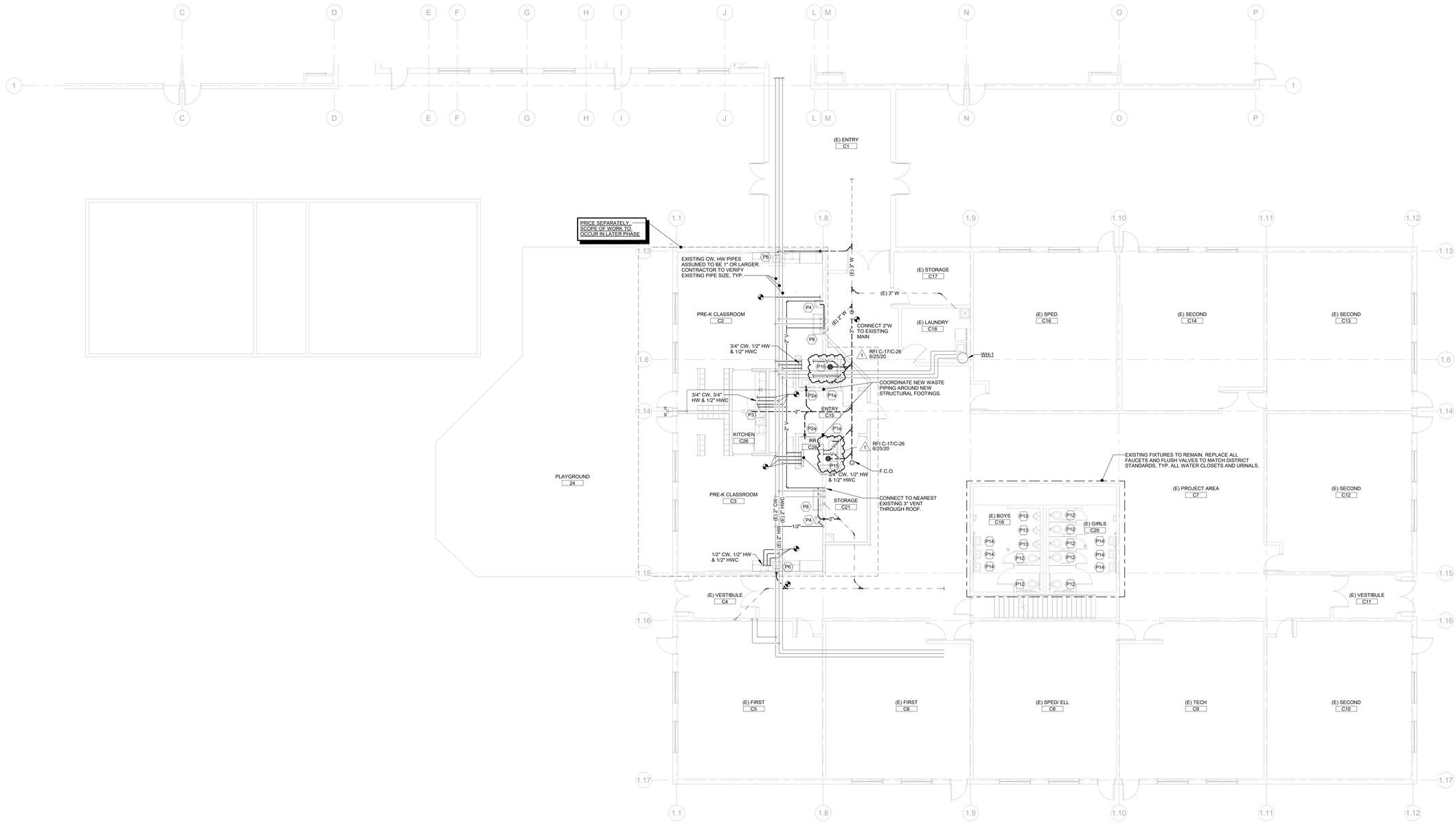

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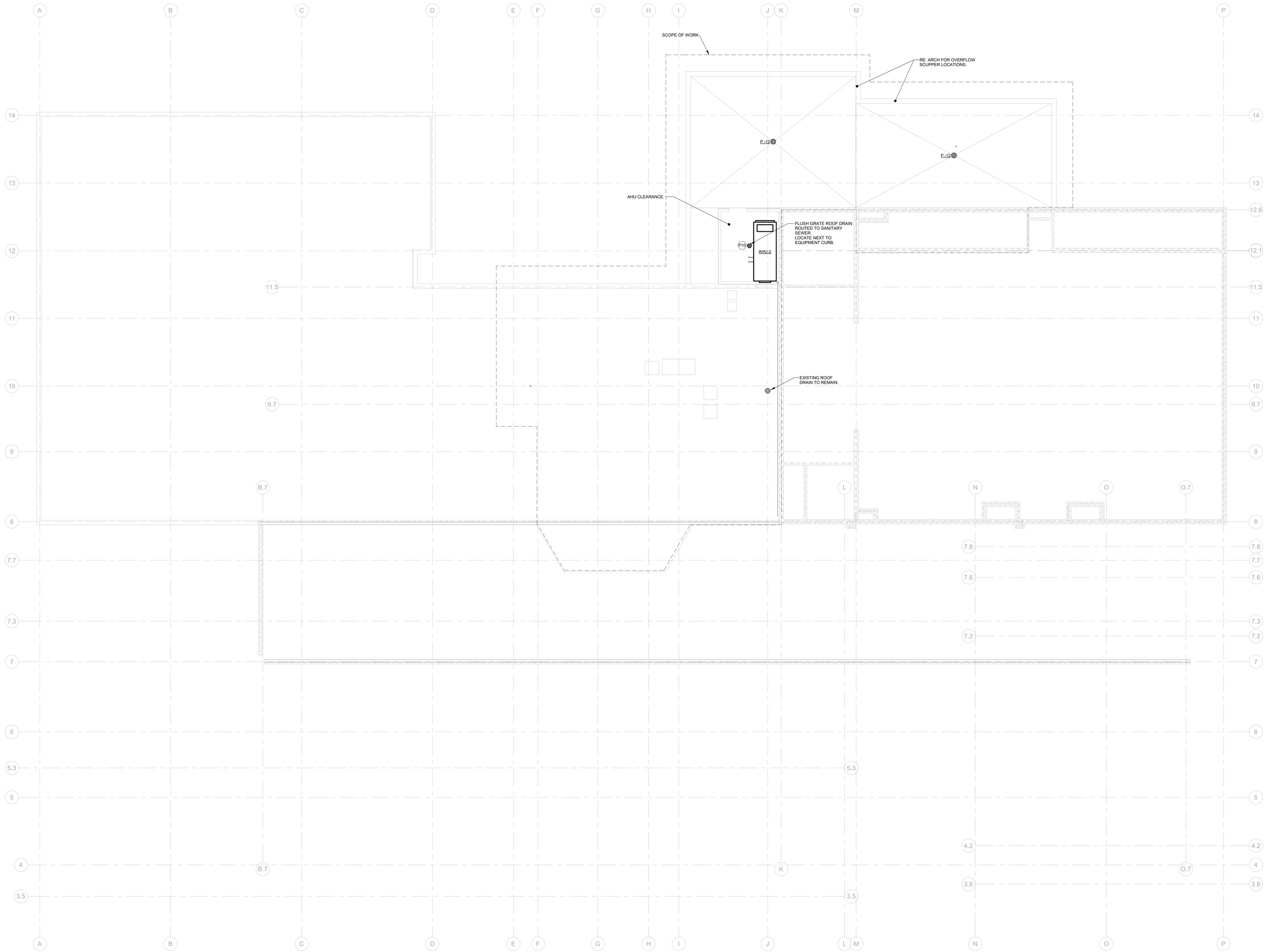

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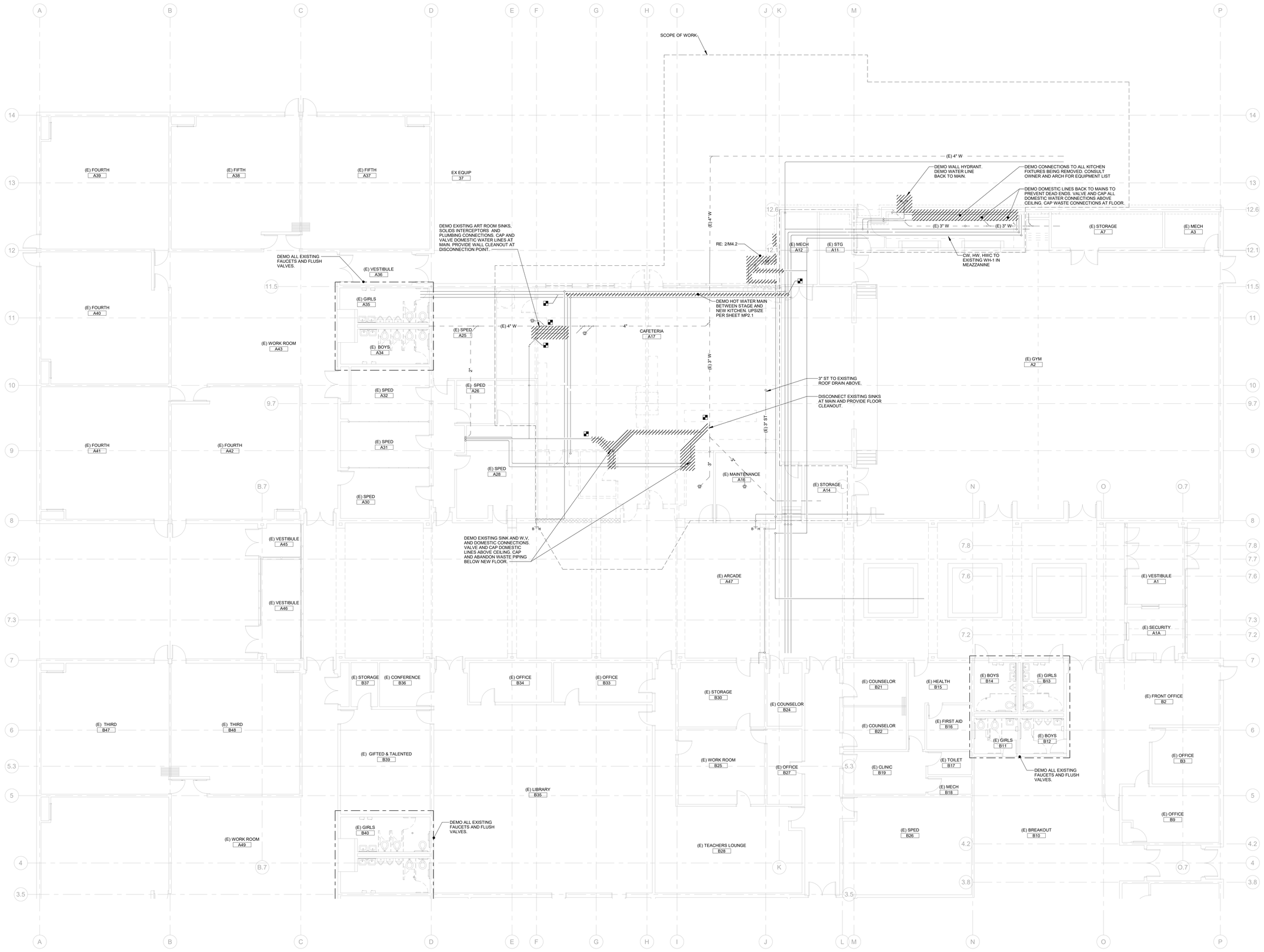

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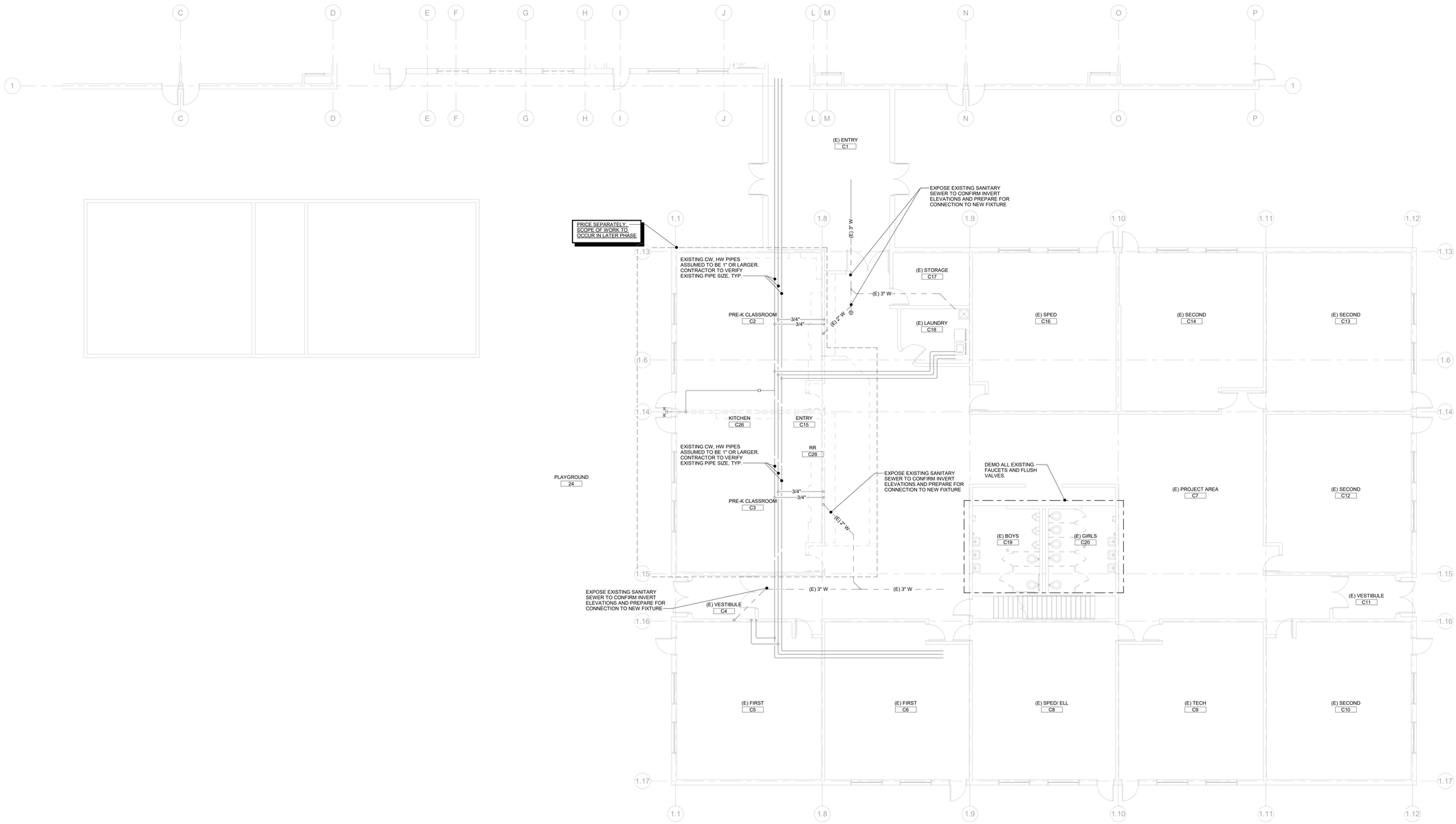

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Tab 9:
Commissioning Observation Report

COMMISSIONING AGENT'S FIELD REPORT

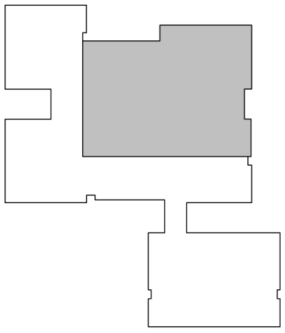
Project: Steamboat Springs SD RE-2 – Strawberry Park ES	**Field Report #: 1**	**PCD Project #:** 20004
Address: 39620 Amethyst Drive, Steamboat Springs, CO 80487	**Date:** September 24, 2020	
Weather: Sunny	**Time:** 11:30 am to 1:00 pm	
Temp: 80°F	**RH:** -	
Conformance with Schedule: N/A	**% Complete:** N/A	
Report By: Alan Niemeyer	**Reviewed By:** Peter D'Antonio	

WORK IN PROGRESS

1. The new construction exterior walls and roof are in place for the Art and Music Classrooms.

2. The main and branch ductwork has been installed in the Art and Music Classrooms, as well as the Cafeteria area.

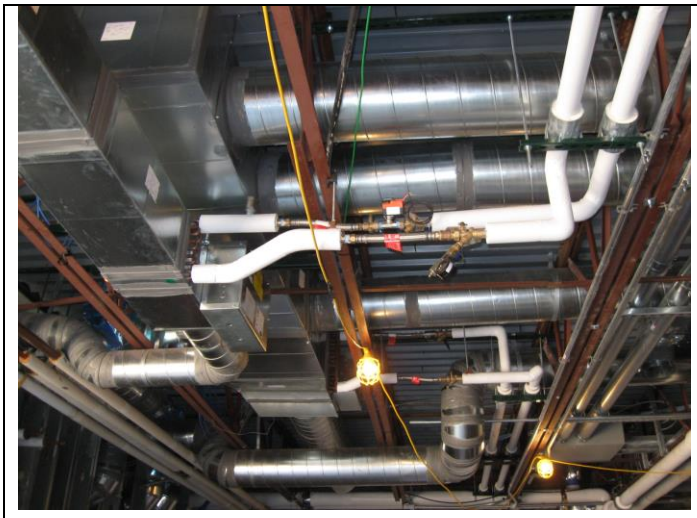
   The kitchen area build-out is in-progress.



Building Addition: Music Classroom

Music Classroom: Main and Branch Ductwork Installed

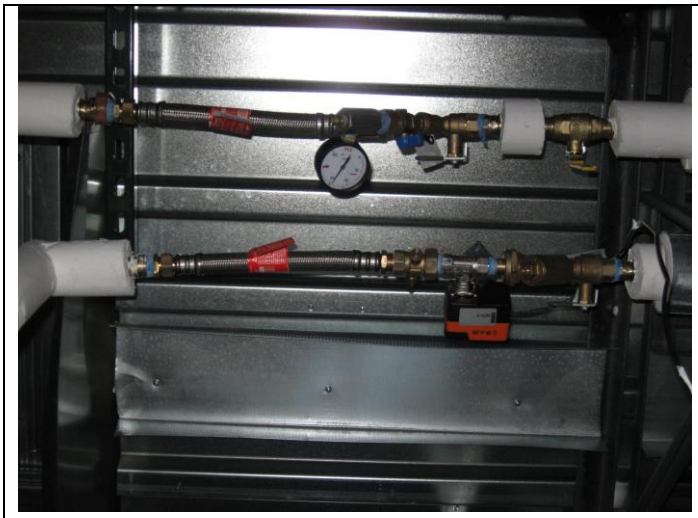
3. The variable air volume (VAV) boxes have been installed and the HW reheat coil piping has been completed. The HW coil piping installations were reviewed and no commissioning issues were observed. The following photos show typical VAV box installations with HW reheat coils.



VAV-01 Installation

VAV-02 Installation

4. The HW piping pressure testing was underway and pressure gauges were observed at two locations. The following photos show a piping pressure test gauge on the branch piping to a VAV box.



Piping Pressure Test Gauge on VAV Branch HW Piping

Piping Pressure Test Gauge

5. AHU-2 has been set in place on the roof and inside the penthouse. The matching DX condensing unit, CU-1, has also been set in place on the roof. Both units are ready for piping connections / installations. The following photos show the AHU-2 and CU-1 installations.

	
AHU-2 Installation	CU-1 Installation

PRESENT AT SITE

1. R&H Mechanical: Louis Cozalter – Supervisor
2. R&H Mechanical: Pipefitter Foreman
3. PCD Engineering: Alan Niemeyer

INFORMATION OR ACTION REQUIRED

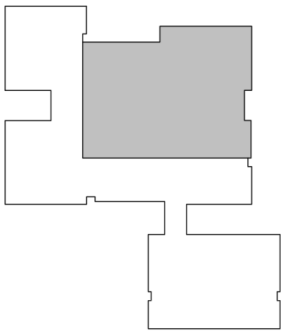
1. None

Cc: File

COMMISSIONING AGENT'S FIELD REPORT

Project: Steamboat Springs SD RE-2 – Strawberry Park ES	**Field Report #: 2**	**PCD Project #:** 20004
Address: 39620 Amethyst Drive, Steamboat Springs, CO 80487	**Date:** November 5, 2020	
Weather: Sunny	**Time:** 10:30 am to 12:00 pm	
Temp: 65°F	**RH:** -	
Conformance with Schedule: Yes	**% Complete:** N/A	
Report By: Alan Niemeyer	**Reviewed By:** Peter D'Antonio	

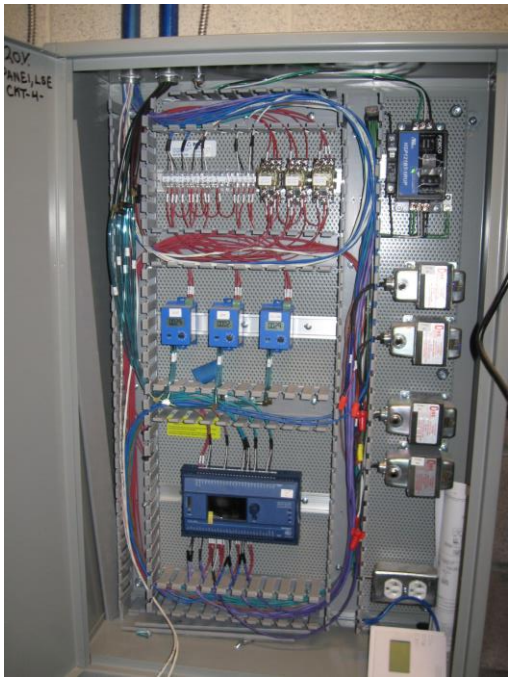
WORK IN PROGRESS



1. The start-up for AHU-2 and CU-1 was completed on 11/4/20 and the start-up report will be available soon.

2. The Test, Adjust, and Balancing (TAB) work was underway for AHU-2 and the five VAV terminal boxes for the air and water balancing.

3. The HVAC system BAS controls were being checked out and configured by LONG Building Intelligence. The new AHU BAS controller was not operating correctly and was contributing to a control system communication truck failure. The AHU controller was in the process of being replaced. The following photos show the new BAS control panel and the new JACE controller for supervisory control of control devices.

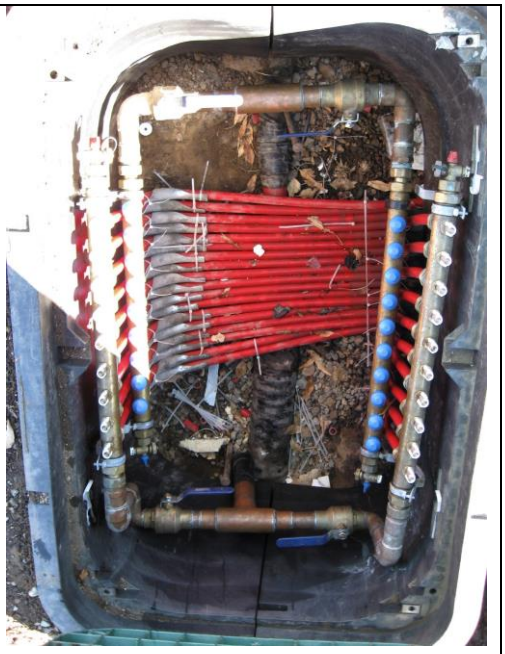


New BAS Control Panel with AHU Controller

New JACE Controller with Niagara

4. The new snowmelt area on the north side of the school has been completed and is connected to the existing snowmelt boiler, SB-3. In discussion with the installing contractor, the existing snowmelt boiler is currently not operable. The snowmelt boiler requires service and repair (currently underway) to bring it online to provide snow melting. The following photos show SB-3 and the snowmelt manifold box for this area.

Existing Snowmelt Boiler – SB-3 serving New Snowmelt Area



Snowmelt Manifold Box with Two Manifolds

PRESENT AT SITE

1. Haselden: Jason Luna; Ian Grams
2. R&H Mechanical: John Dietrich
3. LONG Building Intelligence: Steve Tanner
4. PCD Engineering: Alan Niemeyer

INFORMATION OR ACTION REQUIRED

1. None

Cc: File

Tab 10:
O&M Manual Review

R & H MECHANICAL

"People & Products You Can Count On"

Strawberry Park Elementary School

Mechanical and plumbing renovation

40138 Strawberry Park Rd, Steamboat Springs CO

Operation & Maintenance Manual

Date:12/17/2020

1119 Chambers Ave. / P.O. Box 810, Eagle, Colorado 81631
Phone: 970-328-2699 / Fax: 970-328-0234 / Email: info@randhmechanical.com
Website: www.randhmechanical.com

R & H MECHANICAL

"People & Products You Can Count On"

Strawberry Park Elementary School

Mechanical and plumbing renovation

40138 Strawberry Park Rd,
Steamboat Springs CO

Operation & Maintenance Manual

Reviewed O&M Manual for Equipment Commissioned: AHU, VAV Air Terminal Units, HVAC Control Devices; Exhaust Fans.
PCD: No Exceptions Taken

1119 Chambers Ave. / P.O. Box 810, Eagle, Colorado 81631
Phone: 970-328-2699 / Fax: 970-328-0234 / Email: info@randhmechanical.com
Website: www.randhmechanical.com

Acuity Controls Submittal Package

Strawberry Park Elementary

Steamboat Springs, CO

ABC Project # 134479

5/6/2020

Reviewed O&M Manual for Equipment
Commissioned: Lighting Controls
PCD: No Exceptions Taken

Table Of Contents

5/6/2020

Job Name: Strawberry Park Elementary

Location: Steamboat Springs, CO

CONNECT Solutions Group

Preprogrammed Lighting Control

CONNECT Solutions Group and **The Lighting Agency** are excited to present **Preprogrammed Lighting Control Systems**, custom built and assembled for your specific project

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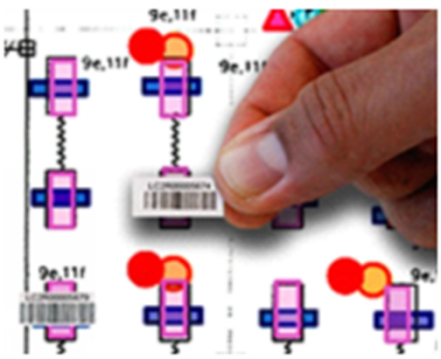
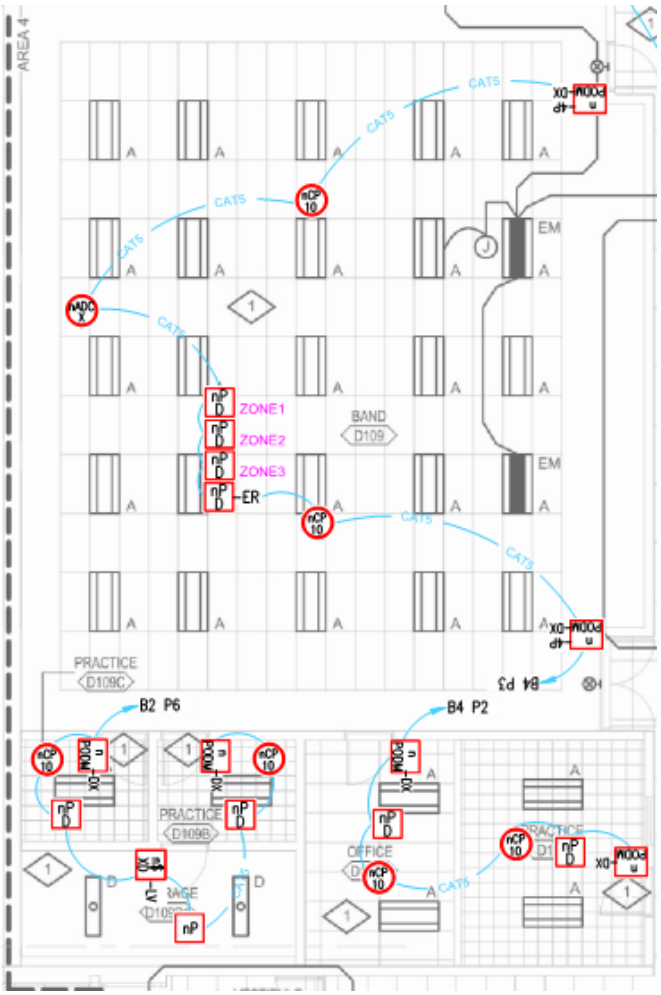
- Designers
- Contractors
- Distributors
- End Users

Get the most out of your lighting control system

Eliminate many of the known industry pitfalls associated with lighting control





CONNECT SOLUTIONS GROUP LLC
Phone: 303.455.1012
Fax: 303.458.8247
146 Yuma St, Denver, CO 80223

The Lighting Agency

Connect Solutions Group

Pre-Programmed Lighting Control Systems

Acceptance Criteria

- **The Control Purchase Order must be placed 6-8 weeks prior to needing material on-site for install (timeline dependent on job size and complexity).**
  - **Beginning Install Date Required _____**
-
- **All materials must be originally ordered with CSG as the Ship to address:**
  - **Connect Solutions Group 146 Yuma St, Denver, CO 80223**

- **Contractor will be notified when materials are ready for final delivery. The below address is where the E.C. will need the PROGRAMMED material to be delivered**
- **Final Material Delivery Address: _____**
  _____

- **E.C. Site Contact: _____**
- **E.C. Site Contact Phone/Email: _____**
- **E.C. Project Manager Contact: _____**
- **E.C. Project Manager Phone/Email: _____**
- **Will you require a full sized, plotted copy of the As-Programmed Dwgs (Y/N): ___**
- **Contractor PO#: _____**
- **Special Instructions: _____**
  _____

Pre-Programmed Solutions include:

- **Fully tested, "programmed and digitally labeled" devices packaged in cartons labeled for the room/area where they are to be installed**
- **Inventory verification of received and shipped orders.**
- **An Electronic pdf copy of the shop drawings with documented device bar-code ID stickers will be provided. See above if a plotted copy is needed.**
- **Instant R/A for defective materials discovered during Pre-Programming**

Contractor Representative Signature

_____Date_____

For on-site tech startup support (when required) please contact;
service@connectsolutionsgroup.com

Tab 11:
Commissioning Meeting Minutes

Project: SSSD Soda Creek ES / Strawberry Park ES / Steamboat Springs MS

Meeting: Construction Phase – Commissioning (Cx) Kickoff Meeting

Meeting Minutes from: 9/24/2020, 10:00 AM to 11:30 AM - Cx Kickoff Meeting

Facilitator: Alan Niemeyer

Attendees:

AN Alan Niemeyer, Commissioning PM, PCD Engineering
TR Todd Raper, Owner's Representative PM, Dynamic Project Management
SL Sarah Lara, Owner's Representative Sr. PM, Dynamic Project Management
RH Rachel Hill, Project Manager – Soda Creek ES, TAB Associates, Inc.
WH Warner Hopkins, Project Manager – SPES and SSMS, TAB Associates, Inc.
CW Chance Warren, Superintendent, Haselden Construction, LLC
MC Mike Concordia, Project Engineer - SCES, Haselden Construction, LLC
IG Ian Grams, Project Engineer – SPES and SSMS, Haselden Construction, LLC
JD John Dietrich, Project Manager, R&H Mechanical
JG Jed Gibson, Project Manager, Central Electric, LLC
GC Greg Custer, Controls Specialist, LONG Building Technologies

CC'd: **RO** Reilly O'Brien, Owner's Rep PM, Dynamic Project Management
CK Colleen Kaneda, Owner's Rep Project Director, Dynamic PM
TS Tony Soddy, Superintendent, Haselden Construction, LLC
JL Jason Luna, Superintendent, Haselden Construction, LLC
PD Peter D'Antonio, President, PCD Engineering

NOTE: The following notes reflect our perception of discussions at the above-mentioned conference. In the event you believe we have misinterpreted a discussion, please inform us. If we do not receive any comments within seven calendar days, we will assume the following statements accurately reflect issues and directions to be followed. These conference notes are not complete minutes of the meeting. They are only intended to reflect issues related to contracted and/or proposed work of PCD Engineering.

SUBJECT:	ACTION BY:
1. The project team members introduced themselves.	None required.
2. The Cx Plans for Soda Creek ES, Strawberry Park ES, and Steamboat Springs MS were presented by AN to the project team. The General Building Information was reviewed. AN will update the Scheduled Completion Dates for Strawberry Park ES to November 19, 2020 and for Steamboat Springs MS to November 13, 2020.	AN
3. An overview of the Cx Plan purpose, goals, objectives, and scope was provided by AN.	None required.
4. The systems and equipment to be commissioned were discussed. The equipment and systems include: Soda Creek ES – FCU-1 through -6 with remote CUs; exhaust fans EF-1, -2, and -3; Snowmelt System with circ pump, HXer, and controls; electric DHW heater and circ pump; ceiling and wall lighting occupancy sensors; daylighting photocell controls; and exterior lighting photocell sensor controls. Strawberry Park ES – AHU-2 with remote CU; VAV boxes; exhaust fans EF-1, -2, -3, and -4 for Art Classroom, restrooms, and kiln room; kitchen hood exhaust, KEF-1; dishwasher hood exhaust, KEF-2, two (E) fan powered (FP) VAV boxes; and (E) Snowmelt Boiler-3 – addition of new snow-melted area (5,015 SF); ceiling and wall lighting occupancy sensors; and daylighting photocell controls. Steamboat Springs MS – (E) RTU-1 – new SF motor; VAV boxes; restroom exhaust fan, EF-1; dishwasher hood exhaust, KEF-1; kitchen hood exhaust, KEF-2; laboratory fume hoods, FH-1 and FH-2; (E) Snowmelt Boiler-1 – addition of new snow-melted area (2,200 SF); ceiling and wall lighting occupancy sensors; daylighting photocell controls; and exterior lighting photocell sensor controls. AN will update the systems / equipment to be commissioned per the meeting discussion.	AN
5. The commissioning team information was reviewed. The updated contact information for RH with TAB Associates will be input for SCES. The personnel for R&H Mechanical and Central Electric will updated. The TAB Contractor, Certified Balance, will be added to the Cx plans.	AN

SUBJECT:	ACTION BY:
6. The roles and responsibilities for the commissioning process were presented by AN, including protocols for issue resolution. For notifying installing contractors of Cx deficiencies, AN will upload the Cx issues to each project's ProCore web-based site. Notification will be sent out to the pertinent project team members. Any changes required for the project must be approved by the SSSD project manager and the A/E team, as applicable.	None required.
7. The commissioning process for the construction phase was discussed, including Cx meetings, site observations, pre-functional checklists, and functional test procedures. The log of Cx issues will be maintained on the ProCore sites for each project to track deficiencies and to record recommended actions and resolutions. The commissioning site observations will also be recorded and tracked on the ProCore sites.	None required.
8. The prefunctional checklists (PFCs) were discussed. The PFCs provide a list of pre-startup and post-startup items to be checked off by the installing contractors. The PFCs will be developed by PCD for the equipment to be commissioned and electronic copies of the PFCs (in PDF format) will be sent to Haselden. The PFCs will be posted to the ProCore sites for each project. AN will provide the PFCs and send out by 10/02/20.	AN, Haselden
9. A sample of a functional performance test (FPT) script was reviewed. AN will provide the FPTs to the project team for the systems being commissioned. The FPTs will be posted to the ProCore sites for each project.	AN, Haselden
10. The commissioning meetings will be held as required to coordinate the commissioning work. The site observations are commensurate with the equipment / systems installation progress.	None required.
11. The owner's training and O&M manuals were briefly discussed. The owner's training will be videotaped by the contractors providing the training. PCD will review the O&M manuals for the equipment / systems being commissioned and will provide comments.	None required.
12. The commissioning process for the warranty phase was discussed. The warranty phase will include tracking deficiencies, resolution of outstanding issues, and end-of-warranty site observations and report.	None required.

SUBJECT:	ACTION BY:
13. The Cx Schedule was discussed. The start dates for commissioning site activities are commensurate with the overall project schedule. AN provided an overview of the commissioning process sequence and priority. The prefunctional checklists need to be completed prior to equipment start-ups, followed by the completion of the TAB work; PFCs and TAB need to be completed prior to the start of Cx functional testing.	None required.
14. Cx Schedule - Warranty Phase is 12 months after substantial completion and will include tracking Cx deficiencies to resolution, plus a 10th-month site observations and report.	None required.
15. The construction phase Cx kickoff meeting was adjourned.	None required.

Tab 12:
Commissioning Correspondence

Alan Niemeyer

From: Mike Concordia <MikeConcordia@haselden.com>
Sent: Tuesday, September 15, 2020 11:28 AM
To: Rachel Hill; Reilly O'Brien; Alan Niemeyer; Ian Grams
Cc: Todd Raper; Colleen Kaneda; Sarah Lara; pginesta@ssk12.org; Greg Macik; Warner Hopkins; Ivan Gonzalez
Subject: RE: SSSD - Cx Kickoff Combined-Meeting for SCES - SPES - SSMS

Great, thank you. I will provide a call-in link for those who cannot attend in person.

Best,
Mike

Mike Concordia
Project Engineer
Haselden Construction
MikeConcordia@haselden.com
720-603-2923

From: Rachel Hill <rachel@tabassociates.com>
Sent: Tuesday, September 15, 2020 11:06 AM
To: Mike Concordia <MikeConcordia@haselden.com>; Reilly O'Brien <reilly.obrien@dynamicpm.co>; Alan Niemeyer <alan@pcdengineering.com>; Ian Grams <IanGrams@haselden.com>
Cc: Todd Raper <todd.raper@dynamicpm.co>; Colleen Kaneda <colleen.kaneda@dynamicpm.co>; Sarah Lara <sarah.lara@dynamicpm.co>; pginesta@ssk12.org; Greg Macik <greg@tabassociates.com>; Warner Hopkins <warner@tabassociates.com>; Ivan Gonzalez <ivan@tabassociates.com>
Subject: RE: SSSD - Cx Kickoff Combined-Meeting for SCES - SPES - SSMS

I would be available for a call in meeting. But I am not available to be on site that day. However, I know Ivan or Warner is available to attend in person.

Attachments: None

TAB Associates, Inc.
The Architectural Balance

Rachel Hill
Project Manager

56 Edwards Village Blvd.
Suite 210
Edwards, CO 81632
(970) 766-1470 x110
(970) 766-1471 fax
rachel@tabassociates.com
www.tabassociates.com

From: Mike Concordia <MikeConcordia@haselden.com>
Sent: Tuesday, September 15, 2020 9:11 AM

To: Reilly O'Brien <reilly.obrien@dynamicpm.co>; Alan Niemeyer <alan@pcdengineering.com>; Ian Grams <IanGrams@haselden.com>
Cc: Todd Raper <todd.raper@dynamicpm.co>; Colleen Kaneda <colleen.kaneda@dynamicpm.co>; Sarah Lara <sarah.lara@dynamicpm.co>; pginesta@ssk12.org; Greg Macik <greg@tabassociates.com>; Warner Hopkins <warner@tabassociates.com>; Rachel Hill <rachel@tabassociates.com>; Ivan Gonzalez <ivan@tabassociates.com>
Subject: RE: SSSD - Cx Kickoff Combined-Meeting for SCES - SPES - SSMS

Reilly,

Please let me know if we need to move the meeting to accommodate DPM's schedule.

TAB – Please let me know what works best for your schedule as well.

Best,
Mike

Mike Concordia
Project Engineer
Haselden Construction
MikeConcordia@haselden.com
720-603-2923

From: Reilly O'Brien <reilly.obrien@dynamicpm.co>
Sent: Tuesday, September 15, 2020 8:52 AM
To: Mike Concordia <MikeConcordia@haselden.com>; Alan Niemeyer <alan@pcdengineering.com>; Ian Grams <IanGrams@haselden.com>
Cc: Todd Raper <todd.raper@dynamicpm.co>; Colleen Kaneda <colleen.kaneda@dynamicpm.co>; Sarah Lara <sarah.lara@dynamicpm.co>; pginesta@ssk12.org; Greg Macik <greg@tabassociates.com>; Warner Hopkins <warner@tabassociates.com>; Rachel Hill <rachel@tabassociates.com>; Ivan Gonzalez <ivan@tabassociates.com>
Subject: RE: SSSD - Cx Kickoff Combined-Meeting for SCES - SPES - SSMS

Mike and Alan,

I'll be available to join the 8:45 for 7th St, but will need to run for the 10 am for the other schools. ***Todd,*** are you available on 9/24 at 8:45 and 10 for the Cx Kickoff meetings?

Thanks,

Reilly O'Brien, Project Manager
Dynamic Program Management
303.775.5051 | reilly.obrien@dynamicpm.co

From: Mike Concordia <MikeConcordia@haselden.com>
Sent: Tuesday, September 15, 2020 7:26 AM
To: Alan Niemeyer <alan@pcdengineering.com>; Ian Grams <IanGrams@haselden.com>
Cc: Reilly O'Brien <reilly.obrien@dynamicpm.co>
Subject: RE: SSSD - Cx Kickoff Combined-Meeting for SCES - SPES - SSMS

Alan,

Thank you for your email. I will send out an invitation today for the two Cx kickoff meetings. Let's shoot for both meetings on the morning of September 24th. The meeting at 10:00am for the three larger schools will be held at Strawberry Park Elementary. The 7th Street meeting will be held at 8:45pm at the 7th Street campus giving us a little extra time to get between meetings.

Please find the addresses below:

Strawberry Park
39620 Amethyst Dr.
Steamboat Springs, CO 80487

7th Street (YVHS)
325 7th Street
Steamboat Springs, CO 80487

Best,
Mike

Mike Concordia
Project Engineer
Office: 720-603-2923
MikeConcordia@haselden.com

From: Alan Niemeyer <alan@pcdengineering.com>
Sent: Monday, September 14, 2020 6:04 PM
To: Ian Grams <IanGrams@haselden.com>; Mike Concordia <MikeConcordia@haselden.com>
Cc: Reilly O'Brien <reilly.obrien@dynamicpm.co>
Subject: SSSD - Cx Kickoff Combined-Meeting for SCES - SPES - SSMS

Ian / Mike,

I'm sending you the commissioning (Cx) kickoff meeting agenda for the combined meeting for Soda Creek, Strawberry Park, and SS Middle School (see attached).
Also attached are the Cx Plans for each school and three sample documents (prefunctional checklist, functional performance test, and Cx Issues Log).

Per our discussion last week, combining the Cx kickoff meetings for the three schools into one meeting would work well, as the same installing contractors are working on all three schools.
Please send out a meeting invite with the attached agenda, Cx Plans, and sample documents. Please include a video conference link or meeting call-in info for those who can't be onsite for the meeting. We discussed scheduling this meeting for Sept. 24th starting at 10:00 am. I estimate the meeting will be about 1.5 hours.
If the 10 am time slot doesn't work, we could schedule the meeting for the afternoon.

Typically, the mechanical / plumbing, electrical, and controls contractors should be invited to attend this meeting. Also, please invite the owner and owner's representative.

Mike – per our discussion about the 7th Street Campus – Cx Kickoff meeting, I would like to schedule that meeting for the Sept. 24th as well. We were looking at a 9:00 am start time for the meeting.
Let me know the onsite location for the 7th Street Campus Cx Kickoff meeting. I'll update the meeting agenda and send out the Cx Plan and documents to be included in the invite for that Cx Kickoff Meeting.

Thanks, Alan

pcd ENGINEERING
ALAN NIEMEYER, CEM, BCxP
Senior Energy &
Commissioning Engineer

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P: 303-678-1108 x702
M: 303-910-1193
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Alan Niemeyer

From: Alan Niemeyer
Sent: Thursday, October 1, 2020 3:22 PM
To: 'Todd Raper'; Sarah Lara; 'Rachel Hill'; 'Warner Hopkins'; Chance Warren; 'Mike Concordia'; 'iangrams@haselden.com'; John Dietrich; Jed Gibson; Gregory Custer (gcuster@long.com)
Cc: 'Reilly O'Brien'; 'Colleen Kaneda'; Tony Soddy; Jason Luna; James Eschelbach
Subject: SSSD SCES / SPES / SSMS - Cx Kick-Off Meeting Minutes and Updated Cx Plans
Attachments: 2020 09 24-SSSD_SCES-SPES-SSMS_Constr Cx Kick-Off_MM.pdf; 2020 09 29-SSSD_Soda-Creek-ES_Cx-Plan.pdf; 2020 09 29-SSSD_Strawberry-Park-ES_Cx-Plan.pdf; 2020 09 29-SSSD_Steamboat-Springs-MS_Cx-Plan.pdf

All,

The SCES / SPES / SSMS - Cx Kick-Off meeting minutes are included in the attached PDF file.

Also, the Cx Plans were updated per the meeting discussion and are attached.

Let me know if you have any questions or comments.

Thanks, Alan

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ALAN NIEMEYER, CEM, BCxP
Senior Energy & Commissioning Engineer
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Alan Niemeyer

From: Alan Niemeyer
Sent: Friday, October 2, 2020 2:16 PM
To: 'iangrams@haselden.com'
Cc: 'Todd Raper'; Sarah Lara; 'Reilly O'Brien'; 'Colleen Kaneda'; Tony Soddy; Jason Luna
Subject: SSSD - Strawberry Park ES and Steamboat Springs MS - Cx Prefunctional Checklists
Attachments: 2020 10 02_Strawberry-Park-ES_Prefunctional-Checklists.zip; 2020 10 02_Steamboat-Springs-MS_Prefunctional-Checklists.zip

Ian,

The prefunctional checklists (PFCs) for the Strawberry Park ES and Steamboat Springs MS renovation projects are in the attached zip files.
The PFCs are for the mechanical and lighting equipment that we will be commissioning.

Please make the PFCs available for the installing contractors to sign.

Let me know if you have any questions.
Thanks, Alan

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Alan Niemeyer

From: Alan Niemeyer
Sent: Friday, October 2, 2020 2:17 PM
To: 'Todd Raper'; Sarah Lara; 'Reilly O'Brien'; 'Colleen Kaneda'; Tony Soddy; Jason Luna; 'iangrams@haselden.com'
Subject: SSSD - Strawberry Park ES: Cx Field Report #1 and Steamboat Springs MS: Cx Field Report #1
Attachments: 2020 09 24-SSSD-SPES_Cx Field Report-1.pdf; 2020 09 24-SSSD-SSMS_Cx Field Report-1.pdf

Hi All,

The Strawberry Park ES and Steamboat Springs MS – Commissioning (Cx) Field Reports are attached. The reports summarize the Cx site observations per my site walk last week.

There are currently no Cx issues per the site observations.

Let me know if you have any questions.

Thanks, Alan

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Senior Energy &
Commissioning Engineer
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M: 303-910-1193
www.pcdengineering.com

Alan Niemeyer

From: Alan Niemeyer
Sent: Wednesday, November 4, 2020 3:22 PM
To: Ian Grams
Cc: John Dietrich; Todd Raper; Sarah Lara; Reilly O'Brien; Colleen Kaneda
Subject: RE: FPTs for Steamboat Springs MS and Strawberry Park ES
Attachments: 2020 11 04-Steamboat-Springs-MS_FPTs.zip; 2020 11 04-Strawberry-Park-ES_FPTs.zip

Hi Ian,

The functional performance tests (FPTs) for the equipment that we will be commissioning at Steamboat Springs MS and Strawberry Park ES are in the attached Zip files.
Let me know if you have any questions.

I'm planning to be on site tomorrow morning to do Cx site observations. Per our earlier discussion, I will meet with the TAB contractor to coordinate any Cx issues.
I spoke with LONG, the controls contractor, this morning. They will be onsite also, and are just beginning to do their controls work for point-to-point checkouts and the BAS programming will follow after checkouts.

Thanks, Alan

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Senior Energy &
Commissioning Engineer
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M: 303-910-1193
www.pcdengineering.com

From: Alan Niemeyer
Sent: Tuesday, November 3, 2020 10:46 AM
To: Ian Grams <IanGrams@haselden.com>
Cc: John Dietrich <johnd@randhmechanical.com>
Subject: RE: FPT

Ian,

Yes, I'll provide the FPTs. I plan to get them sent out by tomorrow.

Thanks, Alan

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ALAN NIEMEYER, CEM, BCxP
Senior Energy &
Commissioning Engineer
BUILDING PERFORMANCE EXPERTS

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P: 303-678-1108 x702
M: 303-910-1193
www.pcdengineering.com

From: Ian Grams <IanGrams@haselden.com>
Sent: Tuesday, November 3, 2020 10:42 AM
To: Alan Niemeyer <alan@pcdengineering.com>
Cc: John Dietrich <johnd@randhmechanical.com>
Subject: FPT

Alan,

In talking with the mechanical subcontractor he has told me that he still needs functional performance tests for each school. Is that something you can provide?

Thanks

Ian Grams
Project Engineer
Mobile: 303-518-0034
Office: 720-603-2927
IanGrams@haselden.com

HASELDEN CONSTRUCTION

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Alan Niemeyer

From: Alan Niemeyer
Sent: Monday, November 30, 2020 10:44 AM
To: Todd Raper
Cc: Sarah Lara; Reilly O'Brien; Colleen Kaneda; Tony Soddy; Jason Luna; iangrams@haselden.com
Subject: RE: SSSD - Strawberry Park ES: Cx Field Report #2 and Steamboat Springs MS: Cx Field Report #2

Todd / All,

I contacted Steve Tanner with LONG to get an update on the BAS controls for SSMS and SPES.
The BAS controls for both school renovations are almost complete, with the exception of the OA airflow station to be installed in AHU-2 at SPES.

I asked about the cold space temperatures for each school. Steve said he has adjusted the VAV box supply air temperatures (SATs) upward to the 90°F to 120°F range, to help with the cold space temperature issues.
I also asked about the RTU / AHU SATs. Steve is tracking the SATs also, and the SATs are between 65°F and 70°F.

I need a copy of the Final TAB Report to review.
We need to determine if there are any air or water flow issues.

I have scheduled the Cx testing, with LONG controls, to be onsite the week of December 7th.

Thanks, Alan

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ALAN NIEMEYER, CEM, BCxP
Senior Energy &
Commissioning Engineer
BUILDING PERFORMANCE EXPERTS

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P: 303-678-1108 x702
M: 303-910-1193
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From: Todd Raper <todd.raper@dynamicpm.co>
Sent: Monday, November 30, 2020 10:12 AM
To: Alan Niemeyer <alan@pcdengineering.com>
Cc: Sarah Lara <sarah.lara@dynamicpm.co>; Reilly O'Brien <reilly.obrien@dynamicpm.co>; Colleen Kaneda <colleen.kaneda@dynamicpm.co>; Tony Soddy <TonySoddy@haselden.com>; Jason Luna <JasonLuna@haselden.com>; iangrams@haselden.com
Subject: Re: SSSD - Strawberry Park ES: Cx Field Report #2 and Steamboat Springs MS: Cx Field Report #2

Have you scheduled a Cx of the completed work at steamboat middle and strawberry elementary?? Both seem really cold and not under control

Sincerely
Todd Raper

(970) 986-2274

On Nov 10, 2020, at 6:14 PM, Alan Niemeyer <alan@pcdengineering.com> wrote:

Hello All,

The Strawberry Park ES and Steamboat Springs MS – Commissioning (Cx) Field Reports are attached.
The reports summarize the Cx site observations per my site walk last week on Thursday.

Let me know if you have any questions.

Thanks, Alan

BUILDING PERFORMANCE EXPERTS

888-840-4PCD toll free
P: 303-678-1108 x702
M: 303-910-1193
www.pcdengineering.com

Alan Niemeyer

From: Alan Niemeyer
Sent: Wednesday, December 2, 2020 8:24 AM
To: Steve Tanner
Cc: Gregory Custer
Subject: RE: SSSD: Cx Testing at SSMS and SPES

Ok. I'll see you there on Wed., 12/9/20, between 7:30 am and 8:00 am.

Please send me the TeamViewer login info and the BAS login info.

Thanks, Alan

pcd ENGINEERING
ALAN NIEMEYER, CEM, BCxP
Senior Energy &
Commissioning Engineer

From: Steve Tanner <stanner@long.com>
Sent: Wednesday, December 2, 2020 8:11 AM
To: Alan Niemeyer <alan@pcdengineering.com>
Cc: Gregory Custer <gcuster@long.com>
Subject: RE: SSSD: Cx Testing at SSMS and SPES

Hi Alan
Lets try for Wednesday and Thursday.

Thanks

Steve Tanner
Lead Controls Technician
Mobile: (720) 799-7388 | stanner@long.com

From: Alan Niemeyer <alan@pcdengineering.com>
Sent: Tuesday, December 1, 2020 7:21 AM
To: Steve Tanner <stanner@long.com>
Cc: Gregory Custer <gcuster@long.com>
Subject: RE: SSSD: Cx Testing at SSMS and SPES

Steve,

I have a change in my work schedule and would like to meet later in the week for next week's commissioning. I'm available next week on Wed., Thurs., and Fri. (12/9, 12/10, and 12/11).

Let me know which two days will work best for you.

Thanks, Alan

pcd ENGINEERING
ALAN NIEMEYER, CEM, BCxP
Senior Energy &
Commissioning Engineer

From: Alan Niemeyer
Sent: Monday, November 30, 2020 11:21 AM
To: Steve Tanner <stanner@long.com>
Cc: Gregory Custer (gcuster@long.com) <gcuster@long.com>
Subject: SSSD: Cx Testing at SSMS and SPES

Hi Steve,

Thanks for the BAS control updates for the SSMS and Strawberry Park ES.
Per our phone discussion, let's meet onsite next week to commission the HVAC systems.

I would like to do the Cx early in the week, between Monday and Wednesday. I think it should take two days, one day per school.
Let me know which two days will work for you.

Also, please send me the new TeamViewer login info and please set up a login ID for the BAS so I can view the HVAC systems for SSMS and SPES.

Thanks, Alan

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ALAN NIEMEYER, CEM, BCxP
Senior Energy &
Commissioning Engineer
BUILDING PERFORMANCE EXPERTS

888-840-4PCD toll free
P: 303-678-1108 x702
M: 303-910-1193
www.pcdengineering.com

Alan Niemeyer

From: James Eschelbach <JamesEschelbach@haselden.com>
Sent: Saturday, February 27, 2021 12:29 PM
To: Alan Niemeyer
Cc: Todd Raper; Peter D'Antonio; David Leyva; Chance Warren
Subject: RE: SSMS Commissioning Observation #44 - Lighting Control Cx Issues Update for SSMS and SPES

Alan,

I confirmed with out electrician that all (3) outstanding lighting control observations for SSMS (41, 43, and 44 in Procore) as well as the (4) for SPE (32-35 in Procore) were addressed over the school break (week of 2/15). All (7) have been changed to "Ready for Review" in Procore. Please let us know when you'd like to visit the site for verification.

Thank you,

James Eschelbach
Project Manager
Mobile: 303-358-5035
JamesEschelbach@haselden.com

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From: Alan Niemeyer <alan@pcdengineering.com>
Sent: Wednesday, February 24, 2021 9:55 AM
To: James Eschelbach <JamesEschelbach@haselden.com>
Cc: Todd Raper <todd.raper@dynamicpm.co>; Peter D'Antonio <peter@pcdengineering.com>
Subject: RE: SSMS Commissioning Observation #44 - Lighting Control Cx Issues Update for SSMS and SPES

James,

I'm checking in with you to see if there are any updates for the lighting control Cx issues at SSMS.
We are currently tracking three lighting control Cx issues for SSMS on Procore.

Also, there are four lighting control Cx issues for Strawberry Park ES. We need to get an update on those also.

I would like to issue the Final Cx Reports for SSMS and SPES as soon as the lighting control issues are resolved.

Thanks, Alan

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Senior Energy &
Commissioning Engineer
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P: 303-678-1108 x702
M: 303-910-1193
www.pcdengineering.com

From: James Eschelbach <JamesEschelbach@haselden.com>
Sent: Tuesday, February 16, 2021 7:20 AM
To: Alan Niemeyer <alan@pcdengineering.com>
Cc: Chance Warren <ChanceWarren@haselden.com>
Subject: FW: SSMS Commissioning Observation #44

Alan,

Thank you for the clarification. We're addressing these items this week as the schools are on break.

Thanks,

James Eschelbach
Project Manager
Mobile: 303-358-5035
JamesEschelbach@haselden.com

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From: Alan Niemeyer <alan@pcdengineering.com>
Sent: Monday, February 15, 2021 5:37 PM
To: James Eschelbach <JamesEschelbach@haselden.com>
Subject: RE: SSMS Commissioning Observation #44

James,

The attached PDF is a snapshot of the building area where Rms A109D and A109E are located.

From the main building entrance, the rooms are on the opposite end of the building.

Thanks, Alan

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ALAN NIEMEYER, CEM, BCxP
Senior Energy & Commissioning Engineer
BUILDING PERFORMANCE EXPERTS

888-840-4PCD toll free
P: 303-678-1108 x702
M: 303-910-1193
www.pcdengineering.com

From: James Eschelbach <JamesEschelbach@haselden.com>
Sent: Monday, February 15, 2021 5:09 PM
To: Alan Niemeyer <alan@pcdengineering.com>
Subject: SSMS Commissioning Observation #44

Alan,

On your Commissioning Observation #44 for Steamboat Springs Middle School, can you tell me which rooms you mean by A109D and A109E? Those room numbers don't match the plans and I want to be sure I'm pointing the electricians in the right direction.

Thanks,

James Eschelbach
Project Manager
Mobile: 303-358-5035
JamesEschelbach@haselden.com

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