



POUDRE SCHOOL DISTRICT R-1

REQUEST FOR QUALIFICATIONS

**BUILDING AUTOMATION / HVAC REPLACEMENT PROJECT
DESIGN SERVICES**

ROCKY MOUNTAIN HIGH SCHOOL

RFQu #20-360-001

RFQu SCHEDULE

RFQu Issued	October 7, 2019
Pre-proposal Conference	October 21, 2019
Questions Due	October 25, 2019 2 p.m. MST
RFQu Closing Date	November 4, 2019 2 p.m. MST

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1.0 PROJECT DESCRIPTION AND SCHEDULE

Poudre School District R-1 (the "District") is issuing this Request for Qualifications ("RFQu") from vendors for Architectural Design Services. The anticipated project description and schedule are as follows:

1.1 PROJECT DESCRIPTION

As identified in the District's 2016 Bond Proposal, RMHS requires a new HVAC automation controls package, along with new HVAC equipment and systems for the cooling of the entire building envelope. The Project Scope (Exhibit A), is based on approximately 292,000 square feet, with a construction budget of \$3,620,000. Exhibits B,C,D and E below will show the technical specifications for each system and the related electrical and plumbing specifications. The existing HVAC systems shall be analyzed and evaluated so that appropriate recommendations can be made in regard to the new equipment schedules/systems.

Complete architectural services, including scheduling and staging of all design services, programming, design, bidding, construction overview and project close-out will be required from the selected firm. While services may be scheduled in stages, this solicitation is for the selection of all architectural services necessary for the entire project. Bidding and construction of the projects will be through a traditional design/bid/build process to qualified general contractors.

It is highly recommended, but not required, that proposing vendors attend a pre-proposal conference to become familiar with the selection process, the schedule, and the elements of the contract.

DATE: Monday, October 21, 2019

TIME: 10 a.m. MST

WHERE: Starting at the Operations Conference Room

ADDRESS: 2445 LaPorte Avenue
Fort Collins, CO 80521

THEN PROCEEDING TO (immediately following the meeting):

Rocky Mountain High School - 1300 West Swallow Road, Fort Collins 80526

1.2 PROJECT SCHEDULE

1.2.1 Anticipated time for design work to commence November 2019

1.2.2 Anticipated construction bid date: April 2020

1.2.3 Anticipated occupancy: no later than August 15, 2020

2.0 MINIMUM QUALIFICATION REQUIREMENTS

As set forth in more detail below, the District will only consider proposals for this Project from vendors that meet the following qualification criteria:

- 2.1 Principal Architect of record must be registered and licensed in the State of Colorado.
- 2.2 Vendor must have an established office within 150 miles of Fort Collins, Colorado at the time of RFQu response submission.
- 2.3 Vendor must demonstrate completion of Projects of a similar size and scope within the last five (5) years.

3.0 SUBMITTAL REQUIREMENTS

As set forth in more detail below, the District is requiring the following information from all vendors as part of their response:

- 3.1 Letter addressing the considerations below
 - 3.1.1 Completed Architect's Qualification Statement - AIA Document B305 – 1993 or successor form. (Exhibit F)
 - 3.1.2 Design professional's summary of previous work for the District.
 - 3.1.3 Design professional's experience on projects of similar type and size within the last five (5) years.
 - 3.1.4 Whether the design professional or any of its principals has ever declared bankruptcy under their current names or former names.
 - 3.1.5 Whether the design professional or any of its principals has ever made an assignment for the benefit of creditors.
 - 3.1.6 Whether there are any unsatisfied judgements or liens against the design professional or any of its principals.
- 3.2 Description of the proposed Project team and approach
 - 3.2.1 Qualifications of proposed key team members
 - 3.2.2 Project approach which shall include:
 - 3.2.2.1 Budget and Cost Control
 - 3.2.2.2 Quality Control
 - 3.2.2.3 Schedule Management

- 3.3 Statement of the vendor's capabilities.
 - 3.3.1 Current and projected workload.
- 3.4 Proposed Fee Schedule
 - 3.4.1 Submittals must include a complete Proposed Fee Schedule & Hourly Rates as provided in Exhibit G.
 - 3.4.2 Fee Proposal Schedule **must include** the following consultant fees where applicable to this Project:
 - 3.4.2.1 Architectural Fee
 - 3.4.2.2 Structural
 - 3.4.2.3 Mechanical
 - 3.4.2.4 Electrical
 - 3.4.3 Identify any additional consultants included in fee proposal not specified above.
 - 3.4.4 Identify hourly rates for the following where applicable to this Project:
 - 3.4.4.1 Principal
 - 3.4.4.2 Project Manager
 - 3.4.4.3 Project Architect
 - 3.4.4.4 CAD Technician
 - 3.4.4.5 Interior Designer
 - 3.4.4.6 Clerical
 - 3.4.5 Additional services and consultants listed on the Fee Schedule & Hourly Rates will be negotiated on an as-needed basis after award of this RFQu.

4.0 RFQu PROCEDURES AND DEADLINES

The procedures and deadlines associated with this RFQu are as follows:

- 4.1 The District shall provide copies of this RFQu and its related documents to vendors through the electronic solicitation platform www.bidnetdirect.com (BidNet), where registered bidders are required to submit their electronic RFQu response along with the first and last name, telephone number and e-mail address of the employee within the vendor's organization who will be designated

as the District's primary contact with respect to this RFQu and the vendor's response thereto. The District may provide copies of this RFQu to other vendors upon request, who are also requested to provide the first and last name, telephone number and e-mail address of the employee within their organization who will be designated as the District's primary contact with respect to this RFQu and their response thereto.

- 4.2 **At no time during the solicitation process, will communication regarding this RFQu be permitted with any district employee, other than Jon Babcock, the District Senior Procurement Agent associated with this RFQu, until an award has been announced. Communication with any district employee other than Jon Babcock may disqualify your organization's proposal from consideration.**
- 4.3 Questions regarding this RFQu must be in writing and directed to the District through the BidNet platform any time after the issuance of this RFQu through and including **2:00 p.m. MST on October 25, 2019.**
- 4.3.1 Each question must be submitted individually. Multiple questions per entry will not be answered.
- 4.3.2 Each question submitted, as well as the District's response thereto, shall be posted to Bidnet as an addendum.
- 4.4 Electronically submitted proposals, as provided in section 3.0 of this RFQu, must be received in BidNet's electronic solicitation portal on or before **3:00 p.m. MST on November 4, 2019.** At that time the submission portal will close, and no further submissions will be allowed, nor considered.
- 4.5 District staff shall review the written proposals to this RFQu during the proposal consideration period commencing on November 4, 2019. During the proposal consideration period, questions may be asked of and additional information may be requested from specified District personnel and select vendors may be asked to give presentations to District staff regarding their RFQu responses.
- 4.6 The selected vendor's services are subject to and conditioned on: (a) an agreement by the District and vendor regarding the terms of a written contract between the parties, including but not limited to the terms specified in section 3.0 of this RFQu; and (b) the execution of the written contract by authorized representatives of the District and vendor.
- 4.7 This RFQu does not commit the District to select or contract with any vendor that provides a response, or to pay any costs incurred by vendors in responding to the RFQu or negotiating a contract. The District reserves the right to reject any and all responses to this RFQu at any point in the process, to waive any irregularities and/or informalities with respect to the RFQu procedures and deadlines, and to select the vendor whose response it deems in its sole discretion to be in the best interest of the District. The award of this RFQu to a selected vendor is contingent upon the execution of a mutually acceptable agreement, a sample of which is provided as AIA Document B101-2017 (Exhibit H). If a mutually acceptable agreement is not executed, the District reserves the

right, at its sole discretion, to negotiate with a subsequent vendor(s) who submitted a responsive and responsible response to this RFQu per the specified terms herein.

- 4.8 Information and materials submitted in response to this RFQu may be considered public records subject to disclosure under the Colorado Open Records Act ("CORA"), C.R.S. §§ 24-72-200.1 to -205.5. Information and materials that vendor believes are confidential and not subject to disclosure under CORA must be submitted separately with a citation to the section of CORA and any other relevant law under which vendor believes they are confidential. The District, not the vendor, shall determine whether information and materials so identified will be withheld as confidential, but will inform vendor in advance of disclosure to give it an opportunity to take legal action to protect its interests vis-à-vis the party making the CORA request.

-- End --

Exhibit A

SCOPE OF WORK

In 2007, a district wide third-party facility condition audit was performed, and through this audit, necessary HVAC equipment replacements were identified. This list was integrated into the 2010 bond project list. During the design phase of these projects, a more effective ventilation, and increased cooling capacity plan began to take shape. Before 2017, the District had 35 schools that had one of, or a combination of mechanical systems to provide ventilation and cooling to the building. There were 15 schools that had no mechanical cooling. However, certain parts of these schools had air conditioning. During the major renovations of 2012-2017, most of these deficiencies were addressed.

A 2015 HVAC study then identified opportunities that would be funded by the 2016 Bond. Rocky Mountain High School (RMHS) was identified as a priority school for an HVAC system upgrade. To address the current needs of the District, and to consider future growth, it is necessary to provide upgraded HVAC/automation systems to keep the learning environment as productive as possible and achieve a higher level of comfort for the students and staff.

The selected vendor is expected to provide a full range of project management, architectural, and engineering services as part of a design team assembled with the intent of providing high level professional services to the District. The scope of services required for the Rocky Mountain High School HVAC/Automation Project are described below.

The selected vendor shall provide complete architectural design services for a multi-phase, multi-year renovation, starting in the Summer of 2020, for the District's HVAC/Automation project listed above. It is expected to assemble a team for design services to include, but not limited to; Architectural Services, Structural, and MEP Engineering, scheduling and staging of all design services, construction overview and project close-out. While services may be scheduled in stages, this solicitation is for the selection of all architectural services necessary for the entire project. The vendor Project team will work closely with the District's Operations Department and other select stake holders.

Exhibit B

**PSD TECHNICAL
SPECIFICATION**

**DIVISION 25
Integrated Automation**

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SECTION 25 00 00 – INTEGRATED AUTOMATION

Part 1: General

1.1 Summary

A. Design Documents

1. Preassembled Control Panels.
2. Actuators, thermostats, sensors, thermowells, gauges and mounting hardware as applicable.
3. Control valves, dampers, linkages and mounting hardware.
4. Construction supervision.
5. Demonstration and training.
6. Warranty.

1.2 Related Sections

1.3 Definitions

1.4 Submittals Required

- A. Shop drawings, manufacturer's data, and/or printouts for:
- B. System sequence of operation.
- C. Point schedule

1.5 Quality Assurance

1.6 Scheduling

1.7 Delivery, Storage, and Handling

1.8 Regulatory Requirements

- A. New schools and major remodel projects will use all direct digital controls. Controls in minor retrofits will match the existing controls, and be installed by the same contractor that originally installed the system or approved by PSD.
- B. The Controls Contractor shall be a fully owned subsidiary of the control manufacturer or factory authorized installer of the major control components and has been in continuous business for at least fifteen years working for PSD in the last three years.
- C. Design a separate temperature control zone with its own thermostat or control sensor for each student area, classroom or office space.
- D. Minimum Design Requirements for Consultants:
 1. Include the listed temperature control drawings among the final contract drawings and make them the same size and of the same sheet material as the other contract drawings no matter what their source, consultant or installing contractor. The mechanical engineer, not the controls contractor, is responsible to see that control drawings meet this standard.
 - i. Floor and roof plan showing thermostat, sensor locations in duct work, controller locations above ceiling and equipment locations.
 - ii. Require point-to-point connection diagrams for wiring and a laminated copy to be placed in the control cabinets
 - iii. Schematic instrumentation and control flow diagram labeled accurately and showing the interrelationship of all controls and the areas and equipment served.
 - iv. Show the sequence of operation on the control documents. The bill of materials shall appear on the Control Contractor's drawings.

Part 2: Products

2.1 Approved Vendors

- A. LONG Building Technologies (Distech)
- B. BTS Building Technology Systems (Honeywell Spyder)

2.2 Products

A. CONTROL VALVES

1. Flanged cast iron in sizes 2-1/2" and larger, otherwise bronze. Seat and inner valve material of

hardened steel. Sizes 2" and smaller with soldered or threaded connections.

2. Spring return to the normal position in the absence of control power, that is, fail with the heating valves open and the cooling valves closed.
3. Modulating electric actuators with adjustable end switches to prevent over stroking are acceptable in sizes <1". Use electric actuators for larger sizes.
4. Use a three-way design at the ends of long runs to keep piping near the service temperature and maintaining pump flow above 25% of design. Otherwise use two-way valves.
5. Size for a 5 PSI maximum drop.

B. DAMPER ACTUATORS

1. Modulating in most applications or two-position in rare cases; i.e., minimum outside air dampers or exhaust dampers.
2. Provide position indication or verification on the outside air, return air and exhaust air dampers of air handling units larger than 15,000 cfm. An example is an analog input to the DDC panel from an actuator with feedback
3. Provide at least one operator for each 16 square feet of damper, or for each length greater than 48".
4. Modulating electric actuators with adjustable end switches to prevent over stroking are acceptable in small dampers associated with unitary equipment like exhaust fans. Consult the District if exceptions are desired or in remodel projects where no instrument air compressor exists.
5. 4-20 mA, 24 vac or 0-10 vdc for electric. Do not use 24 vdc if the actuator position must be reported.
6. Fire dampers spring return to the fire alarm position upon power failure.
7. VAV box actuators: capable of permanent stall operation without damage. Adjustable stop pins for stroke limits. Drive gears of nickel steel, no plastic.

C. INDICATORS

1. Interface each indicator with remote sensor/controller to display measured value.
2. Supply selector switches for multiple indicators that show which variable is being measured.
3. Accurate and repeatable to $\pm 0.5\%$ of the measured variable's maximum value.
4. Electro mechanical device or panel mounted back screen display.
5. Indicators are not required for values that can be reported by the DDC system.

D. TRANSDUCERS

1. Electronic transducer: Accuracy $\pm 1\%$ of maximum value.
2. Fully adjustable (not fixed) 0-25psi fixed range.
3. Approved manufacturers: Differential Pressure Transducer-Dwyer 629-03-CH-P2-E5-S1-Submit others to District for approval.

E. SENSORS

1. Temperature: 1K, 10K, 20K type 2 or 3 Thermistor or platinum RTD, Accuracy $\pm 1^\circ\text{F}$. Do not use RTDs that require transmitters.
2. Differential Building Static pressure: vary output voltage linearly. Range: -0.1 to 0.1" W.C. with an accuracy of 2% of its range, repeatable to 0.5% of range.
3. Duct static pressure: vary output linearly. Range -1 to +4" W.C., accuracy 3% of range, repeatable within 1.5% of range.
4. Air velocity: linear indication of the velocity of air in a duct from 0 to 2000 FPM, Accuracy, ± 50 FPM from which the central controller can calculate CFM.
5. Outdoor air temperature: Approved manufacturers: Mamac 205 F, high resistance change versus temperature change, designed for outdoor mounting insulated from the building on north facing wall and out of the sun, minimum range -20 to $+110^\circ\text{F}$, accuracy $\pm 1^\circ\text{F}$, repeatable within $1/2^\circ\text{F}$.
6. Room temperature: minimum range 50°F to 95°F , accuracy $\pm 1^\circ\text{F}$, repeatable 1.5% of range.

7. Duct temperature: minimum range 32°F to 110°F, accuracy ±1°F, repeatable 1.5% of range. Use averaging elements, not bulbs.
8. Liquid temperature: insert in a pipe well and immerse in a substance designed to enhance heat transfer and rapid response. Minimum range 35°F to 220°F, 1% accuracy, repeatable within 1% of range.

F. MISCELLANEOUS DEVICES

1. Smoke detectors
2. Freeze Detection Thermostats (Freeze Stats):
 - i. Line voltage liquid-filled type responsive only to the lowest temperature sensed along any one-foot length of its element.
 - ii. Adjustable.
 - iii. Auto reset.
3. Plastic laminate labels on all panels and major field devices screwed or riveted to the panel faces, no adhesives. Do not attach labels to replaceable devices or room thermostats or sensors. The definition of *major* is left to the consultant.
4. Flow Switches:
 - i. Pressure differential type with SPDT contacts. Do not use paddle switches except where required to maintain a chiller or boiler warranty or where other devices would not work reliably. If in doubt, check with the District. The engineer must include a detail of paddle switch installation, if they are used, and assure that the contractor installs them according to manufacturer specification or PSD plumbing spec. Use McDonnell-Miller FS4-3 or approved equal.
 - ii. Use current switches to prove low head pump flow where appropriate.
5. Wind dampening "weather head" on each atmospheric pressure sensing point; e.g., Dwyer A-306. Locate above wind eddies caused by the building structure and roof equipment.
6. Shielded cable on critical communication and sensor lines as recommended by the manufacturer or advised by the consultant.
7. Place thermostats or temperature control sensors inside locking transparent plastic covers (in common spaces, and in aluminum covers (Kele ATK04 for gyms) that discourage tampering and vandalism at all locations in Middle and High Schools. Not required in administration spaces, or anywhere in elementary schools except gyms. Use surface mounted sensors with digital display mounted on interior walls, installed with necessary insulation from wall.
8. Use adjustable CT switches on motors to provide fan status input points into the DDC panel.
9. Use adjustable CT on pump motors to provide pump status input points into the DDC
10. Humidity Transducer where applicable acceptable manufacturer: MamacHU-224-2
11. CO2 sensors
 - i. Return sensor acceptable manufacturer: Kele KCD-D
 - ii. Room sensor acceptable manufacturer: Kele KCD-W
12. Relays for isolation of point and HOA control acceptable manufacturer: RIBU1S

Part 3: Execution

3.1 Preparation

3.2 Installation

- A. The Controls Contractor is responsible for preassembling and installing panels and all hardware with his own employees, proving the system and training District people in its proper function and maintenance.
- B. Wiring, conduit placement and the installing of actuators and related linkage may be subcontracted to a District approved installer but in this case the controls contractor shall label and connect all wiring terminations and be responsible for the subcontractor's work.
- C. DEMONSTRATION AND TRAINING

1. 12 hours at each elementary or 18 hours at each middle or high school to demonstrate the controls to District personnel and answer questions.
 2. Optionally 24 hours minimum of formal classroom training to District personnel in the theory, function and application of each hardware and software element and each component in the control system, plus 8 hours of telephone consultation.
 3. The consultant shall confer with the District at the time of design to determine how much training will be required by the construction documents.
- D. Control cabinets shall have
1. Accurately labeled terminal strips representative of the control drawings
 2. Labeled wires to exterior devices and on interior cabinet wiring
 3. Labeled relays, transformers and safeties
 4. Controller labeled to corresponding device/s
 5. GFI protected outlet for computer charging station
 6. Power supply disconnect for the entire cabinet
 7. Transformers to have a resettable overload
 8. PSD freeze alarm relay to have points available to land to the PSD burglar alarm panel (landed by PSD personnel)
 9. Properly sized wire tracking
 10. Controllers need to have HOA's for ease of testing
 11. Ethernet cable to be provided by PSD to meet IT spec (if required for Jace connection)
 12. Jace controllers shall be Tridium 8000 unless otherwise approved by PSD (if a Jace enclosure), with no NDIO board attached to the Jace unless approved by PSD
 13. See attached picture 1A
- E. Plenum rated cable inside of plenums. Wiring suspended neatly from the overhead structure. Do not support on top of ceiling tiles. Minimum wire size, 18 AWG stranded.
- F. Number or color code wiring terminals and provide a cross reference to ease later checkout and diagnosis.
- G. Place exposed control wiring in conduit with proper identification.
- H. Controllers above ceiling shall be in a PSD approved enclosure and approved location only when necessary
- I. SENSORS
1. Surface mount with standard plastic covers with exposed knobs only in classrooms to permit a $\pm 3^\circ$ deviation from setpoint.
 2. Install liquid temperature sensors inside of pipe wells with an appropriate heat transfer compound inside the well.
- J. ACCESSIBILITY
1. Install all control devices in "Readily Accessible" locations not above any hard lid ceilings unless within 2 feet of the access hatch.
 2. All devices (sensors, VAV controllers, remote controllers) accessible from a 6 ft ladder, or approved by PSD personnel
 3. Above ceiling controllers shall be located on the equipment or as close to equipment as possible, to be approved and located by PSD personnel
 4. Corresponding transformers shall be mounted on the outside of the controller enclosure with the wiring step down inside the enclosure
 5. Sensor and controller locations to be labeled with adhesive labels on the drop ceiling grid, and identified on the construction drawings
- 3.3 Cleaning and Protection

END OF SECTION 25 0000

SECTION 25 09 23 – DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

Part 1: General

1.1 Summary

- A. The need for computers and related software to be located outside the controlled building must be decided in conference with the District at the time of design of the new building or remodel. The consultant is required to consult the District prior to issuing the schematic design submittal.
- B. SCOPE
 - 1. Central DDC Panel.
- C. Software to monitor and control HVAC operations.
- D. The term *Central DDC Panel* refers in this document to the main DDC controller in the controlled building that acts as the hub for communication with individual equipment controllers holds most or all the control software, connects directly to the modem and resides in the Communications Room. Actual nomenclature will differ among manufacturers.

1.2 Related Sections

1.3 Definitions

1.4 Submittals

1.5 Quality Assurance

1.6 Scheduling

1.7 Delivery, Storage, and Handling

1.8 Regulatory Requirements

1.9 LEED Requirements

Part 2: Products

2.1 Manufactures

- A. Tridium Niagara N4
- B. Distech
- C. Honeywell Spyder

2.2 Products

A. CENTRAL DDC PANEL

- 1. Connect direct to field data points or individual equipment controllers.
- 2. Electrically isolate and otherwise protected against voltage transients, sudden drops, spikes, and power surges unless this protection is provided to the DDC system from outside itself.
- 3. Removable circuit boards and plug-in terminal for ease of servicing.
- 4. Permit special global commands such as date, time of day, history, night setback, setpoint adjustments, or summer/winter setpoint changeover that will automatically apply to all subsidiary (individual equipment) controllers.
- 5. 24 hours of battery backup with a programmed alarm after expiration of the recommended battery life to prompt replacement.
- 6. If more than one panel is required to comprise the central DDC controller, seamlessly connect them such that they will be addressable as if only a single DDC controller were operating the system.
- 7. Power connections
- 8. NEMA 1 cabinet(s) assembled, furnished and installed by the Controls Contractor.

- B. House the microprocessor, communication interface, all controllers (except those required for individual equipment), relays, indicators, clocks, switches, pilot lights, override timers, etc. to allow quick access for adjustment and troubleshooting.

C. CENTRAL DDC CONTROLLER SOFTWARE

- 1. Multi-tasking menu driven in plain English. If programming code is used, eg, C or Pascal, provide

a translator or explanatory remarks in the code so that a user unfamiliar with programming codes can understand the program. An intelligent user shall be able to add, delete, or modify any control sequence, value, schedule or assignment without additional software or proficiency in a programming language.

2. Include but do not limit functions to:
 - i. Universal inputs and outputs
 - ii. Digital Inputs and outputs
 - iii. Momentary Digital Outputs.
 - iv. Accumulate Pulsed Inputs, eg, KW demand.
 - v. Analog Inputs.
 - vi. Analog Outputs with clamping.
 - vii. Time Functions:
 - a. Weekly clock: 24 hours, 8 days.
 - b. Yearly clock: 365 days for holiday schedule.
 - viii. demand limiting.
 - ix. Control Functions.
 - x. Analog to Digital Converter.
 - xi. Math and Logic Functions:
 - a. Add, Subtract, Multiply, Divide.
 - b. Minimum, Maximum, Average.
 - c. And, Or, Exclusive or.
 - d. Not and, Nor, Exclusive nor.
 - e. Square root.
 - f. Absolute value.
 - g. Sign value.
 - h. Equal or not equal to.
 - i. Exponentiation.
 - xii. Accumulation Function:
 - a. Run Time Totalization with automatic alarm and reset.
 - b. Analog Integration with automatic alarm and reset.
 - xiii. Alarm Functions:
 - a. Digital, Analog and Hi/Lo settings and dead band.
 - b. Conditional Alarms with If/Then/Else logic.
 - c. Alarm Inhibiting.
 - d. Fluttering Alarm Suppression.
 - e. Customized Alarm Messages of at least 70 Characters.
 - f. Auto dial of any alarm condition to the dumb Epson printer/modem combination or up to 5 phone numbers.
 - g. Provide dry contact closures for up to seven alarms that can be wired by the owner to the security panel. Install a 1" conduit with a nylon pull line from the point where alarms are gathered to the security panel. (i.e. District freeze alarms)
3. Produce the necessary reverse acting or direct acting PID signals as required by the control sequence of the equipment being controlled.
4. Include self-diagnostic procedures for checking the LED digital displays (if any) and verify the integrity of the CPU memory and database.
5. Provide sequences to accommodate power failure, operate under emergency power and restart after power has been restored.
6. Compare up to 100 analog readings to preset high and low limits, unique to each data point, and annunciate each time a value exceeds a limit.
7. Where applicable assign each alarm points a return-to-normal dead band.

8. Any analog value resulting from a mathematical calculation shall be assignable as an alarm.
9. An alarm point can be inhibited by another digital point if desired. The condition of the digital point when the inhibit condition occurs can be operator programmed for either an open contact or a closed contact.
10. Provide time delays for alarms that are easily changed by the user.
11. Allow the operator to design, test, then implement desired ("What if") control strategies on-line without harming controlled equipment. Once satisfied with a control strategy, the user can release the controls to automatic and monitor the performance of the system.
12. Reports:
 - i. Name: Returns all points with their assigned English names.
 - ii. Type: Returns all points with their types such as analog or digital.
 - iii. Address: Returns a list of controller addresses.
 - iv. Status: Returns all points with a specific status; e.g., all zones in heating, all zones in cooling, all zones unoccupied, or all zones in manual override control.
Value: Returns all points greater to, equal to or less than a specified value. For example lists all zones with a temperature greater than 76°F.
 - v. History: Displays the history of a value over a specified time at specified intervals.
13. Allow "wild cards" or similar procedures to group points and functions.
14. Diagnostics:
 - i. Capable of self-diagnosing without a query by an operator.
 - ii. Alarm a power failure or a communication failure with any controller to the dumb Epson printer/modem via telephone. Repeat alarms at programmable intervals while the situation remains unattended and unacknowledged. Acknowledging and silencing alarms shall be a simple procedure from a remote PC or the central controller.
15. Password Security:
 - i. Level 1—Proprietary: All functions available. Retained by the manufacturer and given to the District.
 - ii. Level 2--Super: All functions available. May read or change passwords including but no higher than itself. Give to the District's project manager or mechanical engineer in a sealed envelope and do not reveal during training and demonstration sessions.
 - iii. Level 3—Working: All functions available (Read, write and invoke). May read or change passwords including but no higher than itself. May be revealed during training and demonstrations.
 - iv. Levels 4, 5 & 6: Functions assignable by higher passwords.
 - v. Level 7: Read only does not allow invoke or write ability
16. To simplify error checking and reprogramming write software in logical groups or subroutines each serving one piece of equipment or an intuitive collection. Add nonfunctional remarks in the software to explain the function of each group and identify the equipment controlled. As much as possible reuse standard routines that have been proven effective by experience and duplicate them for identical equipment.

Part 3: Execution

3.1 Preparation

3.2 Installation

- A. Graphics are to be separate per unit, no relativized graphics permitted on PSD systems
- B. No subcontractors permitted for programming or graphic creation on PSD systems
- C. Programming contractor has standard programs, unique to PSD standardization practices that are adjusted as needed to fit the current control sequence
- D. Contractor uses an in house second person verification process to assure programs meet PSD standardization and can be readily edited and understood. This includes the points having alarms,

- trends, graphics are all configured correctly
 - E. Provide a printed and electronic copy of the final sequence of operations and a point assignment list to the PSD Building Automation Controls Department.
 - F. Present 16 training hours in the proprietary software in addition to controls training required elsewhere. The consultant shall confer with the District prior to issuing construction documents to determine the amount of training desired.
- 3.3 Cleaning and Protection

END OF SECTION 25 09 23

SECTION 25 09 33 – ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

Part 1: General

- 1.1 Summary
 - A. Electronic analog or direct digital automatic temperature controllers for individual HVAC equipment.
- 1.2 Related Sections
- 1.3 Definitions
- 1.4 Submittals

- 1.5 Quality Assurance
- 1.6 Scheduling
- 1.7 Delivery, Storage, and Handling
- 1.8 Regulatory Requirements

Part 2: Products

- 2.1 Manufactures
- 2.2 Products
 - A. ALL INDIVIDUAL EQUIPMENT (APPLICATION SPECIFIC) CONTROLLERS
 - 1. Function independently on loss of communication with the central DDC controller.
 - 2. Capable of program changes or displaying data while in communication with:
 - i. A portable computer plugged into the central DDC controller.
 - ii. A remote computer via telephone modem through the central DDC controller.
 - 3. Locally adjustable address, setpoints and sensor scaling.
 - 4. Control by proportional, integral, derivative or combination.
 - 5. Proportional heating and cooling with adjustable dead band.
 - 6. Either 0 to 10 vdc or 4 to 20 mA proportional output (except VAV boxes).
 - 7. Internal switches (or software) for each output to change from direct to reverse acting.
 - B. MAJOR EQUIPMENT CONTROLLERS
 - 1. Locally and centrally control each item of equipment such as an air handling unit, boiler, chiller or tower by a controller mounted on or near that piece of equipment. Preferably boiler plants or the chiller/tower combination may be operated from one controller or directly from the central DDC controller.
 - 2. Equipment requires separate controller/s NDIO to the Jace is not acceptable unless approved by PSD
 - 3. If not in the specification, PSD shall be consulted about required points for the equipment not listed
 - 4. Each individual equipment controller shall have the below listed data (as applicable) readable and command able at the individual equipment controller with the plug-in computer, at the central DDC controller or from a remote computer, as applicable. Design an EIA-232

communication bus or similar capability among major equipment controllers so that the foregoing is possible.

5. Percentage data readings must state percent open. NOTE: * = Read only
 - i. Current building KW demand *.
 - ii. Administration area cooling unit on or off.
 - iii. Each air-handling unit:
 - a. Supply fan on/off.
 - b. Exhaust fan on/off.
 - c. Outside air damper percent open.
 - d. Return air damper percent open.
 - e. Exhaust air damper percent open.
 - f. Heating coil valve percent open.
 - g. Cooling coil valve percent open.
 - h. Discharge air pressure using the same pressure sensor used to set the inlet vanes.
 - i. Inlet vane percent open.
 - j. Discharge air temperature.
 - k. Smoke detector alarm *.
 - l. Freeze stat alarm *.
 - m. Mixed air temperature.
 - n. Return air temperature.
 - iv. Outside air temperature using the sensor which resets heating water temperature*.
 - v. Heating system:
 - a. Each boiler on or off.
 - b. Boiler pump on or off if applicable
 - c. Heating water pumps on or off.
 - d. Heating pump VFD speed if applicable
 - e. Heating system differential pressure if applicable
 - f. Combustion air damper position
 - g. HWS DP setpoint and reading
 - h. Heating water supply temperature.
 - i. Heating water return temperature *.
 - j. Boiler room temperature
 - k. Alarm status *:
 1. No heating water flow.
 2. Flame failure
 3. Heating water temperature out of limits.
 4. PSD freeze alarm (below 100-degree HWS and below 30 degrees OAT)
 - vi. Cooling system
 - a. Chiller on or off.
 - b. Chilled water supply temperature.
 - c. Chilled water return temperature *.
 - d. Chilled water pump on or off*.
 - e. Cooling tower off, on low or high speed or VFD feedback*.
 - f. Condenser water supply temperature.
 - g. Condenser water return temperature *.
 - h. Condenser water pump on or off*.
 - i. Alarm status *:
 1. Chiller off when commanded on or chiller on when commanded off.
 2. No chilled water flow when needed.
 3. No condenser water flow when needed.

- 4. Report any other chiller alarm as a "Chiller General Alarm Problem".
- vii. Condenser Water System (cooling tower)
 - a. Cooling tower fan on or off
 - b. Cooling tower fan VFD feedback
 - c. Cooling water system pumps on or off
 - d. Cooling tower spray pump on or off
 - e. Cooling tower pump on or off
 - f. Condensed water supply temperature
 - g. Condensed water return temperature
 - h. Change over valve position if applicable
 - i. Alarm status
 - 1. Cooling tower alarm
 - 2. Vibration alarm if applicable
 - 3. Water treatment alarm
- viii. Heat pumps
 - a. Supply fan on or off
 - b. Supply air temp sensor
 - c. Supply air temp active DAT
 - d. Mixed air temp
 - e. Iso valve status
 - f. Compressor start stop
 - g. Compressor status
 - h. Reversing valve status
 - i. Safety status form the heat pump
 - j. Space temperature
 - k. Cooling set point
 - l. Heating set point
 - m. ERV serving the heating pump supply air temperature
- ix. Energy recovery roof top unit
 - a. Supply fan on or off
 - b. Supply fan VFD speed
 - c. Exhaust fan on or off
 - d. Exhaust fan VFD speed
 - e. Evap cooling on or off if applicable
 - f. Evap leaving temperature
 - g. Exhaust air temperature before cooling section
 - h. Heat wheel on or off
 - i. Heat wheel leaving air temperature
 - j. Freeze stat status
 - k. Smoke detector status
 - l. Supply duct high limit status
 - m. Supply air temperature
 - n. Supply air temperature setpoint
 - o. Duct static pressure setpoint
 - p. Duct static pressure inches water column +/-0.1
 - q. Supply air humidity percentage
- x. Roof top unit with or without DX
 - a. Supply fan on/off.
 - b. Exhaust fan on/off.
 - c. Outside air damper percent open.

- d. Return air damper percent open.
- e. Exhaust air damper percent open.
- f. Heating coil valve percent open.
- g. Cooling coil valve percent open.
- h. Discharge air pressure using the same pressure sensor used to set the inlet vanes.
- i. Discharge air temperature.
- j. Smoke detector alarm *.
- k. Freeze stat alarm *.
- l. Mixed air temperature.
- m. Return air temperature.
- n. DX on or off if applicable
- o. DX cooling capacity if applicable
- p. Co2 return sensor if applicable
- q. Duct static pressure inches water column adjustable +/-0.1
- r. Duct static setpoint
- s. Supply fan VFD speed if applicable
- xi. Vertical unit ventilators VUV
 - a. Supply fan on start or stop
 - b. Supply fan speed if applicable
 - c. Low limit status
 - d. DX command on or off if applicable
 - e. Mixed air damper position percent open if applicable
 - f. Outside air damper position percent open if applicable
 - g. Hot water valve position percentage open
 - h. Chilled water valve position percentage open if applicable
 - i. Supply air temperature
 - j. Supply air temperature setpoint
 - k. Exhaust fan on or off if applicable
 - l. Outside air DX lock out set point if applicable
 - m. Space temperature (read only)
 - n. Motion off delay timer if applicable
- xii. Fan coils
 - a. Supply fan start or stop
 - b. Supply fan status
 - c. Supply air temperature
 - d. Supply air temperature active DAT
 - e. Lox limit or freeze stat status
 - f. Hot water valve position percent open
 - g. Mixed air temperature
 - h. Mixed air damper position percent open
 - i. Mixed air damper minimum position percent open
 - j. Return air temperature
 - k. Space temperature
 - l. Active cooling set point
 - m. Active heating set point
- xiii. Exhaust fans
 - a. Fan start or stop
 - b. Fan status
 - c. Fans on wall switches will have no alarms unless fan is for kitchen hoods
- xiv. VAV BOX CONTROLLERS (if applicable)

- a. Pressure independent control.
 - b. Separate adjustable heating, cooling, and fan maximum and minimum volume setpoints, if applicable.
 - c. Modulate the heating control valve (two-position valves are not permitted).
 - d. Each VAV box locally and centrally controlled by a single controller mounted accessible and near the box.
 - e. Readable and adjustable at each VAV box controller, the central DDC controller or from a remote computer:
 - f. Room heating setpoint temperature, occupied/unoccupied.
 - g. Room cooling setpoint temperature, occupied/unoccupied.
 - h. Maximum cooling velocity or cfm.
 - i. Minimum cooling velocity or cfm.
 - j. Minimum heating velocity or cfm.
 - k. Box fan on-off trip point (as applicable).
 - l. Actual supply air velocity or cfm (read only).
 - m. Box fan status (read only, if applicable).
 - n. Actual room temperature (read only).
 - o. Heating valve percent open.
 - p. Actual supply air temperature downstream of the heating coil (read only).
 - q. Active supply temperature setpoint with an override
 - r. Actual supply air temperature (RTU supply temperature) upstream of the VAV box (read for diagnostics only).
- xv. IN-DUCT blower coil heating and cooling
- a. Supply fan on or off
 - b. Supply air temperature setpoint
 - c. Supply air temperature
 - d. Chilled water valve percent open
 - e. Heating water valve percent open
 - f. Mixed damper position (percentage open if applicable)
 - g. Room temperature
 - h. Room cooling setpoint
 - i. Room heating setpoint
 - j. Motion sensor status if applicable
 - k. Motion sensor off delay time if applicable
 - l. Window switch status if applicable
 - m. Smoke damper position pulled to a chart for ease of review on the DDC system
- xvi. IN-DUCT TERMINAL HEATING (or COOLING) CONTROLLERS (for constant volume systems)
- a. Modulate the heating or cooling control valve (two-position valves are not permitted).
 - b. Each heating or cooling control valve locally and centrally controlled by a single controller mounted accessible and near the heating or cooling coil
 - c. Readable and adjustable at each controller, the central DDC controller or from a remote computer:
 - 1. Room heating setpoint temperature, occupied/unoccupied.
 - 2. Room cooling setpoint temperature, occupied/unoccupied.
 - 3. Actual room temperature (read only).
 - 4. Control valve percent open.
 - 5. Actual supply air temperature downstream of the coil (read only).
 - 6. Actual supply air temperature set point downstream of the coil

7. Actual supply air temperature upstream of the coil (read for diagnostics only).
- xvii. Mode: Occupied, unoccupied, warmup *.
- a. Fan mode continuous or occupied where applicable (CPU labs)

C. BOILER PLANT CONTROLLER

1. Use the central DDC control panel to sequence the boilers and reset heating water temperature.
2. Use the central DDC outside air temperature sensor to reset heating water temperature. If a second one is provided for the boiler plant, it remains the consultant's responsibility to specify a location out of the sun and away from any other source of error-producing heat.
3. Follow the guidelines above for major equipment controllers.

D. COOLING PLANT OR DX CONTROLLER

1. The chiller/tower/pump combination will usually be supplied with a central controller factory designed to smoothly integrate with each component in the system and this is preferred. It is the Consultant's responsibility to ensure that between the DDC system and the cooling plant controller there are no gaps or overlaps. The DDC system will in most but not all cases be limited to enabling the cooling plant and reading water temperatures but in this case probably not starting pumps.
2. The DX controller will usually be part of the air handling unit controller but if not, a separate controller for the condensing unit will be required.
3. Follow the guidelines above for major equipment controllers.

E. INDIVIDUAL EQUIPMENT CONTROLLER SOFTWARE

1. Routinely report to the central DDC controller.
2. Continuously poll data for changes at minimum intervals of 100ms.
3. Continuously accumulate data pulses up to two per second.
4. Digital outputs in four forms; pulsed, sustained, pulse width modulated and binary staged closures.
 - i. Pulsed closures: 200 milliseconds.
 - ii. Keep sustained closures in the commanded state until receipt of a contrary command.
 - iii. Vary pulse width modulation from 100ms to 255 seconds.
 - iv. Permit up to 25 levels of staging, e.g., boiler modules.

Part 3: Execution

3.1 Preparation

3.2 Installation

- A. Locate each individual equipment controller near the equipment served (inside the building) and label its function.

3.3 Cleaning and Protection

END OF SECTION 25 09 33

SECTION 25 13 00 – INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK (DASHBOARDS)

Part 1: General

1.1 Summary

- A. Provide requirements that will ensure that *buildings* are constructed or altered in a way that will provide the capability for their energy use, production and reclamation to be measured, monitored and reported. This includes the design of energy distribution systems to isolate load types, the installation of or ability to install in the future *meters*, devices and a data acquisition system, and the installation of or the ability to provide for public displays and other appropriate reporting mechanisms in the future.
- B. All forms of energy delivered to the *building* and *building site*, produced on the *building site* or in the building and reclaimed at the *building site* or in the *building* shall be *metered* and all energy load types measured.
- C. The intent of these requirements is to provide for the ongoing metering, measuring, reporting and display of the energy use, energy demand and emissions associated with the energy use of the whole *building* and its systems

1.2 Related Sections

1.3 Definitions

1.4 Submittals Required

A. Product Data:

B. Samples:

1.5 Quality Assurance

1.6 Scheduling

1.7 Delivery, Storage, and Handling

1.8 Regulatory Requirements

Part 2: Products

2.1 Manufacturers

2.2 Products

- A. **Energy distribution design requirements and load type isolation.** Energy distribution systems within, on or adjacent to and serving a *building* shall be designed such that each primary circuit, panel, feeder, piping system or supply mechanism supplies only one energy use type as defined. The load type served by each supply mechanism shall be clearly designated with the use served, and adequate space shall be provided for installation of *metering* equipment or other data collection devices, temporary or permanent, to measure these loads. The energy distribution system shall be designed to facilitate the collection of data for each of the *building* energy use categories and for each of the end use categories listed. Where there are multiple *buildings* on a *building site*, each *building* shall comply separately.
 1. **Exception:** *Buildings* designed and constructed such that the total usage of each of the load types described shall be permitted to be measured using installed sub- *meters* or other equivalent methods as *approved*.
 2. **HVAC system total energy use.** This category shall include all energy used to heat, cool, and provide *ventilation* to the *building* including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.
 3. **Lighting system total energy use.** This category shall include all interior and exterior lighting used in occupant spaces and communal areas.
 4. **Energy used for building operations.** This category includes all energy use by vertical transportation systems, automatic doors, motorized shading systems, ornamental

fountains and *fireplaces*, swimming pools, snow-melt systems, and all other *building* operations.

5. **Miscellaneous loads.** Loads other than those specified.
- B. **Energy type metering.** *Buildings* shall be provided with the capability to determine energy use and peak demand for each of the energy types. Utility energy *meters* shall be permitted to be used to collect whole *building* data, but, shall be equipped with a local data port connected to a data acquisition system.
1. **Gaseous fuels.** Gaseous fuels including, but not limited to, natural gas, LP gas, coal gas, hydrogen, landfill gas, digester gas and biogas shall be capable of being *metered* at the *building site* to determine the gross consumption and peak demand of each different gaseous fuel by the *building* and each *building* on a *building site*. The installation of gas *meters* and related piping shall be in accordance with the *International Fuel Gas Code*.
 2. **Liquid fuels.** Liquid fuels including, but not limited, to fuel oil, petroleum based diesel, kerosene, gasoline, bio diesel, methanol, ethanol and butane shall be capable of being *metered* at the *building site* to allow a determination of the gross consumption and peak demand of each liquid fuel use by the *building* and each *building* on a *building site*. The installation of *meters* and related piping shall be in accordance with the *International Mechanical Code*.
 3. **Solid fuels.** Solid fuels including, but not limited to coal, charcoal, peat, wood products, grains, and municipal waste shall have their use determined at the *building site* to allow a determination of the gross consumption and peak demand of each solid fuel use by the *building* and each *building* on a *building site*.
 4. **Electric power.** Electric power shall be capable of being *metered* at the *building site* to allow a determination of the gross consumption and peak demand by the *building* and each *building* on a *building site*. The installation of electric *meters* and related wiring shall be in accordance with NFPA 70.
 5. **District heating and cooling.** Hot water, steam, chilled water, and brine shall be capable of being *metered* at the *building site*, or where produced on the *building site*, to allow a determination of the gross consumption of heating and cooling energy by each *building* on a *building site*. Energy use associated with the production of hot water, steam, chilled water or brine shall be determined based on the fuel used.
 6. **Combined heat and power.** Equipment and systems with a connected load greater than 125,000 *Btu/hr* providing combined heat and power (CHP) shall be capable of being *metered* to allow a determination of the gross consumption of each form of delivered energy to the equipment. The output of CHP shall be *metered* based on the form(s) of output from the CHP.
 7. **Renewable and waste energy.** Equipment and systems providing energy from renewable or waste energy sources, or from which energy is included in the determination of the *building TANEU* shall be capable of being *metered* to allow a determination of the output of such equipment and systems.
 - i. **Solar electric.** Equipment and systems providing electric power through conversion of solar energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.
 - ii. **Solar thermal.** Equipment and systems providing heat to fluids or gases through the capture of solar energy shall be capable of being *metered* such that the peak thermal

- energy (*Btu/hr*) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of heat captured (*Btu*) for delivery to the *building* and its systems can be determined at a minimum of hourly intervals.
- iii. **Waste heat.** Equipment and systems providing energy through the capture of waste heat shall be capable of being *metered* such that the amount of heat captured and delivered to the *building* and its systems can be determined at a minimum of hourly intervals.
 - iv. **Wind Power Systems.** Equipment and systems providing electric power through conversion of wind energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.
 - v. **Other renewable energy electric production systems.** Equipment and systems providing electric power through conversion of other forms of renewable energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.
- C. **Energy load type sub-metering.** For buildings that are 25,000 square feet in total building floor area and larger, all the Energy Load Types as defined above shall be metered using sub-meters or other approved, equivalent methods.
- 1. **Buildings less than 25,000 square feet.** For *buildings* that are less than 25,000 square feet in *total building floor area*, the energy distribution system shall be designed and constructed in such a way as to accommodate the future installation of sub-meters and other *approved* devices. This includes, but is not limited to, providing access to distribution lines and ensuring adequate space for the installation of sub-meters and other *approved* devices.
- D. **Minimum energy measurement and verification.** *Meters* sub-meters, and other *approved* devices installed shall be connected to a data acquisition and management system capable of storing not less than 36 month's of data collected by all *meters* and other *approved* devices and transferring the data in real time to a display.
- 1. **Annual emissions.** The data acquisition and management system shall provide the data necessary to calculate the annual *CO2e emissions* associated with the operation of the *building* and its systems using the results of annual energy use measured. The calculation shall be based on energy measured for each form of energy delivered to the site on an annual basis.
- E. **Energy display.** A permanent, readily accessible and visible display shall be provided adjacent to the main *building* entrance or on a publicly available internet website. The display shall provide all the following:
- 1. The current energy demand for the whole *building* level measurements, updated for each fuel type at the intervals specified above.
 - 2. The average and peak demands for the previous day and the same day the previous year,
 - 3. The total energy usage for the previous twelve (12) months.

Part 3: Execution

- 3.1 Preparation
- 3.2 Installation
- 3.3 Cleaning and Protection

1.9 END OF SECTION 25 13 00

Quality Assurance

- 1.10 Scheduling
- 1.11 Delivery, Storage, and Handling
- 1.12 Regulatory Requirements

Part 2: Products

2.3 Manufactures

2.4 Products

A. ALL INDIVIDUAL EQUIPMENT (APPLICATION SPECIFIC) CONTROLLERS

- 1. Function independently on loss of communication with the central DDC controller.
- 2. Capable of program changes or displaying data while in communication with:
 - i. A portable computer plugged into the central DDC controller.
 - ii. A remote computer via telephone modem through the central DDC controller.
- 3. Locally adjustable address, setpoints and sensor scaling.
- 4. Control by proportional, integral, derivative or combination.
- 5. Proportional heating and cooling with adjustable dead band.
- 6. Either 0 to 10 vdc or 4 to 20 mA proportional output (except VAV boxes).
- 7. Internal switches (or software) for each output to change from direct to reverse acting.

B. MAJOR EQUIPMENT CONTROLLERS

- 1. Locally and centrally control each item of equipment such as an air handling unit, boiler, chiller or tower by a controller mounted on or near that piece of equipment. Preferably boiler plants or the chiller/tower combination may be operated from one controller or directly from the central DDC controller.
- 2. Equipment requires separate controller/s NDIO to the Jace is not acceptable unless approved by PSD
- 3. If not in the specification, PSD shall be consulted about required points for the equipment not listed
- 4. Each individual equipment controller shall have the below listed data (as applicable) readable and command able at the individual equipment controller with the plug-in computer, at the central DDC controller or from a remote computer, as applicable. Design an EIA-232 communication bus or similar capability among major equipment controllers so that the foregoing is possible.
- 5. Percentage data readings must state percent open. NOTE: * = Read only
 - i. Current building KW demand *.
 - ii. Administration area cooling unit on or off.
 - iii. Each air-handling unit:
 - a. Supply fan on/off.
 - b. Exhaust fan on/off.
 - c. Outside air damper percent open.
 - d. Return air damper percent open.
 - e. Exhaust air damper percent open.
 - f. Heating coil valve percent open.
 - g. Cooling coil valve percent open.
 - h. Discharge air pressure using the same pressure sensor used to set the inlet vanes.
 - i. Inlet vane percent open.

- j. Discharge air temperature.
 - k. Smoke detector alarm *.
 - l. Freeze stat alarm *.
 - m. Mixed air temperature.
 - n. Return air temperature.
- iv. Outside air temperature using the sensor which resets heating water temperature*.
- v. Heating system:
- a. Each boiler on or off.
 - b. Boiler pump on or off if applicable
 - c. Heating water pumps on or off.
 - d. Heating pump VFD speed if applicable
 - e. Heating system differential pressure if applicable
 - f. Combustion air damper position
 - g. HWS DP setpoint and reading
 - h. Heating water supply temperature.
 - i. Heating water return temperature *.
 - j. Boiler room temperature
 - k. Alarm status *:
 1. No heating water flow.
 2. Flame failure
 3. Heating water temperature out of limits.
 4. PSD freeze alarm (below 100-degree HWS and below 30 degrees OAT)
- vi. Cooling system
- a. Chiller on or off.
 - b. Chilled water supply temperature.
 - c. Chilled water return temperature *.
 - d. Chilled water pump on or off*.
 - e. Cooling tower off, on low or high speed or VFD feedback *.
 - f. Condenser water supply temperature.
 - g. Condenser water return temperature *.
 - h. Condenser water pump on or off*.
 - i. Alarm status *:
 1. Chiller off when commanded on or chiller on when commanded off.
 2. No chilled water flow when needed.
 3. No condenser water flow when needed.
 4. Report any other chiller alarm as a "Chiller General Alarm Problem".
- vii. Condenser Water System (cooling tower)
- a. Cooling tower fan on or off
 - b. Cooling tower fan VFD feedback
 - c. Cooling water system pumps on or off
 - d. Cooling tower spray pump on or off
 - e. Cooling tower pump on or off
 - f. Condensed water supply temperature
 - g. Condensed water return temperature
 - h. Change over valve position if applicable
 - i. Alarm status
 1. Cooling tower alarm
 2. Vibration alarm if applicable
 3. Water treatment alarm
- viii. Heat pumps

- a. Supply fan on or off
 - b. Supply air temp sensor
 - c. Supply air temp active DAT
 - d. Mixed air temp
 - e. Iso valve status
 - f. Compressor start stop
 - g. Compressor status
 - h. Reversing valve status
 - i. Safety status form the heat pump
 - j. Space temperature
 - k. Cooling set point
 - l. Heating set point
 - m. ERV serving the heating pump supply air temperature
- ix. Energy recovery roof top unit
 - a. Supply fan on or off
 - b. Supply fan VFD speed
 - c. Exhaust fan on or off
 - d. Exhaust fan VFD speed
 - e. Evap cooling on or off if applicable
 - f. Evap leaving temperature
 - g. Exhaust air temperature before cooling section
 - h. Heat wheel on or off
 - i. Heat wheel leaving air temperature
 - j. Freeze stat status
 - k. Smoke detector status
 - l. Supply duct high limit status
 - m. Supply air temperature
 - n. Supply air temperature setpoint
 - o. Duct static pressure setpoint
 - p. Duct static pressure inches water column +/- .01
 - q. Supply air humidity percentage
 - x. Roof top unit with or without DX
 - a. Supply fan on/off.
 - b. Exhaust fan on/off.
 - c. Outside air damper percent open.
 - d. Return air damper percent open.
 - e. Exhaust air damper percent open.
 - f. Heating coil valve percent open.
 - g. Cooling coil valve percent open.
 - h. Discharge air pressure using the same pressure sensor used to set the inlet vanes.
 - i. Discharge air temperature.
 - j. Smoke detector alarm *.
 - k. Freeze stat alarm *.
 - l. Mixed air temperature.
 - m. Return air temperature.
 - n. DX on or off if applicable
 - o. DX cooling capacity if applicable
 - p. Co2 return sensor if applicable
 - q. Duct static pressure inches water column adjustable +/- .01
 - r. Duct static setpoint

- s. Supply fan VFD speed if applicable
- xi. Vertical unit ventilators VUV
 - a. Supply fan on start or stop
 - b. Supply fan speed if applicable
 - c. Low limit status
 - d. DX command on or off if applicable
 - e. Mixed air damper position percent open if applicable
 - f. Outside air damper position percent open if applicable
 - g. Hot water valve position percentage open
 - h. Chilled water valve position percentage open if applicable
 - i. Supply air temperature
 - j. Supply air temperature setpoint
 - k. Exhaust fan on or off if applicable
 - l. Outside air DX lock out set point if applicable
 - m. Space temperature (read only)
 - n. Motion off delay timer if applicable
- xii. Fan coils
 - a. Supply fan start or stop
 - b. Supply fan status
 - c. Supply air temperature
 - d. Supply air temperature active DAT
 - e. Lox limit or freeze stat status
 - f. Hot water valve position percent open
 - g. Mixed air temperature
 - h. Mixed air damper position percent open
 - i. Mixed air damper minimum position percent open
 - j. Return air temperature
 - k. Space temperature
 - l. Active cooling set point
 - m. Active heating set point
- xiii. Exhaust fans
 - a. Fan start or stop
 - b. Fan status
 - c. Fans on wall switches will have no alarms unless fan is for kitchen hoods
- xiv. VAV BOX CONTROLLERS (if applicable)
 - a. Pressure independent control.
 - b. Separate adjustable heating, cooling, and fan maximum and minimum volume setpoints, if applicable.
 - c. Modulate the heating control valve (two-position valves are not permitted).
 - d. Each VAV box locally and centrally controlled by a single controller mounted accessible and near the box.
 - e. Readable and adjustable at each VAV box controller, the central DDC controller or from a remote computer:
 - f. Room heating setpoint temperature, occupied/unoccupied.
 - g. Room cooling setpoint temperature, occupied/unoccupied.
 - h. Maximum cooling velocity or cfm.
 - i. Minimum cooling velocity or cfm.
 - j. Minimum heating velocity or cfm.
 - k. Box fan on-off trip point (as applicable).
 - l. Actual supply air velocity or cfm (read only).

- m. Box fan status (read only, if applicable).
 - n. Actual room temperature (read only).
 - o. Heating valve percent open.
 - p. Actual supply air temperature downstream of the heating coil (read only).
 - q. Active supply temperature setpoint with an override
 - r. Actual supply air temperature (RTU supply temperature) upstream of the VAV box (read for diagnostics only).
- xv. IN-DUCT blower coil heating and cooling
- a. Supply fan on or off
 - b. Supply air temperature setpoint
 - c. Supply air temperature
 - d. Chilled water valve percent open
 - e. Heating water valve percent open
 - f. Mixed damper position (percentage open if applicable)
 - g. Room temperature
 - h. Room cooling setpoint
 - i. Room heating setpoint
 - j. Motion sensor status if applicable
 - k. Motion sensor off delay time if applicable
 - l. Window switch status if applicable
 - m. Smoke damper position pulled to a chart for ease of review on the DDC system
- xvi. IN-DUCT TERMINAL HEATING (or COOLING) CONTROLLERS (for constant volume systems)
- a. Modulate the heating or cooling control valve (two-position valves are not permitted).
 - b. Each heating or cooling control valve locally and centrally controlled by a single controller mounted accessible and near the heating or cooling coil
 - c. Readable and adjustable at each controller, the central DDC controller or from a remote computer:
 1. Room heating setpoint temperature, occupied/unoccupied.
 2. Room cooling setpoint temperature, occupied/unoccupied.
 3. Actual room temperature (read only).
 4. Control valve percent open.
 5. Actual supply air temperature downstream of the coil (read only).
 6. Actual supply air temperature set point downstream of the coil
 7. Actual supply air temperature upstream of the coil (read for diagnostics only).
- xvii. Mode: Occupied, unoccupied, warmup *.
- a. Fan mode continuous or occupied where applicable (CPU labs)
- C. BOILER PLANT CONTROLLER
1. Use the central DDC control panel to sequence the boilers and reset heating water temperature.
 2. Use the central DDC outside air temperature sensor to reset heating water temperature. If a second one is provided for the boiler plant, it remains the consultant's responsibility to specify a location out of the sun and away from any other source of error-producing heat.
 3. Follow the guidelines above for major equipment controllers.
- D. COOLING PLANT OR DX CONTROLLER
1. The chiller/tower/pump combination will usually be supplied with a central controller factory designed to smoothly integrate with each component in the system and this is preferred. It is the Consultant's responsibility to ensure that between the DDC system and the cooling plant controller there are no gaps or overlaps. The DDC system will in most but not all cases be limited to enabling the cooling plant and reading water temperatures but in this case probably not

starting pumps.

2. The DX controller will usually be part of the air handling unit controller but if not, a separate controller for the condensing unit will be required.
 3. Follow the guidelines above for major equipment controllers.
- E. INDIVIDUAL EQUIPMENT CONTROLLER SOFTWARE
1. Routinely report to the central DDC controller.
 2. Continuously poll data for changes at minimum intervals of 100ms.
 3. Continuously accumulate data pulses up to two per second.
 4. Digital outputs in four forms; pulsed, sustained, pulse width modulated and binary staged closures.
 - i. Pulsed closures: 200 milliseconds.
 - ii. Keep sustained closures in the commanded state until receipt of a contrary command.
 - iii. Vary pulse width modulation from 100ms to 255 seconds.
 - iv. Permit up to 25 levels of staging, e.g., boiler modules.

Part 3: Execution

3.4 Preparation

3.5 Installation

- A. Locate each individual equipment controller near the equipment served (inside the building) and label its function.

3.6 Cleaning and Protection

END OF SECTION 25 09 33

SECTION 25 13 00 – INTEGRATED AUTOMATION CONTROL AND MONITORING NETWORK (DASHBOARDS)

Part 1: General

1.9 Summary

- A. Provide requirements that will ensure that *buildings* are constructed or altered in a way that will provide the capability for their energy use, production and reclamation to be measured, monitored and reported. This includes the design of energy distribution systems to isolate load types, the installation of or ability to install in the future *meters*, devices and a data acquisition system, and the installation of or the ability to provide for public displays and other appropriate reporting mechanisms in the future.
- B. All forms of energy delivered to the *building* and *building site*, produced on the *building site* or in the building and reclaimed at the *building site* or in the *building* shall be *metered* and all energy load types measured.
- C. The intent of these requirements is to provide for the ongoing metering, measuring, reporting and display of the energy use, energy demand and emissions associated with the energy use of the whole *building* and its systems

1.10 Related Sections

1.11 Definitions

1.12 Submittals Required

A. Product Data:

B. Samples:

1.13 Quality Assurance

1.14 Scheduling

1.15 Delivery, Storage, and Handling

1.16 Regulatory Requirements

Part 2: Products

2.3 Manufacturers

2.4 Products

- A. **Energy distribution design requirements and load type isolation.** Energy distribution systems within, on or adjacent to and serving a *building* shall be designed such that each primary circuit, panel, feeder, piping system or supply mechanism supplies only one energy use type as defined. The load type served by each supply mechanism shall be clearly designated with the use served, and adequate space shall be provided for installation of *metering* equipment or other data collection devices, temporary or permanent, to measure these loads. The energy distribution system shall be designed to facilitate the collection of data for each of the *building* energy use categories and for each of the end use categories listed. Where there are multiple *buildings* on a *building site*, each *building* shall comply separately.
 1. **Exception:** *Buildings* designed and constructed such that the total usage of each of the load types described shall be permitted to be measured using installed sub- *meters* or other equivalent methods as *approved*.
 2. **HVAC system total energy use.** This category shall include all energy used to heat, cool, and provide *ventilation* to the *building* including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.
 3. **Lighting system total energy use.** This category shall include all interior and exterior lighting used in occupant spaces and communal areas.
 4. **Energy used for building operations.** This category includes all energy use by vertical transportation systems, automatic doors, motorized shading systems, ornamental

fountains and *fireplaces*, swimming pools, snow-melt systems, and all other *building* operations.

5. **Miscellaneous loads.** Loads other than those specified.
- B. **Energy type metering.** *Buildings* shall be provided with the capability to determine energy use and peak demand for each of the energy types. Utility energy *meters* shall be permitted to be used to collect whole *building* data, but, shall be equipped with a local data port connected to a data acquisition system.
1. **Gaseous fuels.** Gaseous fuels including, but not limited to, natural gas, LP gas, coal gas, hydrogen, landfill gas, digester gas and biogas shall be capable of being *metered* at the *building site* to determine the gross consumption and peak demand of each different gaseous fuel by the *building* and each *building* on a *building site*. The installation of gas *meters* and related piping shall be in accordance with the *International Fuel Gas Code*.
 2. **Liquid fuels.** Liquid fuels including, but not limited, to fuel oil, petroleum based diesel, kerosene, gasoline, bio diesel, methanol, ethanol and butane shall be capable of being *metered* at the *building site* to allow a determination of the gross consumption and peak demand of each liquid fuel use by the *building* and each *building* on a *building site*. The installation of *meters* and related piping shall be in accordance with the *International Mechanical Code*.
 3. **Solid fuels.** Solid fuels including, but not limited to coal, charcoal, peat, wood products, grains, and municipal waste shall have their use determined at the *building site* to allow a determination of the gross consumption and peak demand of each solid fuel use by the *building* and each *building* on a *building site*.
 4. **Electric power.** Electric power shall be capable of being *metered* at the *building site* to allow a determination of the gross consumption and peak demand by the *building* and each *building* on a *building site*. The installation of electric *meters* and related wiring shall be in accordance with NFPA 70.
 5. **District heating and cooling.** Hot water, steam, chilled water, and brine shall be capable of being *metered* at the *building site*, or where produced on the *building site*, to allow a determination of the gross consumption of heating and cooling energy by each *building* on a *building site*. Energy use associated with the production of hot water, steam, chilled water or brine shall be determined based on the fuel used.
 6. **Combined heat and power.** Equipment and systems with a connected load greater than 125,000 *Btu/hr* providing combined heat and power (CHP) shall be capable of being *metered* to allow a determination of the gross consumption of each form of delivered energy to the equipment. The output of CHP shall be *metered* based on the form(s) of output from the CHP.
 7. **Renewable and waste energy.** Equipment and systems providing energy from renewable or waste energy sources, or from which energy is included in the determination of the *building TANEU* shall be capable of being *metered* to allow a determination of the output of such equipment and systems.
 - i. **Solar electric.** Equipment and systems providing electric power through conversion of solar energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.
 - ii. **Solar thermal.** Equipment and systems providing heat to fluids or gases through the capture of solar energy shall be capable of being *metered* such that the peak thermal

- energy (*Btu/hr*) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of heat captured (*Btu*) for delivery to the *building* and its systems can be determined at a minimum of hourly intervals.
- iii. **Waste heat.** Equipment and systems providing energy through the capture of waste heat shall be capable of being *metered* such that the amount of heat captured and delivered to the *building* and its systems can be determined at a minimum of hourly intervals.
 - iv. **Wind Power Systems.** Equipment and systems providing electric power through conversion of wind energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.
 - v. **Other renewable energy electric production systems.** Equipment and systems providing electric power through conversion of other forms of renewable energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15-minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.
- C. **Energy load type sub-metering.** For buildings that are 25,000 square feet in total building floor area and larger, all the Energy Load Types as defined above shall be metered using sub-meters or other approved, equivalent methods.
- 1. **Buildings less than 25,000 square feet.** For *buildings* that are less than 25,000 square feet in *total building floor area*, the energy distribution system shall be designed and constructed in such a way as to accommodate the future installation of sub-*meters* and other *approved* devices. This includes, but is not limited to, providing access to distribution lines and ensuring adequate space for the installation of sub-*meters* and other *approved* devices.
- D. **Minimum energy measurement and verification.** *Meters* sub-*meters*, and other *approved* devices installed shall be connected to a data acquisition and management system capable of storing not less than 36 month's worth of data collected by all *meters* and other *approved* devices and transferring the data in real time to a display.
- 1. **Annual emissions.** The data acquisition and management system shall provide the data necessary to calculate the annual *CO2e emissions* associated with the operation of the *building* and its systems using the results of annual energy use measured. The calculation shall be based on energy measured for each form of energy delivered to the site on an annual basis.
- E. **Energy display.** A permanent, readily accessible and visible display shall be provided adjacent to the main *building* entrance or on a publicly available internet website. The display shall provide all the following:
- 1. The current energy demand for the whole *building* level measurements, updated for each fuel type at the intervals specified above.
 - 2. The average and peak demands for the previous day and the same day the previous year,
 - 3. The total energy usage for the previous twelve (12) months.

Part 3: Execution

- 3.4 Preparation
- 3.5 Installation
- 3.6 Cleaning and Protection

END OF SECTION 25 13 00

Exhibit C

PSD TECHNICAL SPECIFICATION

DIVISION 23 Heating, Ventilation, and Air Conditioning

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SECTION 23 05 00 – COMMON WORK RESULTS FOR HVAC

Part 1: General

1.01 Summary

THERMAL COMFORT DESIGN CONDITIONS

1. For outdoor design conditions, confirm climate zone design parameters and discuss with project manager. PSD specifies:
 - i. Cooling 90°F dry bulb
 - ii. Heating 5°F dry bulb
2. For indoor design calculations, the following conditions should be used unless otherwise discussed with project manager.
 - i. Cooling 72°F dry bulb
 - ii. Heating 72°F dry bulb

PSD has demonstrated significant energy savings through space cooling systems, which account for over 15.4 percent of electricity used in commercial buildings. According to CEE (Consortium for Energy Efficiency), studies show that at least 25 percent of all rooftop units are oversized resulting in increased energy costs and increased equipment wear. Properly sized equipment dramatically cuts energy costs, increases the life of the equipment, cuts utility bills, and reduces pollution. PSD specifies cooling load to not exceed 1 ton/1,000 sq. ft. C. It is desirable that the most energy efficient options be considered, including:

Outside air for cooling systems: Systems should be designed with economy cycles that automatically allow the quantity of outside air supplied to the building to be varied to net maximum efficiency while maintaining indoor air quality.

Energy and/or heat recovery systems: Systems should be designed to provide as close to balanced outdoor and exhaust airflows as is practical for maximum benefit and efficiency.

Related Sections

Definitions

EER (energy efficiency ratio) is the cooling capacity (in Btu/hour) of the unit divided by its electrical input (in watts) at standard peak rating conditions.

SEER (seasonal energy efficiency ratio), unlike EER, but weighs performance during the cooling season.

COP (coefficient of performance) is the heating capacity (in Btu/h) at standard heating conditions divided by its electrical input (also in Btu/h).

HSPF (heating seasonal performance factor) weighs heating performance at various conditions.

AFUE (annual fuel utilization efficiency): of heat output of the furnace or boiler compared to the total energy consumed by a furnace.

Submittals Required

Quality Assurance

Scheduling

Delivery, Storage, and Handling

Regulatory Requirements

Part 2: Products

Manufacturers

Products

A. NOISE AND VIBRATION CONTROL

1. Provide vibration isolators for motor driven equipment. Vibration isolators shall be Mason Industries, Inc., Vibration Mountings and Control Co., Korfund, Anaconda, Flexonics, Hydro-Flex, Resistoflex.

B. Electric Motors: All three-phase motors are protected by a phase monitors.

Include the following features on all motors:

Ball bearings with lube lines extended to accessible location.

Cast iron or steel base with provision for slide adjustment unless directed otherwise.

Conduit box with ample room for lead terminal connections.

Numbered leads of ample length for connection, terminating in the conduit box.

Permanently stamped nameplate.

Single speed 1750 RPM, unless specified otherwise.

Rated for continuous duty in ambient, not exceeding 40°C.

All motor wiring and windings shall be copper.

Power Factor:

Motors shall have a labeled power factor, at nameplate rating and rated voltage, of not less than 85%. For motors 5 hp and greater and not less than 80% for motors smaller than 5hp. If a motor draws less than 1000 watts labeled rating, it is excluded from the above P.F. requirement. If, through motor or design (i.e., RPM less than 1200), an 85% power factor is not available, the supplier of that motor shall furnish power factor correction components capable of correcting that non-conforming motor to 90% or better.

Energy Efficiency:

Electric motors less than 1 hp and greater than/equal to 0.5 hp shall be specified as Electronically Commutated Motor (ECM) type.

Electric motors 1 hp and greater shall be of the premium efficiency type as defined by the Consortium for Energy Efficiency (CEE). Motors shall have a nominal nameplate efficiency that meets or exceeds the values in Table 1. Those motors that exceed the efficiency requirements listed in Table 1 by at least one numeric percent qualify as an "Enhanced" Premium efficient electric motor under the Xcel Energy Rebate program.

Table 1 - CEE PREMIUM EFFICIENCY™ CRITERIA

Nominal Full Load Efficiencies							
Covered Equipment 1-200 horsepower NEMA design A and B, three phase, integral horsepower, general purpose motors (1200, 1800, 3600 RPM).							
Open Drip-Proof (ODP)				Totally Enclosed Fan-Cooled (TEFC)			
Horsepower	1200 RPM	1800 RPM	3600 RPM	Horsepower	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	77.0	1	82.5	85.5	77.0
1.5	86.5	86.5	84.0	1.5	87.5	86.5	84.0
2	87.5	86.5	85.5	2	88.5	86.5	85.5
3	88.5	89.5	85.5	3	89.5	89.5	86.5
5	89.5	89.5	86.5	5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	7.5	91.0	91.7	89.5

10	91.7	91.7	89.5		10	91.0	91.7	90.2
15	91.7	93.0	90.2		15	91.7	92.4	91.0
20	92.4	93.0	91.0		20	91.7	93.0	91.0
25	93.0	93.6	91.7		25	93.0	93.6	91.7
30	93.6	94.1	91.7		30	93.0	93.6	91.7
40	94.1	94.1	92.4		40	94.1	94.1	92.4
50	94.1	94.5	93.0		50	94.1	94.5	93.0
60	94.5	95.0	93.6		60	94.5	95.0	93.6
75	94.5	95.0	93.6		75	94.5	95.4	93.6
100	95.0	95.4	93.6		100	95.0	95.4	94.1
125	95.0	95.4	94.1		125	95.0	95.4	95.0
150	95.4	95.8	94.1		150	95.8	95.8	95.0
200	95.4	95.8	95.0		200	95.8	96.2	95.4

Single Phase Motors: Furnish for all applications 1/6 through 3/4 HP, single phase, capacitor start, capacitor run, drip-proof, thermally protected motors, for 120 volt 60 hertz current.

Three-Phase Motors: Furnish for all applications 1 HP and larger, 3-phase general purpose, drip-proof, squirrel cage induction motors, for 208V, 60Hz current.

Motors used with adjustable speed drives to be inverter duty and compatible with the drive.

Motors to be sized for an operating load factor between 60% and 75%.

For 208 volt three-phase power, 200 volt motors are to be used. 208-230 volt motors are not acceptable for 208 volt power.

2. V-Belt Drives:

i. Capacity of V-Belt Drives at rated RPM shall be not less than 150% of motor nameplate horsepower rating.

3. Motor starters:

i. Starters shall be across-the-line, with manual reset, trip-free thermal overload relay in each ungrounded conductor, necessary auxiliary contacts, proper NEMA Standard enclosure for location, and hand-off-automatic switches in cover. Provide H-O-A magnetic motor starters for all 3-phase motors. Provide manual motor starters for locally controlled single-phase motors. For single-phase motors interlocked with external devices provide H-O-A magnetic starters or relay and switch rated at locked rotor motor amps and manual starter. Starters, except those furnished mounted in or on equipment, shall be by the same one of the following manufacturers:

Sprecherschuh preferred.

Cutler Hammer.

Square D

ii. For all motors, devices to protect the motor against loss of phase (single phasing protection) shall be provided. Devices to meet this requirement shall be of the current sensing type, and may be provided either as an integral part of the thermal

overload or as a separate device. Units shall have manual reset and adjustable limits. Provide an approved reduced voltage starter, such as a closed transition autotransformer type.

Variable Frequency Drives:*

ABB is PSD's standard/preferred for VFD, Yaskawa approved alternative, Square D not accepted

Variable Frequency Drives shall have separate phase monitors.

- ii. No NEMA 3R Variable Frequency Drives to be mounted outside.
- iii. Drive shall convert the constant frequency AC line voltage to a variable frequency, variable voltage AC output suitable for control of a standard NEMA design B induction motor over a 6:1 speed range.

Provide secondary starters to control motors independently of variable frequency drives, single speed, in case of VFD failure.

Drives shall be as manufactured by ABB, or equal as approved (Yaskawa) by the Engineer and Owner.

Variable Frequency Drives for motors 5 HP and less shall have the following features:

Controller input: 230 volts, 1 phase, 60 Hz.

Controller output: 0-230 volts, 3 phase, 0-60 Hz. Where 480 volt service is used, drive manufacturer shall provide a 480/230 volt single phase isolation transformer with the VFD.

Controller Type: Transistorized "six-step" type, designed to minimize harmonic generated noise in the motor and on the line.

AC line fuses and/or circuit breaker, with voltage transient protection.

Control circuit transformer with 24 volt fused secondary.

Manual speed potentiometer, HAND-AUTO switch, and 4-20 milliamp signal follower, fully isolated and suitable for grounded or ungrounded input signal.

Instantaneous overcurrent shutdown with indicator light when current exceeds 150%. Provide time-overcurrent overload protection for the motor.

Current limiting protection to shut down drive under output short circuit conditions without damage to the controller.

Minimum and maximum speed adjustments.

Variable Frequency Drives for motors shall have the following features:

Controller Input: [460] [230] [208] volts, 3 phase, 60 Hz.

Controller Output: 0-[460] [230] [208] volts, 3 phase, 0-60 Hz.

Controller Type: "Six-step" type, designed to minimize harmonic generated noise in the motor and on the line.

Overcurrent rating: 150% for one minute, minimum.

Enclosure type: NEMA 1.

AC line fuses and/or circuit breaker.

AC line reactors in the drive cabinet for protection without requirement for an input isolation transformer.

Control power transformer with fused primary and 24v or 120v fused secondary.

Manual speed potentiometer, hand-auto switch, and 4-20 milliamp signal follower, fully isolated and suitable for grounded or ungrounded input signal.

Instantaneous overcurrent shutdown with indicator light when current exceeds 150%. Inverse characteristic time-overcurrent overload protection for the motor.

Current limiting protection to shut down drive under output short circuit conditions without damage to the controller.

Input phase loss and undervoltage protection.

Drive shall ride through a momentary power interruption of up to 400 milliseconds without tripping.

Torque/current limit control which will slow the motor without tripping when the motor is subjected to an overload or when accelerating a high inertia load.

Troubleshooting diagnostic features:

- Diagnostic test meter with selector switch to monitor internal power supply voltages, input and output amps, speed reference signal.
- LED indicators for instantaneous overload, motor overload trip, GTO or SCR status, current limit, and other drive functions as required.
- Test mode switch to allow operation and setup of control electronics with power circuitry disabled UL listed.

Part 3: Execution

Preparation

Installation

Cleaning and Protection

A. DISINFECTING AND SPECIAL CLEANING 1.

Ductwork Systems:

- i. As the system of ductwork, supplying air to the building is put into service in whole or in part, provide 2" pleated filters at fan intake to keep the mechanical system and building clean.

END OF SECTION 23 05 00

SECTION 23 05 29 – HANGERS AND SUPPORTS HVAC

Part 1: General 1.01

Summary

Types of supports and anchors specified in this section include the following:

- Hanger-Rod Attachments.
- Building Attachments.
- Saddles and Shields.
- Spring Hangers and Supports.
- Miscellaneous Materials.

Roof Equipment Supports.

Anchors.

Equipment Supports.

Supports and anchors furnished as part of factory- fabricated equipment are specified as part of equipment assembly in other sections.

Related Sections

Definitions

Submittals Required: Product Data, Shop Drawings, Certifications, O&M data

Quality Assurance

Scheduling

Delivery, Storage, and Handling

Regulatory Requirements

Part 2: Products

Manufactures

Products

MISCELLANEOUS MATERIALS

Steel Plates, Shapes, and Bars: ASTM A 36.

Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

ROOF EQUIPMENT SUPPORTS

General: Construct roof equipment supports using minimum 18-ga galvanized steel with fully mitered and welded corners, 3" cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, 18-ga galvanized steel counterflashing and rigid insulation.

Configuration: Construct of sizes as indicated, compensate for slope in roof so top of support is dead level.

Part 3: Execution

3.01 Preparation A.

INSPECTION

B. PREPARATION

3.02 Installation

SHEET METAL DUCT HANGERS AND SUPPORTS

EQUIPMENT SUPPORTS

Housekeeping bases shall be 4" thick minimum, extended 4" beyond machinery bedplates.

SPIRAL LOCK SEAM DUCT HANGERS AND SUPPORTS D. PREFABRICATED ROOFTOP EQUIPMENT

SUPPORTS 1. Equipment Bases:

- i. Equipment base: shall be solid top, equipment base with integral duct curb, and stepped cant to match roof insulation. Base: shall pitch to match roof pitch and provide level unit installation.
- ii. Base: shall be constructed of reinforced 18 gauge galvanized steel, with all welded components, full mitered corners, factory installed 1-1/2" thick rigid fiberglass insulation, wood nailer, and galvanized steel counter-flashing. Base shall be shipped as one piece.

All supports shall be installed in accordance with manufacturer's recommendations.

E. FLASHING AND SAFING

As needed for weather or water-proofed walls, floors, and roofs.

Lead flashing around ducts and pipes passing from equipment rooms, for sound control. F.

SLEEVES AND SEALS

1. Ducts

Roof curbs for duct penetrations REQUIRED.

Counterflash REQUIRED.

3.03 Cleaning and Protection

END OF SECTION 23 05 29

SECTION 23 05 53 – IDENTIFICATION FOR HVAC EQUIPMENT

Part 1: General

1.01 Summary

A. Types of identification devices specified in this section include the following

Plastic Tape.

Plastic Duct Markers.

Valve Tags.

Valve Schedule Frames.

Engraved Plastic-Laminate Signs.

Equipment Markers.

Plasticized Tags.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: PRODUCT DATE, SCHEDULES

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

A. MECHANICAL EQUIPMENT IDENTIFICATION

1. General: Install equipment marker on each individual items of mechanical equipment.

Provide signs for the following general categories of equipment.

Main building systems control and operating valves, including safety devices and hazardous units such as gas outlets.

Room thermostats. iii. Fuel-burning units including boilers and water heaters. iv. Pumps, chillers, and similar motor-driven units. v. Fans and blowers.

HVAC units.

Tanks and pressure vessels.

Water treatment systems and similar equipment.

2. Text of Signs: In addition to the identified unit, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.03 Cleaning and Protection

- A. View of mechanical identification devices ARE NOT TO BE OBSTRUCTED.

END OF SECTION 23 05 53

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required: See Div 1
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

Balancing shall be done by a firm specializing in this work.

Griffith Engineering Service, Denver, Colorado.

Fort Collins/Midwest.

TAB Services of Denver, Colorado.

Lawrence H. Finn & Assoc., Greeley, Colorado.

JPG Engineering, Sedalia, Colorado.

Air-Right, Denver, Colorado.

2.02 Products

Part 3: Execution

Preparation

Installation A. GENERAL

Firm having total professional responsibility for the final testing, adjusting and balancing of the entire system, air and hydronic. All balancing shall be performed by qualified technicians in the employ of the pre-qualified firm.

Instruments shall be used and applied which are best suited to the system function being tested. Instruments shall be in first- class state of repair and have been calibrated within a period of six months prior to starting the job. Instruments shall be recalibrated upon completion of the job if required by the Design Engineer to prove reliability.

All air systems and all hydronic systems shall be balanced using an applicable proportionate procedure.

After all adjustments are made; a detailed written report shall be prepared and submitted for approval. Final acceptance of this project will not be made until a satisfactory report is received and field verified.

The Design Engineer will field verify the report in the following manner:

- i. Select quantities to be tested at random. (Quantity shall not exceed 10% of total.)
- ii. Require balancing firm to read the quantities in his presence.
- iii. Field tested values shall be within plus or minus 10%.

AIR BALANCING PROCEDURES

Before any adjustments are made, room is to be closed off with windows & doors closed. The systems are to be checked for such items as dirty filters, duct leakage, damper leakage, equipment vibrations, correct damper operations, etc. All fan systems, major duct sections, registers, diffusers, etc., are to be adjusted to deliver design air quantities within plus or minus 5%. Individual air outlets, when one of three or more serving a space, may have a tolerance of 10% above average. Design CFM is based on filters being approximately 50% loaded with dirt at 0.45" SPD. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed, check motor amperage with the filters clean.

Exhaust and recirculation air systems shall be adjusted for air and the proper relationship between supply and exhaust established.

Distribution system shall be adjusted to obtain uniform space temperatures free from objectionable drafts and noise within the capabilities of the system.

Sheaves and/or belts shall be exchanged as required to adjust the RPM of all fans so they handle specified air quantity.

HYDRONIC BALANCING PROCEDURES

Before any adjustments are made, strainers shall be cleaned, temperature control valve operation shall be checked, pump rotation shall be checked, pressure reducing valves shall be adjusted, etc.

Using system flow meters and P/T taps, the balancing firm shall adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, etc., to meet design requirements.

Test the hydronic fluid with a refractometer as manufactured by Misco Co., or prior approved equal, for 30% propylene glycol, or analysis by Dow Chemical Co.

MISCELLANEOUS

All installed thermal overload protection shall be observed and noted in the data sheets. If thermal overload protection is incorrect, it shall be the responsibility of the balancing firm to see that proper overload protection is installed at the completion of the job.

The adjusting crew shall measure and set any special conditions; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in "REPORT" below.

All balancing devices, i.e., dampers and valves shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.

When deemed necessary, 24-hour space temperature recording shall be taken and any required partial rebalance of the system shall be performed without additional cost.

Boiler efficiency shall be checked and results included in this report, either by the boiler manufacturer's representative or by the Balancing Contractor. Efficiency shall be measured either by flue gas temperature and percent carbon dioxide or by the ratio of output Btuh to input Btuh. Output Btuh shall be by GPM flow through the boiler and temperature rise. Input Btuh shall be by full firing rate CFM of gas through the gas meter, converted to Btuh.

3.03 Cleaning and Protection

END OF SECTION 23 05 93

SECTION 23 07 00 – HVAC INSULATION

Part 1: General 1.01

Summary

A. Types of mechanical insulation specified in this section include the following:

Equipment Insulation: Fiberglass. Calcium Silicate

Ductwork System Insulation: Fiberglass.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Samples

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation A.

INSPECTION

3.02 Installation

EQUIPMENT INSULATION

1. Cold Equipment (Below Ambient Temperature):

i. Application Requirements: Insulate the following cold equipment:

Refrigeration equipment, including chillers, tanks and pumps, including any cold surfaces not factory insulated.

Drip pans under chilled equipment.

Cold water storage tanks.

Cold and chilled water pumps.

Expansion tanks.

Air separators. ii. Insulate each item of equipment specified above with the following types and thicknesses of insulation:

Rigid Fiberglass: 2" thick for surfaces above 35 deg. F (2 deg. C) and 3" thick for surfaces 35 deg. F (2 deg. C) and lower.

Flexible Elastomeric Sheet: 3/4" thickness for surface temperatures above 35oF (2oC), 1" thickness for surface temperatures below 35oF (2oC).

2. Hot Equipment (Above Ambient Temperature):

i. Application Requirements: Insulate the following hot equipment:

Boilers (not pre-insulated at factory).

Hot water storage tanks.

Water heaters (not pre-insulated at factory)

Hot water expansion tanks.

Hot water pumps.

Air separators. ii. Insulate each item of equipment specified above with the following types and thicknesses of insulation:

a. Fiberglass: 2" thick. Do not use for equipment above 450°F (232°C).

SOUND INSULATION

1. Sound insulation shall be applied to the interior of ducts as listed below:

i. All exhaust, relief, and return ducts and all rectangular supply ducts.

INSTALLATION OF EQUIPMENT INSULATION

3.03 Cleaning and Protection

END OF SECTION 23 07 16

SECTION 23 30 00 – HVAC AIR DISTRIBUTION

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

A. Codes and Standards:

1. ASHRAE 62: Meet or exceed standard.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

BALANCING DAMPERS*

1. Approved manufacturers ONLY. Install upstream of each supply register or diffuser.

SHEET METAL WORK – LOW VELOCITY SYSTEMS

All ductwork located where exposed to the weather shall be of double wall insulated construction. Interior sheet shall be of same material as connecting from inside of building. Exterior sheet exposed to weather shall be zinc-coated iron or steel sheet. Insulation shall be one inch thick, 3-pound density fiberglass. All exterior seams shall be soldered watertight. All interior joints shall be coated with Minnesota Mining's Scotchweld adhesive No. 1838 B/A or equal. All ductwork shall be constructed in accordance with requirements for Low Velocity System, SMACNA. EXHAUST FANS*

Manufactured by Penn, Pace, Acme, Cook, Jenn-Air, Greenheck, or approved equal. 12" minimum roof curb and neoprene gasket required.

All exhaust fans over 1/4 horsepower shall be belt driven.

All fans shall be dynamically and statically balanced at the factory.

Fan ratings shall be based upon tests performed in strict accordance with the AMCA Standard 210-67 Test Code for Air Moving Devices. Each fan shall carry, near the manufacturer's nameplate, the seal authorized by AMCA indicating that ratings are certified. Fans not bearing this seal will not be acceptable.

STATIONARY LOUVERS*

Manufactured by American Warming and Ventilating, Arrow, Industrial Louvers, Dowco, Louvers and Dampers, Inc., or approved equal.

Provide anchor clips and caulk as required for a sound, watertight installation. Make airtight duct connections to installed louvers.

KILN HOOD, KH-1*

1. Acceptable Manufacturers:

- i. Vent-A-Kiln Corp. No substitutes. Model No. 1437, 37" hood diameter with standard overhead counterweight pulley system. System is to be complete with appropriate exhaust fan, 2 speed control, flexible exhaust duct, etc., as needed.

2. System is to be complete with mechanical and electrical connections. Motor 1/25 HP, 115 V, with cord and plug.

ROOFTOP AIR CONDITIONING*

1. Manufacturers

- i. Prior Approved product.

2. General:

- i. Exterior Surfaces: Phosphatized, zinc-coated steel with epoxy resin primer and baked enamel finish.

Controls: All RTU's will be digital ready and compatible with BAS system being used. No factory controllers that must interface with BAS allowed. BAS will run and control RTU.

Minimum efficiency of Unitary Air Conditioners and Condensing Units. All packaged units shall have a minimum ARI rated efficiency meeting or exceeding the Minimum Required Efficiency listed below. (Note: The efficiency levels from the 2011 standards are listed here. Check www.xcelenergy.com for future updates).

Item (Rooftop AC Units & Condensing Units)	Min. Required Efficiency
Air Cooled < 65,000 Btuh (< 5.4 tons)	13.5 SEER
Air Cooled 65,000 – 135,000 Btuh (5.5 – 11.3 tons)	11.0 EER
Air Cooled 135,000 – 240,000 Btuh (11.4 – 19.9 tons)	10.8 EER
Air Cooled 240,000 – 760,000 Btuh (20 – 63.3 tons)	9.8 EER
Air Cooled > 760,000 Btuh (> 63.3 tons)	9.4 EER
Condensing Unit > 65,000 Btuh and > 5.4 tons	11.0 EER

Minimum efficiency of packaged terminal air conditioners. All PTAC's shall have a minimum ARI rated efficiency meeting or exceeding the Minimum Required Efficiency listed below. (Note: The efficiency levels from the 2011 standards are listed here. Check www.xcelenergy.com for future updates).

Item (Packaged terminal air conditioners)	Minimum Required Efficiency
PTAC's	11.0 EER

FIRE DAMPERS*

Install fire damper with code-approved sleeves in all duct openings AS NEEDED. Fabricated and installed in accordance with the UL requirements and bearing UL-label, with access door in duct, folding blade dampers with fusible link, Ruskin IBD, Tuttle & Bailey, Prefco LP Series, Air Balance 119, United Sheet Metal, National Controlled Air VB and HB, or equal, use frame CR for all round ducts. Use frame B for rectangular and square ducts.

Provide ceiling mounted fire dampers to protect grille, register, and diffuser ceiling penetrations where indicated on plans. Unit shall be UL labeled for protection against fire and heat radiation in a roof-ceiling assembly. Damper units shall be Model CFS by National Controlled Air, Inc., or Air Balance Model 219.

FIRE/SMOKE DAMPERS*

Install fire/smoke damper with code-approved sleeves. Fabricated and installed in accordance with the UL requirements and bearing UL-label, with access door in duct, multiple blade dampers with fusible link and electric operator.

Damper to be similar to Prefco Products Inc. Model 5010 with 120-volt electric damper operator Model 5920 with reusable electric McCabe Link and automatic damper reset. Must satisfy UL 33, UL 873, UL 555S, and UL 86A.

Damper shall be able to open and/or close in 15 seconds, from signal from smoke detector, and shall fail closed on loss of power.

Acceptable Manufacturers:

- i. Prefco.
- ii. Ruskin.
- iii. Tuttle & Bailey.
- iv. Air Balance.
- v. United Sheet Metal.
- vi. National Controlled Air.
- vii. Or Approved Equal.

COMBINATION FIRE/SMOKE DAMPERS WITH INTEGRAL DUCT SMOKE DETECTORS

Motor-Driven Smoke Dampers: Provide UL labeled, Class II minimum, motor-driven smoke dampers in sizes indicated, with casing constructed of 16 gauge steel with bonded red acrylic enamel finish, type 304 stainless steel side seals, stainless steel edge seals, bronze oilite bearings, single lock blades, with damper factory mounted electric motor, stainless steel closing springs, motor mounting bracket, along with the following features. Temperature class 250°F.

Out of airstream in-jamb linkage with stainless steel pivots.

The electric damper actuator shall be 120-volt, 2-position motor designed to power open and fail closed.

Damper actuator shall fail close upon loss of power.

Type B or C housing for respective duct type.

U.L. 555 (minimum)

Leakage not greater than 10 CFM per square foot at 1" W. C. pressure differential.

Integral Duct Smoke Detector: Each fire/Smoke damper shall be provided with a factory mounted duct smoke detector. Detector shall be photoelectric type, with sampling tube, 120V connection, and auxiliary contacts for fire alarm system connection. Detector shall be suitable for 300-4,000 fpm duct velocity, 32° F to 120°F air temperature.

Combination Fire/Smoke Dampers shall be factory-wired to accept 120V service, and fire alarm connections for completely functional damper operation.

Ruskin Model FSD60, with DSDF duct smoke detector, or equivalent.

Part 3: Execution

Preparation

Installation

Hang ducts from beams and joists whenever possible. REGISTERS, GRILLES, AND DIFFUSERS* 1.

Adjust air pattern controllers so that drafts are not created.

2. Selection based on NC less than 30.

RELIEF/INTAKE HOODS (RH & IH)*

1. Hoods to be manufactured by Penn, Greenheck, Jenn-Air, Loren Cook, Louvers & Dampers, Inc., Acme, or approved equal.

Units shall be furnished complete with bird screen and anti-condensate coating.

3.03 Cleaning and Protection

END OF SECTION 23 30 00

SECTION 23 31 13 – DUCTWORK

Part 1: General

1.01 Summary

A. Extent of metal ductwork

DUCT SERVICE	TYPE/CONSTRUCTION
Supply air between fan and terminal boxes (medium pressure).	Galvanized steel, spiral, round or rectangular factory fabricated.
Rectangular supply air from discharge of terminal box to air devices (low pressure).	Galvanized sheet metal spiral round or rectangular factory or shop fabricated.
Return air ductwork.	Galvanized steel; factory or shop fabricated.
General building exhaust.	Galvanized sheet metal; factory or shop fabricated.
Transfer ducts.	Internally lined galvanized sheet metal as described above for low pressure supply; factory or shop fabricated.
Sound elbows for R.A. grilles	Galvanized sheet metal (internally lined).
Outdoor air intake ductwork.	Galvanized sheet metal, rectangular, factory or shop fabricated.
Kitchen grease exhaust.	Carbon steel all welded construction per local code and latest NFPA 96. Provide fire-rated external duct wrap as specified.
Exterior uninsulated ductwork.	Aluminum or painted galvanized.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Record Drawings, Maintenance Data

1.05 Quality Assurance

Manufacturer's Qualifications: similar service for not less than 5 years.

Installer's Qualifications: at least 3 years of successful installation C. References to SMACNA, ASHRAE and NFPA are minimum requirements.

D. Codes and Standards:

1.06 Scheduling

1.07 Delivery, Storage, and Handling

Protection Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

Cleaning: Clean shop and factory-fabricated ductwork and accessories at the time of fabrication, and protect from dirt and debris with shrink-wrap or equivalent pallet wrap. C. Storage: store ductwork inside and protect from weather.

D. Temporary Closure: At ends of ducts polyethylene film or other covering

1.08 Regulatory Requirements

1.09 Exposed ductwork in classrooms/throughout building (approach to be approved by PSD in full): A.

Painting is not required.

Collars required at all penetrations (at ceilings, etc.).

Sealing of penetration required if angle of ceiling/barrier does not allow a collar (caulking).

Exposed duct to be cleaned and undamaged – left in a finished condition. Pookied joints are to be covered/not left exposed.

Part 2: Products

Manufactures

Products

DUCTWORK MATERIALS

- 1. Exposed Ductwork Materials: Free from visual imperfections including pitting, seam marks, roller marks, stains, dents, discolorations, and other imperfections, including those which would impair painting.

DUCTWORK

- 1. External Wrap (Thermal):
 - i. Do not install insulation over access panels.
- 2. Internal Liner (Sound) (Rectangular Ducts):

FACTORY-FABRICATED MEDIUM PRESSURE DUCTWORK

General: Provide factory-fabricated duct and fittings. All fittings shall be low loss conical type.

Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gages listed.

Diameter	Minimum Gauge	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam

Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct. Provide internal stiffener rings and external reinforcement as required to meet operating static pressures.

Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.

Diameter	Minimum Gage
----------	--------------

3" to 36"	20
38" to 50"	18

3. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, in minimum gages listed.

Maximum Width	Minimum Gauge
Under 25"	24
25" to 48"	22

i. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams.

4. Internally Insulated Duct and Fittings: Construct with outer pressure shell, 1" thick insulation

layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 12"	26 ga.	24 ga.
13" to 24"	24 ga.	24 ga.
25" to 34"	22 ga.	24 ga.
35" to 48"	20 ga.	24 ga.

i. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams of outer shell.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 ga.	20 ga.
36" to 48"	18 ga.	20 ga.

Part 3: Execution

Preparation

Installation

A. INSTALLATION OF METAL DUCTWORK

All ductwork shall be sealed.

Routing: vertically and horizontally and avoid diagonal runs wherever possible. Run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Locate insulated ductwork for 1" clearance outside of insulation. Conceal

ductwork from view, PSD IS OPEN TO EXPOSED DUCT – SITE SPECIFIC. Do not encase horizontal runs in solid partitions.

Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.

Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on all four sides by at least 1 1/2". Fasten to duct only.

DUCTWORK AND DUCT ACCESSORIES

General: Interior of all ducts shall be smooth and free from obstruction with joints welded or brazed and held air tight with "hard cast" mineral impregnated woven fiber tape.

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

Materials:

Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A90/A90M.

Touch up bare steel areas with Zincilate 810-C, zinc-rich coating.

Duct, fittings and appurtenances shall be manufactured by the Kirk & Blum Manufacturing Company or approved equal.

4. Ductwork:

The following minimum metal thickness shall be applied:

<u>Diameter</u>	<u>U.S. Standard Gage for Class 1</u>
Less than 8 inch	22 gage
8 inch to 18 inches	20 gage
20 to 30 inches	18 gage

Fabricate and support [to UL 181] in accordance with SMACNA [HVAC Duct Construction Standards - Metal and Flexible 2 inch pressure class, Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard, and ACGIH Industrial Ventilation Manual.

T's, bends, and elbows shall be welded high-pressure type.

INSTALLATION OF FLEXIBLE DUCTS

Maximum Length: For any duct run using flexible ductwork, do not exceed 5' - 0".

Lay in diffusers will require adjustable 90 for flex connection.

No flex connected directly to lay in diffuser.

INSTALLATION OF FIRE-RESISTIVE DUCT WRAP

3.03 Cleaning and Protection A.

FIELD QUALITY CONTROL 1.

General:

Ductwork pressure tests shall be observed by Architect/Engineer prior to installation of insulation.

Test Failures.

B. EQUIPMENT CONNECTIONS

1. Provide access doors where required for service, maintenance and inspection of ductwork accessories.

END OF SECTION 23 31 13

SECTION 23 33 00 – AIR DUCT ACCESSORIES

Part 1: General 1.01

Summary

- A. Types of ductwork accessories required for project include the following:

- Manual Volume Dampers.
- Control Dampers.
- Counterbalanced Relief Dampers.
- Turning Vanes.
- Duct Hardware.
- Duct Access Doors.
- Flexible Connections.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Record Drawings, Maintenance Data

1.05 Quality Assurance

- A. Manufacturer's Qualifications: not less than 5 years.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Combination Fire/Smoke Dampers:
 - i. Air Balance, Inc.
 - ii. Phillips Industries, Inc. Conaire Division
 - iii. Ruskin
 - iv. Greenheck
 - v. Prefco
 - vi. Nailor Industries
 - vii. Pottorff
 - viii. Approved equal.

2.02 Products

A. TURNING VANES

Fabricated Turning Vanes: Provide fabricated 22 gauge, single blade or 24 gauge double bladed 4-1/2" radius, 3-1/4" spacing turning vanes and type 2, 4-1/2" wide runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards" Fig 2.3.

Manufactured Turning Vanes: Provide airfoil double bladed turning vanes constructed of 1 1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.

Do not use trailing edge turning vanes. B. DUCT HARDWARE:

General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.

Quadrant Locks: Provide for each manual volume damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

DUCT ACCESS DOORS

General: Provide access doors, at all fire dampers, smoke dampers, temperature control dampers, branch balancing dampers, duct heating coils, upstream of all turning vanes, outside air plenums, inlet of fans, upstream of all duct smoke detectors and all other equipment requiring service and/or access.

Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. All access doors shall have gasket and will be air tight. Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle type latches for larger doors. For spiral ductwork, use United McGill combination access section type ARF-SD for non-insulated duct systems and type ARF-ID double wall insulated door for insulated ducted systems (all supply ductwork).

Hand entry access door openings: 24" x 24" minimum if the duct permits. Personnel entry doors: 18" x 42" minimum.

ACCESS PANELS*

Permit inspection and maintenance of all automatic dampers, fire dampers, control equipment, coils, and other equipment requiring maintenance. Panels shall not be located in top side of ducts. Ceiling panels to be compatible with type ceiling used.

Panels shall be attached to duct with zinc-plated cam latches. 18" x 18" and smaller panels shall have a minimum of two latches. Larger panels shall have a minimum of 4 latches. Panels shall set in rigid frame with sponge rubber gasketing to prevent air leakage. Panels may be of single wall uninsulated construction.

- i. Where duct size permits, access panels shall be minimum 18" x 16" or 2" smaller than duct size, whichever is smaller.

FLEXIBLE CONNECTIONS

General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment. Shelf life shall be verified to not exceed six (6) months. Any sign of cracking on interior or exterior shall be cause for replacement immediately.

Flexible Piping shall be used to connect exhaust drop pipes to machines.

Flexible pipe shall be kept to a length not to exceed 36 inches. ii. Automation Industries, Inc., Flexible Tubing Division, "Spiratube TDS", nylon cover, with vinyl scuff straps, galvanized spring steel helix, nylon liner; with operating range of -10 degrees to 200 degrees F; High-Tech type RFH or approved equal. iii. Use stainless steel clamps and other accessories as required for a complete installation.

Lay in diffusers will require adjustable 90 for flex connection. No flex connected directly to lay in diffuser

Part 3: Execution

Preparation

Installation

INSTALLATION OF DUCTWORK ACCESSORIES

Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

Provide fire/smoke dampers, where ducts and outlets pass through rated components, and where required by authorities having jurisdiction.

Where fire/ smoke dampers are installed in rated construction, provide firestopping between fire smoke damper sleeve and substrate.

FIELD QUALITY CONTROL

1. Test **every** fire/smoke damper for proper operation, letter REQUIRED certifying this work is complete and all dampers are functioning properly.

3.03 Cleaning and Protection

ADJUSTING AND CLEANING

Label access doors in per label and identification requirements.

Final positioning of manual dampers.

EXTRA STOCK

One EXTRA FUSIBLE link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION 23 33 00

SECTION 23 34 00 – HVAC FANS

Part 1: General 1.01

Summary

A. This Section includes the following types of air-handling equipment:

Centrifugal fans.

Inline centrifugal fans.

Centrifugal roof ventilators.

Air intake and relief hoods.

Pre-fabricated roof curbs.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Wiring Diagrams, Record Drawings, and Maintenance Data.

1.05 Quality Assurance

A. Manufacturer's Qualifications: similar service for not less than 3 years.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Products

A. FANS, GENERAL

General: factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

Belt Drive System	Requirement
1-4.9hp	Have at least 2 belts
5-9.9hp	Have at least 3 belts
10-14.9hp	Have at least 4 belts
15-19.9hp	Have at least 5 belts
20hp and greater	Have at least 6 belts

Belts: Oil-resistant, non sparking, and non static.

Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 5 HP; fixed pitch for use with motors larger than 5 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions. Provide energy efficient motor

i. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.

Shaft Bearings: Provide type indicated, having a median life "Rating Life" AFBMA L10 of 200,000 calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

Factory Finish:

Sheet Metal Parts: Prime coating prior to final assembly.

2. Exterior Surfaces: Baked-enamel finish coat after assembly.

Part 3: Execution

3.01 Preparation per manufacturer recommendations

3.02 Installation A.

DEMONSTRATION

1. Demonstration Services: factory-authorized service representative to train Owner's maintenance

Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
Familiarization with contents of Operating and Maintenance Manuals.

END OF SECTION 23 34 00

SECTION 23 35 13 – DUST COLLECTION SYSTEMS

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Shop Drawings, Product Data, Manufacturer's Certificate, Operation and Maintenance Data.

1.05 Quality Assurance

QUALIFICATIONS

Years [documented] experience.

Installer: minimum three years documented experience.

WARRANTY

1. Furnish five year manufacturer warranty for dust collection systems.

EXTRA MATERIALS

1. Two sets of filters for filter separator, TWO SETS OF FILTER BAGS, TWO SETS OF BELTS FOR EACH FAN.

Scheduling

Delivery, Storage, and Handling

Regulatory Requirements

Part 2: Products

2.02 Manufactures

A. Products: DUST COLLECTOR

1. **NO SHAKERS WILL BE ALLOWED**

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 23 35 13

SECTION 23 36 00 – AIR TERMINAL UNITS

Part 1: General 1.01

Summary

A. Types of air terminals specified in this section include the following:

Central Air Terminals

Shutoff Single Duct

Reheat

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Wiring Diagrams, Record Drawings, and Maintenance Data.

1.05 Quality Assurance

A. Manufacturer's Qualifications: not less than 5 years.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

A. Duct Connections: Connect ductwork to air terminals.

3.03 Cleaning and Protection

END OF SECTION 23 36 00

SECTION 23 37 00 – AIR OUTLETS AND INLETS

Part 1: General 1.01

Summary

Fiberglass ductwork is not accepted.

Ductwork exposed on roofs is strongly discouraged. Review with the owner any proposed exposed ductwork.

Do not install turning vanes in unequal ells. Use expansion transitions and duct splits with equal ells.

Do not use "extractors" at duct branch takeoffs, use 45-degree standard branch. Extractors may be used at duct mounted sidewall diffusers.

Consultant to specify pressure, air speed, and show on drawings using SMACNA standards.
 Do not use splitter dampers.
 Include volume control devices required for air balancing on the contract documents.
 Consultant to provide a specific list of work items for renovation of existing equipment and duct work. Global statements to rehabilitate "as required or necessary" are not acceptable.

- Related Sections
- Definitions
- Submittals Required
- Quality Assurance
- Scheduling
- Delivery, Storage, and Handling
- Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

A. DUCTWORK

<u>Diameter</u>	<u>Collar</u>	<u>Blade</u>
3" thru 14"	11	14
15" thru 26"	10	12
27" thru 36"	9	10

GRILLES, DIFFUSERS, REGISTERS

1. Use of duct socks to be approved by PSD HVAC Department.

VARIABLE AIR VOLUME (VAV) BOXES 1. If authorized by the District.

Part 3: Execution

Preparation

Installation

So that duct interiors may be cleaned, external duct wrap insulation is preferred over duct lining.

Consider the use of mufflers or sound attenuators to reduce fan noise.

Locate manual dampers for diffuser control as far from the diffuser as possible but still in the room or preferably the adjacent corridor to minimize noise.

3.03 Cleaning and Protection

END OF SECTION 23 37 00

SECTION 23 50 00 – CENTRAL HEATING EQUIPMENT

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products A.

STRAINERS

Strainers for water, 2" and smaller shall be cast iron or semi-steel, screwed "Y" strainer, 250 lb. construction, and 1/2 inch ball valve with capped hose adapter, to be capped with brass not plastic, for blow-down. Strainer shall be Armstrong No. A1SC, or prior approved equal for 2-1/2" and less, Armstrong No. A1FL for 2 1/2" and larger.

Screens for water service shall be stainless steel. For strainers 2 inches and less, strainers shall be 20-mesh or 1/32" perforations. For strainers 2 1/2" to 8", mesh shall be perforated brass with 1/16" openings.

AIR SEPARATOR*

Acceptable Manufacturers:

- i. Amtrol.
- ii. Bell & Gossett (Rolairtrol).
- iii. Taco.
- iv. Spirol Vent (Preferred)
- v. Approved Equal.

Separator shall be the centrifugal type, with strainer, line size, with a Hoffman #79 auto air release valve. 125 psi working pressure. Pipe discharge to glycol feeder (preferred) or floor drain

Air separator shall be suitably supported in piping system with clearance provided for strainer removal.

AIR VENTS*

Provide manual (not automatic) air vent valves at the high point wherever drops occur in the direction of water flow, at the top of all supply risers and at the high point of return risers on all hot water heating supply and return mains. Air vent ball valves shall be installed on the top of the risers in an accessible location. A 1/4" copper tube shall extend from a reducer provided at the high point to a point where a bucket can be placed to catch any drips. No Armstrong air vents will be allowed. Use Hoffman of applicable size. Or approved equal.

Add air vents to high points in RTU piping.

Provide isolation ball valves for replacement.

The high side of heating elements on up-fed cabinet unit heaters, etc., shall be piped complete with a 3/4" x 4" high air chamber with a reducer at the top from which a 1/4" copper tube shall be extended to an accessible manual (not automatic) air vent valve as above.

BACKFLOW PREVENTER*

Acceptable Manufacturers: Watts. Watts 909QT only

Shall be the reduced pressure type with atmospheric vent, for boiler water make-up.

Bronze body and accessory construction and replaceable seats.

Bronze body ball valve test cocks, unions, full port ball valve shut-offs on inlet and outlet, and bronze inline strainer.

Watts Model U909 QTS, 3/4" size with strainer on inlet side and spring check valve on upstream side.

EXPANSION TANK*

Acceptable Manufacturers:

Amtrol.

Armstrong

Bell & Gossett. iv.

Taco.

v. Or approved equal.

Tank shall be the elastomeric bladder type, with positive water and air separation, pressurized.

Size as specified and as required for proper venting pressure.

With vertical mounting support feet, air charging valve, and air pressure gauge. Accessible floor-type with isolation and union.

FINNED TUBE RADIATION (FTR-1)* 1. Acceptable Manufacturers:

American Air Filter.

Sterling. iii. Trane. iv. Vulcan.

v. Approved Equal.

Cover shall be complete with hangers, supports and accessories. Provide end pieces, joining pieces, mounting brackets and accessories as required for a complete installation. Provide end caps. Copper tube and aluminum fins.

Enclosure shall be minimum 16-gauge construction, with access panels and factory backed enamel paint. Cover shall also conceal HWS & HWR piping from wall to unit ventilator.

FLOW VENTURIS (FV)*

1. Acceptable Manufacturers:

Aeroquip Barco.

Gerand.

Approved Equal.

Description: Cast iron or brass body flow measuring device of venturi type with readout plugs constructed for 125 psig working pressure. Provide with nameplate showing capacity data with integral or separate curves of head pressure versus capacity for range of flows.

Flow Measuring Device Schedule:

Drawing

<u>Code</u>	<u>Make</u>	<u>Model</u>	<u>Delta P</u>	<u>Flow, GPM</u>	<u>Press. Drop</u>
-------------	-------------	--------------	----------------	------------------	--------------------

FV-1 Barco - - - -

HOT WATER HEATING COILS*

- 1. Acceptable Manufacturers:
 - i. Airtherm.
 - ii. McQuay.
 - iii. Trane.
 - iv. Approved Equal.

2. Hot water heating coils shall be constructed of 1/2" O.D. minimum copper tubes expanded into aluminum plate fins and cast iron or seamless copper headers. Coil circuiting shall be single tube continuous with same end connection. Casings shall be constructed of 16 gauge galvanized steel with fins recessed into channels to minimize air bypass. Casing shall include -1/2" flanges for duct connections. Coils shall be rated for 150 psig working pressure and shall have capacities and characteristics as scheduled on the plans. Coil water velocity shall not exceed 5 feet per second.

3. Supervise all installations to ensure proper pitch for drainage and venting. Make all connections and install all specialties as detailed after installation in duct system.

4. Coils shall be isolated with ball valves, unions and balance valves, installed to allow easy coil removal.

HOT WATER HEATING PUMP AND DOMESTIC HOT WATER CIRC PUMPS*

- 1. Acceptable Manufacturers:
 - i. Taco
 - ii. Bell & Gossett
 - i. Grundfos Magna
 - v. ~~Patterson Enviroflo~~
 - vi. Armstrong
 - vii. Wilo

2. Pumps shall have mechanical seals designed for hot water service to 220°F, steel shafts, renewable wearing rings, bronze impellers, and casings designed for 150 PSIG working pressure. Pumps, except close-coupled type, shall have flexible couplings of non-metallic or single barrel spring design. Multiple spring couplers will not be accepted.

Provide one (1) extra set of mechanical seals for each pump.

Pump manufacturer shall machine the pump impellers, if necessary, to meet capacities scheduled. Pumps shall be dynamically balanced prior to shipment.

Extreme care is to be exercised when installing pumps such that no strain whatsoever is placed on the mains due to pump position.

Motors shall be built for pump service, with electrical characteristics as indicated.

Motors shall have built-in thermal overload protection. And premium efficiency.

Ball valve isolations on each side of pumps.

Install hot water heat pumps on return side to prevent overheating.

3. Domestic Hot Water recirculating pumps shall be the cartridge type, system lubricated, bronze body, and stainless steel shaft, rotor, and faceplate. 1/25 HP. Taco is preferred.

UNIT HEATERS*

- 1. Acceptable Manufacturers: Modine is standard of design. (NO STANDARD UNIVENTS) No Reznor units accepted.

Part 3: Execution

Preparation

Installation

Cleaning and Protection

END OF SECTION 23 50 00

SECTION 23 51 00 – BREECHINGS, CHIMNEYS, AND STACKS

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Quality Control Submittals, Record Drawings

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

INSTALLATION OF DOUBLE WALL CONNECTORS, BREECHINGS AND VENTS

The system shall have a 10" minimum clearance to combustibles with flue gases not exceeding 1000°F continuous.

The inner pipe joints shall be field sealed with Containment Bands and high temperature sealant.

Stacks extending above the roof must terminate a minimum of 3'-0" above the roof or parapet per NFPA 211, or as required by local code.

INSTALLATION OF DAMPERS

1. Install barometric and thermostatically operated dampers in accordance with manufacturer's instructions. Locate as close to draft hood collar as possible.

3.03 Cleaning and Protection A.

ADJUSTING AND CLEANING

1. Clean breechings internally during installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

END OF SECTION 23 51 00

SECTION 23 52 00 – HEATING BOILERS

Part 1: General

1.01 Summary

- A. Heating water boilers only, no steam except in limited applications in old buildings to replace like equipment.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

- A. CONTROLS: BAS will be able to interface with the firing rate of the boiler.

Temperature controller capable of interfacing with temperature controls shall be supplied as a part of the boiler package. Sequence of operation by the Consultant.

Water Boiler Standard Controls:

Low limit (operating) temperature control.

High limit temperature control.

Combination pressure-temperature-altitude gauge(s) to indicate boiler water temperature, system pressure, and elevation.

ASME certified pressure relief valve(s) set to 50 psi, ASME working pressure.

Low water cut-offs, McDonnell Miller No. 63, as required by codes, with test and check valves.

The boiler shall be furnished with a factory-constructed wiring harness to facilitate wiring the electrical safety controls into the limit control circuits. Provide the following indication/warning lights:

Call for heat light. ii. Main burner "ON." iii. Pilot burner "ON."

iv. Failure lights to indicate burner lock out for any reason, magnetic starter trip-out, low water cut-out, or manual high limit trip-out.

High-Low Fire Control:

The boiler shall be furnished with a water temperature controller and/or proportional staging control to control the high fire operator of the operating gas valve.

Control shall be adjusted to permit low-fire and high-fire control.

Actual control of the high/low firing shall be done through the control system.

The boiler shall be furnished with a Honeywell 7800 Flame Guardian WFG electronic control system. The Honeywell system must have an LED display installed.

The Flame Guardian system shall be factory pre-wired, with pilot proving air flow proving and main flame proving control modules to provide intermittent electronic pilot ignition with proven low-fire start, high-fire run operation.

The Flame Guardian system shall provide nominal 4-second flame response timing with 90-second lockout in the event the pilot flame is not proven. Safety pilot burner shall be intermittent.

At least two sections with inspection and cleanout tappings on each end.

Full opening and removable access doors at each end.

1. ACCEPTABLE MANUFACTURERS:

i. Buderus is preferred- both condensing and non-condensing

ii. Burnham.

i. Weil-McLain.

ii. Lochinvar

~~iv. Aereco~~

v. Dedietrich for cast iron sectional

vi. *Or approved equal*

BURNER

1. Acceptable Manufacturers:

Power Flame.

Approved Equal - Burner shall be capable of delivering the necessary air at 5000 ft. elevation for proper combustion, to pressurize the firebox and to deliver sea level Btuh output at 5000 ft. elevation.

2. Burner startup and combustion test:

Factory-authorized technician shall perform start-up.

A complete combustion test report shall be submitted to the Engineer indicating the following:

Percent of Carbon Dioxide (CO₂).

Stack temperature.

Stack pressure.

Room temperature.

Manifold gas pressure.

Boiler shall have an input and gross output as scheduled when fired with natural gas. Boiler shall be tested for and shall bear ASME symbol for low pressure heating boiler, 85% minimum efficiency.

Minimum efficiency of Boilers. All packaged boilers shall have a minimum ARI rated efficiency meeting or exceeding the Minimum Required Efficiency listed below. (Note: The efficiency

levels from the 2011 standards are listed here. Check www.xcelenergy.com for future updates).

Item (Boiler)	Minimum Required Efficiency
Non-Condensing Boiler	85% AFUE
Condensing Boiler	92% AFUE

Part 3: Execution

Preparation

Installation

Provide a single 4" minimum raised reinforced concrete housekeeping pad for all boiler units that rests on top of the boiler room floor.

Boiler shall be field assembled. Boiler shall be complete with air eliminator, insulated jacket, cast iron sections, forced draft burner, approved gas train, pressure relief valve, and controls. With pressurized fire box for forced draft venting.

3.03 Cleaning and Protection

END OF SECTION 23 52 00

SECTION 23 55 00 – FUEL-FIRED HEATERS

Part 1: General 1.01

Summary

A. Types of fuel-fired heaters specified in this section include the following:

1. Gas-Fired Propeller Unit Heaters.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Wiring Diagrams, Record Drawings, and Maintenance Data.

1.05 Quality Assurance

A. Manufacturer's Qualifications: not less than 5 years.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

A. GAS-FIRED PROPELLER UNIT HEATERS

Part 3: Execution

3.01 Preparation

- 3.02 Installation
 - A. INSTALLATION OF GAS-FIRED PROPELLER UNIT HEATERS
 - B. START-UP
- 3.03 Cleaning and Protection

END OF SECTION 23 55 00

SECTION 23 57 00 – HEAT EXCHANGERS FOR HVAC

Part 1: General 1.01

Summary

A. Types of heat exchangers specified in this section include the following:

- 1. Water-to-Water Plate and Frame Heat Exchanger.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Record Drawings, and Maintenance Data.

1.05 Quality Assurance

A. Manufacturer's Qualifications. To be evaluated and approved by PSD HVAC Department..

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

A. WATER-TO-WATER PLATE AND FRAME HEAT EXCHANGER:

1. Units shall be ASME rated for 125 psig operating pressure, 300 deg. F. (149 deg. C) maximum temperature. **Part 3: Execution**

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 23 57 00

SECTION 23 60 00 – CENTRAL COOLING EQUIPMENT

Part 1: General

1.01 Summary

DESCRIPTION

Air cooled condensing units.
Refrigerant piping and specialties.
Cooling Towers.
Chillers.

For new buildings or those receiving a major replacement of mechanical equipment or others authorized for refrigeration cooling:

About 50,000 square feet or larger, use chilled water and cooling towers or evaporative condensers.

20,000 square feet and less, use DX equipment.

Others use either type of equipment or air cooled chillers depending on the building's use and the Engineer's analysis.

Design a separate DX unit for the administration area to be used during extended hours when the rest of the school is unoccupied. This option may not be required if the school cooling plant has a chiller which may be turned down far enough to match the Admin. area load.

Direct expansion (DX) systems should be RTU's

Major remodels of existing buildings without air conditioning will have that capacity added in the remodel. Confer with the District at the time of design. Add-on units must be split systems with low speed fans to reduce noise to a minimum.

Special design considerations shall be given for server room cooling installations. Systems shall be right sized according to the application and consider outdoor air use. Special considerations include:

Setpoints are different than those set for thermal comfort. IT equipment and server room setpoints shall be 80°F.

Design shall consider exhaust and heat removal from server rooms.

Design shall consider point-specific airflow for racks.

Equipment closets shall be considered different than server room closets in design.

Related Sections

Definitions

Submittals Required

Quality Assurance

Scheduling

Delivery, Storage, and Handling

Regulatory Requirements

Part 2: Products

Manufactures

Products

REFRIGERATION SPECIALTIES

Filter-dryers

AIR COOLED CONDENSING UNIT All to have hail guards (RTU, and split systems)

AUTHORIZED TYPES: CHILLER

Less than 100 tons: Reciprocating or screw.

140 tons and larger: Centrifugal.

Between 100 and 140 tons: Determined by the consultant and the District.

Minimum efficiency of Chillers. All packaged chillers shall have a minimum ARI rated efficiency meeting or exceeding the Minimum Required Efficiency listed below. (Note: The efficiency levels from the 2011 standards are listed here. Check www.xcelenergy.com for future updates).

Item (Chillers)	Min. Required Efficiency
Scroll or Rotary Screw < 150 tons	0.74 kW/ton
Scroll or Rotary Screw > 150 tons and < 300 tons	0.67 kW/ton
Air Cooled	10.0 EER
Water Cooled Centrifugal	Must improve on IECC 2006 baseline by 0.016 kW/ton

APPLICABLE TO ALL THREE TYPES

The preferred power is 460v, 3ph, 60hz. If 460 volt power is not available, 230 or 208 volt is acceptable. No single phase equipment.

Single Factory Package:

Refrigerant compressor(s). (Minimum of two) ii. Water cooled shell and tube refrigerant condenser. iii. Evaporator. iv. Expansion valve.

Electric drive motors for the compressor(s) and the oil pump.

Controls mounted within a common panel. vii. Water cooled oil cooler and oil circulating pump.

viii. Electric oil preheater.

Applicable Standards and Regulations:

ANSI - American National Standards Institute (Safety Codes for Mechanical Refrigeration). ii. ARI - Air Conditioning and Refrigeration Institute - (All applicable equipment rating and construction standards). iii. ASME - American Society of Mechanical Engineers - (Boiler and Pressure Vessel Code, Section VIII, Division 1, latest edition).

NEC - National Electrical Code.

NEMA - National Electrical Manufacturer's Association - (Motors for Hermetic Refrigeration Compressors).

ARI factory performance test required for chillers > 100 tons.

ASHRAE - Standard 15, Safety Code for Mechanical Refrigeration.

Design chilled water supply temperature > 47°F.

Design condenser water temperature < 73°F.

The liquid being chilled and the condenser cooling liquid will be strained water containing biocides and anti-scaling compounds.

Self-excited vibration velocity < 0.10 inch/second in any of the three axes.

Heat exchanger fouling factor: 0.0005.

Target efficiency: 0.62 KW/ton (centrifugal), 0.70KW/ton (screw) or 0.82KW/ton (reciprocating) at full rated load under the service conditions specified. Examine part load efficiency figures and base specify the optimal machine.

Evaporator:

Shell-and-tube design with seamless copper tubes and designed, manufactured, tested and stamped in accordance with Section VIII, Division 1, latest edition of the ASME Boiler and Pressure Vessel Code and its addenda. ii. Shell: Carbon steel plate, incorporate rupture disc conforming to ANSI/ASHRAE 15-1978 Safety Code, and be furnished with a 150 psig cast-iron water box. Factory-applied thermal insulation.

iii. Positive liquid and vapor seal between the refrigerant and water side of the shell.

iv. Copper tube wall thickness: 0.035 inch.

v. Position intermediate tube support sheets along the length of the shell to avoid contact and relative motion between adjacent tubes. vi. Use multiple layers of metal mesh screen or some other device to form an eliminator to be installed over the tube bundle along the entire length of the evaporator to prevent liquid refrigerant carryover into the compressor.

Water Cooled Condenser:

Shell and tube design with seamless copper tubes, integral fins. Stamp in accordance with Section VIII, Division 1, latest edition of the ASME Boiler and Pressure Vessel Code.

Position intermediate tube support sheets along the length of the shell to avoid contact and relative motion between adjacent tubes.

Copper tube wall thickness: 0.035 inch.

Purge system to operate automatically for removing any non condensables and water vapors which may be present in the refrigerant system. Automatic non condensable discharge and refrigerant return. Remove water with a manual blow-off valve.

Controls and Safeties:

i. Completely prewired control panel mounted on the chiller assembly:

120V single phase/60 Hz with its own transformer.

Numbered terminal strip for field interlock wiring.

Individually numbered and color coded panel wires.

Number wires same as the manufacturer's circuit drawings.

ii. Automatic safety shutdown with a pilot light and a manual reset each for low evaporator refrigerant temperature, high condenser pressure, high motor temperature and low oil pressure. iii. Capacity control mechanisms to limit maximum amperage drawn by the compressor. Setpoint of the compressor demand limit adjustable to any value between 40 and 100% of full load. iv. Individual dial-type pressure gauges to indicate purge drum, condenser, evaporator and oil pressures.

Anti-recycle timer to ensure safe intervals between successive compressor starts.

Panel-mounted meters to indicate total number of compressor starts and elapsed running time. A system pilot light to indicate control power "ON" to the panel. vii.

Pilot Lights:

Start-up in progress.

Anti-recycle timer active.

Condenser water pump on.

Chilled water pump on.

Oil pump on.

Chiller on. viii. Adjustable Temperature Controls:

Deadband.

Chilled water supply temperature setpoint between 45°F and 55°F.

ix. Wire safety controls to the starter to stop the chiller if:

Low evaporator temperature.

High condenser pressure.

High compressor motor temperature.

Low oil pressure.

Loss of condenser water flow.

Loss of chilled water flow.

Imminent freezing of chilled water.

Include a device to reset the chilled water supply temperature set point from the return water temperature. Incorporate a minimum of two field adjustable reset schedules into the controls to match any application with the reset schedule.

Permit automatic chiller unloading during periods when the load decreases below the normal operation. Automatically restart upon an increase in load. xii. Provide connections to automatically start and stop or demand limit the chiller from a future remote energy management device.

xiii. Provide the capacity to unload the chiller from a remote signal.

xiv. Compressor motor starter: Factory mounted, wired and tested on the chiller. Free standing starters requiring field wiring are not acceptable unless mounted next to the chiller. Include an electronic motor protection system to monitor and protect against the following conditions:

Overload.

Phase unbalance.

Distribution fault protection to prevent reconnection of the compressor motor while it is out-of-phase with the line voltage. If a distribution fault is detected, the fault trip indicator shall be displayed and manual reset shall be required.

Distribution faults of 1-1/2 electrical cycle durations shall be detected and the compressor motor shall be disconnected within six electrical cycles. xv. Manually reset high and low refrigerant pressure cutout switches.

xvi. Relief valve in compressor discharge circuit. No valves between the compressor discharge and the relief valve. xvii. Interlocks that will permit field connections from these interrupt signals:

The compressor motor power interrupted on loss of cooling or chilled water flow.

The compressor motor cannot start until the chilled water pump and cooling water pump are operating.

xviii. Disconnect switch mounted on the frame near the starter. xix. Furnish with chilled and condenser water flow switches. xx. An ammeter for each electrical power phase.

xxi. Provide for refrigerant recovery.

Vibration Isolators:

i. Free-standing, laterally stable without any housing, and complete with acoustical friction pads between the baseplate and the support.

5 year warranty on all reciprocating compressors.

Comply with the latest CFC regulations. E. SPLIT SYTEMS:

1. Minimum efficiency of split systems. All packaged split systems shall have a minimum ARI rated efficiency meeting or exceeding the Minimum Required Efficiency listed below. (Note: The efficiency levels from the 2011 standards are listed here. Check www.xcelenergy.com for future updates).

Item (Split systems)	Minimum Required Efficiency
Split System < 65,000 Btuh and < 5.4 tons	14.0 SEER

Part 3: Execution

Preparation

Installation

A. START-UP

1. Provide factory start up services for the chiller and the tower.

3.03 Cleaning and Protection

END OF SECTION 23 60 00

SECTION 23 65 13 – FORCED-DRAFT COOLING TOWERS

Part 1: General

1.01 Summary

- A. This section includes factory-assembled and -tested, open-circuit, induced-draft, cross-flow cooling towers.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Shop Drawings, Wiring Diagrams, Coordination Drawings, Product Certificates, Field Quality Control Test Reports, Operation and Maintenance Data, Warranties.

1.05 Quality Assurance

- A. Warranty Period: Five years from date of Substantial Completion.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

A. HANDRAILS, LADDERS, AND PLATFORMS

1. Platforms: Galvanized steel with a bar grating floor.

Part 3: Execution

3.01 Preparation

3.02 Installation

CONNECTIONS

1. Install flexible pipe connectors at final connections of towers.

STARTUP SERVICE

- Engage a factory-authorized service representative to perform startup service.
- Verify operation of tower basin automatic blowdown, and controlling device.
- Prepare a written startup report that records the results of tests and inspections.

ADJUSTING

- Set and balance water flow to each tower inlet.
- Adjust water-level control for proper operating level.
- Occupancy Adjustment: MAY BE REQUIRED – TBD PER PROJECT.

DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

3.03 Cleaning and Protection

END OF SECTION 23 62 13
SECTION 23 71 20 – GLYCOL

SYSTEMS

Part 1: General 1.01

Summary

- A. Types of glycol system specialties specified in this section include the following:
 - Propylene glycol
 - Feed Pump
 - Provide glycol feeder for all new construction and anytime a boiler room is being upgraded. Engineer to size the feeder. Axiom Industries LTD or equal.
 - Provide a combination pot feeder and filter system with filter socks unless previously installed by owner. Typical of an Eaton unit.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required: Product Data, Maintenance Data, Test Results.

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

- A. Inhibited Propylene Glycol Solution:
 - Chillsafe
 - Dow

2.02 Products

GLYCOL SYSTEM

1. GLYCOL TRANSFER PUMP

- i. Provide a Hand-Operated Rotary Transfer Pump with 8 feet of 1 inch hose and a non sparking 3/4" nozzle for the transferring of glycol from the glycol container to the glycol feed tank. The pump shall have a 1 inch telescoping suction pipe, and bung adapter with 2 inch thread.

GLYCOL SOLUTION

1. Heating Water System:

Provide 30% glycol solution suitable to a temperature of -20°F.

Provide on extra 55 gallon drum of propylene glycol.

2. Chilled Water System:

Provide 30% propylene glycol solution.

Provide one extra 55 gallon drum of propylene glycol.

3. Approved glycol: 100% Propylene Virgin Dowfrost glycol with inhibitor (or equal) added so the final result has 30% glycol throughout the system. Any "or equal" approvals should be confirmed prior to CDs going out to bid if design team wants to suggest an alternative. A substitution from a GC would have to be approved per PSD front ends/procedure.

Part 3: Execution

Preparation

Installation

- A. Thoroughly clean and flush system before adding propylene glycol solution. Notify PSD Plumbing Department 24 hours in advance, to verify clean and flush.
- B. Feed propylene glycol to system through make-up line with pressure regulator. Do not use glycol feeder to fill system. Set to fill at 12 psi (69 kPa).
- C. Perform tests determining strength of propylene glycol solution before system is turned over to the Owner. Provide test prior to end of the first year of operation and replenish as required. PSD to confirm 30% solution maintained at end of the year.

3.03 Cleaning and Protection

END OF SECTION 23 71 20

SECTION 23 72 00 – OUTDOOR AIR VENTILATION (AIR TO AIR SYSTEMS)

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products
 - A. Ventilation Outdoor Air Control
 - 1. Minimum ventilation outdoor air control.
 - i. Variable air volume systems shall have a positive means to maintain minimum outdoor air rates regardless of supply air volume. Setting a fixed minimum outdoor air damper position shall not be acceptable. Acceptable means include:
 - Separate minimum damper setpoints for design supply air volume and minimum supply air volume, as indicated by fan speed or other supply air duct static pressure controller. [Note to designer: this is the least accurate method, but least expensive and available as standard on some packaged units.]
 - Outdoor airflow measuring station designed to be $\pm 10\%$ accurate at minimum airflow rates, used to modulate outdoor air and/or return air dampers to maintain minimum outdoor air flow rates.
 - Differential pressure sensor across fixed minimum outdoor air damper with setpoint calibrated to correspond to minimum outdoor air rate, used to modulate return air dampers to maintain minimum outdoor airflow rates.

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
- 3.03 Cleaning and Protection

END OF SECTION 23 72 00

SECTION 23 74 00 – PACKAGED OUTDOOR HVAC EQUIPMENT

Part 1: General 1.01

Summary

- A. Outdoor air handling units.
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required: Product Data, Wiring Diagrams, Record Drawings, Maintenance Data
- 1.05 Quality Assurance
 - A. Manufacturer's Qualifications: not less than 5 years.
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
 - A. Outdoor Air Handling Units – All must be approved by PSD
- 2.02 Products

OUTDOOR AIR HANDLING UNITS

- 1. Disposable Type: Provide disposable type air filters 2" thick, consisting of viscous coated fibers with filtering media encased in fiberboard cell sides having perforated metal grids on each side to provide media support.

Part 3: Execution

Preparation

Installation A. EXTRA STOCK

- 1. Obtain receipt from Owner that new filters have been installed AT THE END OF THE CONSTRUCTION BEFORE OWNER TAKE OVER.

TRAINING – REQUIRED

3.03 Cleaning and Protection

END OF SECTION 23 74 00

SECTION 23 81 43 – HEAT PUMPS

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required: Shop Drawings, Product Data, Manufacturer's Certificate, Operation and Maintenance Data.
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

- AAON (PREFERRED)
- WaterFurnace International, Inc.
- ClimateMaster, Inc.

2.02 Products

1. UNITARY HEAT PUMP UNITS: Minimum efficiency of Heat Pumps. All packaged heat pumps shall have a minimum ARI rated efficiency meeting or exceeding the Minimum Required Efficiency listed below. (Note: The efficiency levels from the 2011 standards are listed here. Check www.xcelenergy.com for future updates).

Item (Heat Pumps)	Minimum Required Efficiency
Ground Source Heat Pump	ENERGY STAR® qualified, closed-loop systems, with a minimum 3.3 COP and 14.1 EER rating
Air Source* < 65 mbtu/h	12.0 EER or 7.7 HSPF
Air Source* 65 – 135 mbtu/h	10.1 EER, 3.2 COP
Air Source* 136 – 240 mbtu/h	9.3 EER, 3.1 COP
Water Source Heat Pump	14.0 EER
*Value listed are from the Federal Energy Management Program (FEMP); check the “Whole Building Design Guide” for future updates.	

B. ELECTRICAL CHARACTERISTICS AND COMPONENTS 1.

Disconnect Switch: Factory mount on equipment.

Part 3: Execution

3.01 Preparation

3.02 Installation

Provide a self-regulating balance valve for each heat pump. Balance valve are not permitted to be used as isolation valves.

Provide a remote reset on heat pumps.

3.03 Cleaning and Protection

END OF SECTION 23 81 43

SECTION 23 82 00 – CONVECTION HEATING AND COOLING UNITS

Part 1: General

1.01 Summary

Preferred system: Hot water baseboard radiation along perimeter walls and in-duct hot water coils to zones with high ventilation loads or excessive heat losses. No radiators or other heating units on walls of student restrooms.

Radiant ceiling panels are NOT ALLOWED. Permitted as replacement items for similar existing equipment or where an existing floor plan makes baseboard radiation impractical.

Unit ventilators NOT permitted

Locate any equipment or duct mounted devices, which may require maintenance or replacement, outside classrooms and in locations where maintenance activities will have minimal disruption to the function of the school.

Related Sections

Definitions

Submittals Required

Quality Assurance

Scheduling

Delivery, Storage, and Handling

Regulatory Requirements

Part 2: Products

Manufactures

Products

BASEBOARD RADIATION

Cabinets or enclosures: 16-gauge or maximum security steel with closed ends to resist abuse and vandalism. Slope the top to discourage the storage of materials.

Design perforations to discourage vandalizing the fin tube or controls with sharp instruments.

Cabinet paint: Baked on enamel or prime coating.

Fin tubes: 3/4", 1", or 1-1/4" copper with a safe working pressure of 200 psi at 250°F and 0.016" thick or heavier aluminum fins spaced no closer than 48 per foot.

Approved manufacturers are Dunham-Bush, Standard, Sterling, or Vulcan. Consult the District for others.

UNIT VENTILATORS OR CABINET HEATERS (NO STANDARD UNIVENTS)

Part 3: Execution

Preparation

Installation

Cleaning and Protection

END OF SECTION 23 82 00

Exhibit D

**PSD TECHNICAL
SPECIFICATION**

**DIVISION 26
Electrical**

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SECTION 26 01 00 – GENERAL REQUIREMENTS

Part 1: General

1.01 Summary

- A. Electrical design and installation shall, as a minimum, use the most recent applicable versions or regulatory requirements of the following:
 - 1. Federal and State regulations.
 - 2. OSHA
 - 3. ANSI/ NFPA 70 (National Electrical Code) as adopted by the AHJ
 - 4. NEMA
 - 5. IEEE
 - 6. ANSI
 - 7. ANSI/ IEEE C2 – National Electrical Safety Code (NEC)
 - 8. Local Protective Signaling Systems
 - 9. NFPA 72A
 - 10. Fire Detection in Mechanical Systems
 - 11. NFPA – 90A
 - 12. NFPA – 101A
 - 13. Life Safety Code

1.02 INTENT

- A. These technical specifications are for guidance only. These guidelines are founded on considerable design and maintenance experience with the intent of reducing future maintenance problems and extending the trouble-free life of expensive equipment. With these overall goals in mind, the consulting engineers should apply these design priorities consistent with budget constraints:
 - 1. Occupant safety
 - 2. Low life cycle cost of equipment including maintenance and energy
 - 3. Low first cost
- B. All substitutions/changes from this document require the approval of the PSD Electrical Department.

1.03 MATERIALS

- A. All materials shall be brand new and current production runs. No close-out items are allowed.

1.04 WARRANTY

- A. A one-year warranty shall include all electrical lamps.
- B. All work, labor and materials shall carry a two-year written warranty. Warranty period shall start on the date of the Poudre School District's final acceptance.

1.05 AS-BUILT DRAWINGS

- A. Use the red-lined drawings maintained by the Contractor during construction.
 - 1. One-line diagram(s) with revised load calculation.
 - 2. Accurate routing of wiring.
 - 3. Locations of panels and loads.
 - 4. Point-to-point connection diagrams.
 - 5. Accurately locate buried conduit.
 - 6. Accurate circuit connection designations.

1.06 SCHEMATIC DIAGRAMS

- A. Include schematic diagrams and point-to-point wiring diagrams for the following systems.
 - 1. Clock systems.
 - i. New construction master/synchronous clocks are done by IT dept

2. Electrical systems control.
3. Fire detection/ alarm systems.
4. Lighting/ dimming control systems.
5. Medium voltage equipment.
6. Motor control systems.
7. Kitchen hood fire control panel.
8. Communication system (rough-in)
9. Security systems (rough-in)
10. Stage lighting systems.
11. Sound systems.

Part 2: GENERAL DESIGN GUIDELINES

2.01 General

- A. Provide dual level switching or dimmable LED Fixtures in classroom and office areas
- B. Do not design corridor receptacles or custodial use receptacles on classroom or office circuits.
- C. Provide receptacles at maximum 30' on center in corridors.
- D. Receptacles for school kitchen point of sale (POS) shall be on a dedicated circuit with isolated ground.
- E. Avoid kitchen POS locations in floors. Try and locate on wall or columns. Conduit and floor boxes in slabs are prohibited unless there is a written approval from the PSD Project Manager.
- F. Coordinate placement of receptacles for TV's, overhead projectors, smartboards, etc. as necessary.
- G. Do not locate any electrical panels or switchgear in areas accessible to students.
- H. Provide receptacle outlets in the following areas. Small Rooms: One duplex receptacle at door 48" AFF, Custodian Closet, Mechanical Rooms, Storage Areas. Large Mechanical Rooms: One duplex on all walls 48" AFF.
- I. New branch circuits needing a neutral, installed from the panelboard shall have an individual neutral wire installed for the circuit. Sharing a neutral in multi-wire branch circuits is not permitted.

Part 3: INSTALLATION

3.01 General

- A. Include in the O&M manual certifications received with any electrical equipment and data for any equipment tests performed.
- B. Pour 4"-thick reinforced concrete housekeeping pads to support major equipment like main power transformers and switchgear.
- C. Label main electrical gear with the name, voltage, phase, amp rating, source, and destination of power.

3.03 Cleaning and Protection

- A. Remove construction debris and leave areas broom clean after construction. In electrical rooms, the MDC shall be vacuumed and contacts dusted.

END OF SECTION 26 01 00

SECTION 26 01 10 – Operation and Maintenance of Medium-Voltage Electrical Distribution

Part 1: General

1.01 Summary

- A. Voltage considered for this section is 277/ 480V - 3 ϕ :
- B. Standard Electrical System Phase Colors:
 - 1. ϕ A – Brown
 - 2. ϕ B – Orange
 - 3. ϕ C – Yellow
 - 4. Neutral – Gray
 - 5. Ground – Green

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 01 10

SECTION 26 01 20 – Operation and Maintenance of Low-Voltage Electrical Distribution

Part 1: General

1.01 Summary

- A. Voltage considered for this section is 120/ 208V - 3 ϕ :
- B. Standard Electrical System Phase Colors:
 - 1. ϕ A – Black
 - 2. ϕ B – Red
 - 3. ϕ C – Blue
 - 4. Neutral – White
 - 5. Ground – Green

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 01 20

SECTION 26 01 26 – MAINTENANCE TESTING OF ELECTRICAL SYSTEMS

Part 1: General

1.01 Summary

- A. Test electrical systems for continuity of circuits, proper insulation resistance, overload settings, rotation of motors, phasing, satisfactory completion of connections and splices, and other conditions to insure that the systems are satisfactory for operation.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

- A. Test Reports:

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

- A. Specified tests shall be performed and witnessed by a School District Electrical Department Representative as a requirement for final payment. Explain the functions and demonstrate the operation of major equipment. Tests to be run on the following systems (minimum 1 hour per system):

1. Fire alarm.
2. Clock system.
3. Emergency generator system
4. Exterior lighting controls

- 5. Other special systems.
 - 6. Special lighting system
- 3.02 Installation
- A. When the installation of all apparatus and wiring is complete, test all electrical conductors to insure continuity, freedom from grounds and insulation resistance values.
 - B. Set and adjust all overload devices to suit the load conditions and tests made to determine actual loads.
 - C. All feeders and branch circuits rated below 600 volts shall be megger tested between phase conductors and between phase conductors and ground, using a 1,000-volt megger. Tests shall be made upon completion of all connections and splices and insertion of all overcurrent devices. Tests shall indicate freedom from short circuits and grounds.
 - D. Include a power quality survey for power factor after installation to ensure no system issues (e.g., power factor is satisfactory). The survey should be done with varying load (e.g., a light to heavy range).
 - E. Make all tests in the presence of the Owner's Representative. Contractor shall notify the Owner's Representative in writing seven calendar days prior to testing of the time, place and type of tests to be performed.
 - F. All components, both singularly and as a whole, shall be adjusted and left in a satisfactory operating condition.
 - G. Contractor shall submit a written report of the results of all electrical tests.
- 3.03 Cleaning and Protection
- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 01 26

SECTION 26 05 00 – COMMON WORK RESULTS OF ELECTRICAL

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products
 - A. Clocks: Clocks are located in Division 27 53 13. But for the purposes of the PSD Electrical Department maintaining, supplying and replacing clocks that are not a part of the newer intercom/ clock system the manufacturer and part numbers are listed below for the convenience of information:
 - 1. Synchronous Clocks:
 - a. American Time & Signal: 10" Round, 120V, Flush Mount, U45baaa504 (Lincoln MS)
 - b. American Time & Signal: 12" Round, 24V, Flush Mount, U55baba504

- c. American Time & Signal: 12" Round, 120V, Flush Mount, U55baaa504
 - d. Franklin Instrument Company (Fort Collins High School) Model: F125MA
BLK F08/ 10, 24VDC/ ma (BIPI) Min. Impulse
2. Digital Clocks:
- a. New constructed building clocks are spec'd in Div. 27
 - b. American Time & Signal: 4" rectangle, 24V, DSY441RSB3 (Webber)
 - c. Simplex, 4" rectangle, 120V, Celestra 2000, 6334-9140 (Blevins)
3. 120V or Battery Operated Clocks:
- a. American Time & Signal: 12" Round, 120V plug-in surface mount, E56baav304
 - b. American Time & Signal: 12" Round, Battery w/ booster pack, E56baqd304bf
 - c. American Time & Signal: 12" Round, Atomic Surface Mount, E55band501
 - d. American Time & Signal: 12" Round, Battery Surface Mount, E56baqd304
4. Wire Guards:
- a. American Time & Signal: 16.5"x7.25"x5", G2091 (FRHS)
5. Back-boxes (surface or flush) to match clock being used.

Part 3: Execution

3.01 Preparation

3.02 Installation

Special Note:

Modular Buildings: Modular specs are located in Division 13 34 23. This is the electrical excerpt for modular buildings.

Part 1: General

1.01 Summary

- A. All installation of wiring shall follow PSD Technical Specifications.

1.02 Related Sections

- A. Division 13 34 23

Part 2: Products

Part 3: Execution

3.02 Installation

- A. Electrical services for future temporary buildings must be terminated in 36" traffic rated vault.
- B. Vaults
 - 1. Coordinate location of two vaults in an area close to where such buildings might be placed.
 - a. One (1) 36" vault- Electrical Power
 - b. One (1) 36" vault- Special Systems
- C. Label vaults on the backside of vault cover with the panel label ID and electrical room number from where power is fed.
- D. Extend adequate empty conduit (s) from the main building Comm/Data room (s).
- E. Underground Conduit Sizes
 - 1. One (1)- 2" conduit for Electrical Power.
 - 2. One (1)- 1" conduit for Fire Alarm.
 - 3. Two (2)- 2" conduit for IT/Data.
- F. Label all underground conduits where they are fed from and/ or where they feed to on each end of the conduit run.
- G. Install pull string in each empty conduit.

H. Raceway and Boxes for Electrical Systems

1. 3/8" flex or MC is not allowed for use except for use of fixture whips.
2. Single gang steel boxes w/ bracket are not allowed for the use of device outlets. (Switches, Receptacles etc.) 4" square box w/ bracket and plaster ring are the PSD approved method.
3. J-boxes shall be a minimum of 2-1/8" deep 4" sq. box with combo 1/2" & 3/4" concentric KO's.

I. Wire Connectors

1. Push-on wire connectors are not allowed for use. (This does not include the manufacturers push-in connector used as the ballast disconnect in a lighting fixture)

A. Motors:

1. No contactors, transformers, or control devices to be located above ceilings. Unless approved by PSD Electrical Department.
2. Phase Protection: All motors using 3-phase power and 3-phase air conditioning units shall have protection for phase reversal, loss of phase, or phase unbalance of 10% voltage drop or greater on any one phase.
3. Provide proper rotation of all motors.

B. Wire:

1. Minimum wire size:
 - a. #12 AWG for power and lighting circuits.
 - b. #14 AWG for control and signal circuits.
2. Conductor type:
 - a. Conductors #10 AWG and larger, shall be stranded copper.
 - b. Conductors #12 AWG can be solid or stranded copper.
 - c. Conductors #14 AWG can be solid or (stranded copper, depending on application.)
 - d. Conductors smaller than #14, can be solid copper or stranded.
3. Wire sizing:
 - a. For 20 ampere 120V circuits longer than 75', use #10 AWG conductors.
 - b. For 20 ampere 277V circuits longer than 150', use #10 AWG conductors.
 - c. For circuit amperes other than 20 ampere and for distances greater than listed above, calculate voltage drop and size conductors for maximum three (3) percent voltage drop from last overcurrent device.
4. Purple or Pink wire is the preferred color for the load side of switches. (Switch leg)

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 05 00

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals

- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

A. Grounding System:

1. Provide separate grounding conductor in all raceways.
2. Provide separate grounding jumpers from grounding screw of all receptacle devices to metallic box in which it is mounted. Jumpers may be attached to the box with a separate grounding screw. No ground clip devices are allowed.
3. Provide separate bonding conductor in all runs to exterior lighting standards; i.e. post lights, signs, etc.
4. All conductors used for grounding and bonding purpose shall be copper bare or insulated green only.
5. Provide a separate grounding jumper for all dielectric unions in a fresh water system of the same size as main service ground.
6. Neutral/ground bonding point shall be done within transformers for secondary distribution systems.

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
- 3.03 Cleaning and Protection
 - A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 05 26

SECTION 26 05 29 – Hangers and Supports for Electrical Systems

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

A. Anchors:

1. Only anchors that use removable bolts or screws are allowed. Screw type anchors approved for the application will be the only type of fastener accepted. Anchors shall be used and approved for use per manufacturer instructions. Examples listed.
 - a. **Drywall:** Molly, E-Z anchor (drywall screw in type), toggle bolt and other.
 - b. **Masonry, block, concrete:** Plastic, lead w/ machine screw bolt, drop-in and other.
 - c. Nail in or Pin type anchors **shall not** be used to mount fixtures, straps, boxes, or any device associated with the electrical system.

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 05 29

SECTION 26 05 33 – Raceway and Boxes for Electrical Systems

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

A. Boxes:

1. J-boxes in boiler rooms, mech./elect. rooms, storage rooms or above ceilings shall be a minimum of 2-1/8" deep 4" sq. boxes w/ combo 1/2" & 3/4" concentric KO's.
2. Any boxes in public areas shall be cast weather-proof type or surface raceway (E.g. Wiremold, mid-depth 5748)
3. One extension box is permitted on remodel work to extend existing installations. Where more than one box is needed to flush out installation, provide a larger (i.e. 6" x 6" minimum) box to flush out the existing box and nipple over to a new box.

3.03 Cleaning and Protection

END OF SECTION 26 05 33

SECTION 26 05 33.13 – Conduit for Electrical Systems

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. Conduit:
 - 1. Electrical metallic tubing (EMT) "thinwall" shall not be embedded in poured concrete floors, walls, or roofs. AC, MC, and flexible conduit shall not be used for branch circuits or feeders.
 - 2. All underground conduit runs must be rigid conduit 12" below grade to 48" above grade before transitioning to other styles of conduit.
 - 3. PVC conduit is prohibited above ground.
 - 4. Label all spare conduits on the ends as to where it originates and terminates. Install pull string in each empty conduit. (Exception: it is not necessary to label spare conduits that are stubbed for future use directly above an electrical panel.)
 - B. Flexible Conduit:
 - 1. No MC or AC cable is allowed for use unless approved for use by a PSD electrician for a specific project.
 - 2. ½" flex is minimum size to be used.

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 05 33.13

SECTION 26 05 33.23 – Surface Raceways for Electrical Systems

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. Use medium depth box -1 ¾" (E.g.- Wiremold 5748) as standard unless for specific reasons a shallower or deeper box would be more practical.
 - B. Use 2-hole straps in all areas of the building. **A one-hole strap may be used if it is above the ceiling. No clip type straps are allowed in student accessible areas.*
- 3.03 Cleaning and Protection
 - A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 05 33.23

SECTION 26 05 39 – Underfloor Raceways for Electrical Systems

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products
 - A. Floor boxes for cast-in-place concrete floors:
 - 1. Prohibited without written approval from PSD.

2. Must be fully adjustable, Cast Iron, Formed Gavanized Steel or Plastic. (PSD acceptable floor boxes and covers listed below. If listed boxes and covers are not available, all substitutions must be approved by the PSD Electrical Dept.)
3. Listed Parts as follows:
 - a. Wiremold/Legrand 4-compartment cast iron combination floor box: RFQ4-CI-1
 1. FPBTBK: Black hard floor cover
 2. FPCTCBK: Black carpet flange cover
 - b. Wiremold/Legrand: 'Walker' Modulink plastic gangable floor box: 880MP2
 1. 880MPA: Nonmetallic floor box adjusting ring
 2. 827PCC-BLK: Two-gang nonmetallic carpet flange (black)
 3. 828PR-BLK: Nonmetallic duplex cover plate (black)
 4. 829PCK-BLK: Nonmetallic communication cover plate (black)
4. Front face shall be perpendicular to the floor to prevent entrance of liquids and debris.

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Must be fully adjustable, Cast Iron, Formed Galvanized Steel or Plastic. (PSD acceptable floor boxes and covers listed below. If listed boxes and covers are not available, all substitutions must be approved by the PSD Electrical Dept.)

3.03 Cleaning and Protection

END OF SECTION 26 05 39

SECTION 26 05 53 – Identification for Electrical Systems

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. All electrical panels and equipment shall be labeled. All labels shall be engraved plastic, white letters on black background. Labels shall be attached with screws or rivets. No pressure-sensitive adhesives will be allowed.
- B. The following equipment shall have a plastic nameplate with a minimum letter height of 1/4":
 - 1. Main Service Feeder Switch or Circuit Breaker.
 - 2. Sub-distribution Equipment.
 - 3. Main Switchboard and Panel.
 - 4. All Sub-distribution Panelboards and Special Equipment and Boxes.
- C. The following equipment shall have a plastic nameplate with a minimum letter height of 3/16":
 - 1. Each separately mounted disconnect and starter for a motor or fixed appliance.
 - 2. Nameplate shall also provide the motor designation, voltage, and phase. (Panel and circuit #)
- D. The following equipment shall have a plastic nameplate with a minimum letter height of 1/4":
 - 1. All branch circuit panelboards, complete with voltage and phase.
 - 2. All branch circuit panelboards shall have their directories neatly typed.
- E. All switches that control mechanical equipment, pumps, fans, boilers, etc., shall have plastic nameplates with a minimum letter height of 1/8".
- F. Device covers (receptacles, switches) shall be labeled neatly with a permanent marker or label maker with panel & circuit number. (ex. L1A-10)
- G. On the cover of each junction box and pull box: the circuit number(s) of the enclosed conductors are to be legibly written with a black permanent ink broad tip marking pen and the system identification.
- H. All disconnects & motor starters shall be labeled with panel and circuit number.
- I. Panelboard directories shall be labeled with the actual **finished** building room numbers for circuit identification and not the room numbers from the construction plans. (Unless they are the same)

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 05 53

SECTION 26 05 83 – Wiring Connections

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

A. Devices

1. If a device (switch, receptacle, etc.) is terminated with stranded wire (14, 12 or 10 gauge) a crimp-on type terminal is required.

B. Tying into Existing 'Live' Circuits

1. When tying into a live circuit of a multi-wire circuit the electrical contractor doing the work will be responsible for damage to electronic equipment if a neutral wire accidentally or inadvertently gets 'opened -up'. Otherwise the circuit should be shut off which may require scheduling a time with other classrooms or offices affected by the circuit being turned off.
2. Leave splices long enough to tap for future use. If new wires are being run through a box, leave a loop big enough to splice into at a later date.

C. Wire Connectors

1. Push-on wire connectors are not allowed for use. This does not include the push-in connector used as a lighting disconnect from a fixture whip to a ballast or LED driver in the fixture.

3.03 Cleaning and Protection

- A. Wiring scraps and stripped insulation shall be swept clean from the floor.
- B. Wiring scraps shall not be left on top of the ceiling tiles.

END OF SECTION 26 05 83

SECTION 26 12 00 – MEDIUM VOLTAGE TRANSFORMERS

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

- A. Comply with US Department of Energy's Candidate Standard Level three (CSL-3).
- B. Comply with IEEE-519.
- C. Exceed National Electric Code related requirements.
- D. Exceed NEMA TP-1.

Part 2: Products

2.01 Manufactures

- A. Powersmiths International Corporation or PSD approved equal
- 2.02 Products
 - A. T1000-C3 or PSD approved equal

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. Provide built-in surge suppression and enhanced energy efficient harmonic cancellation.
 - B. Provide 25 year warranty.
- 3.03 Cleaning and Protection
 - A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 12 00

SECTION 26 24 00 – PANELBOARDS

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
 - A. Panelboard manufacturers:
 - 1. Square D
 - 2. Siemens/ ITE
- 2.02 Products

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. General:
 - 1. Install 3/4" conduit from electric meter(s) to main com/data room.
 - 2. Install 3/4" conduit from gas meter(s) to main com/data room.
 - 3. Install 3/4" conduit from water meter(s) to main com/data room.
 - B. Main Distribution Center shall be installed on a 4" housekeeping curb, wall mounted, with a maximum height of 90" to the top of the equipment from finished floor, level and plumb.
 - C. Install nameplates identifying main distribution center, AIC rating, voltage, amps, phase, all branch loads and main devices.
 - D. Provide locks with two keys furnished per lock. All panels keyed alike.
 - E. Door-in-door type front panel construction with nameplate mounted on front of panel.

- F. Install nameplates identifying main distribution center, AIC rating, voltage, amps, phase, all branch loads and main devices.
 - G. Furnish typewritten directory boards to identify each circuit. Note spare circuits on directory cards in pencil.
 - H. Label each breaker within a panel as to type of circuit and area served with room numbers.
 - I. Locate in a dedicated lockable room.
 - J. Main Distribution Switchboard/Panelboards: Copper or tin-plated aluminum bus bars. Prefer Square D or approved equal by PSD Electrical Department.
 - K. Safety Switches: Heavy-duty type fusible or nonfusible, NEMA rating for environment installed. Prefer Square D or approved equal.
 - L. Transformers shall be high efficiency type. (PowerSmith to be approved) Sound levels shall not exceed level listed by ANSI-C89. Transformers to be mounted with additional isolation pads and electrical connections made with flexible conduit.
 - M. Electrical services to include 25% spare capacity for future. Extend service to exterior location directed by School District for each future modular building site and terminate in vault.
 - N. Provide 25% spare capacity and space in all branch circuit panels.
 - O. Provide 3 spare fuses for each size installed. Provide appropriate size spare fuse cabinet to store spare fuses.
 - P. Label all spare conduits on each end as to where it originates and terminates. Install pull string in each empty conduit.
- 3.03 Cleaning and Protection
- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 24 00

SECTION 26 27 26 – Wiring Devices

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products
 - A. Cover Plates:
 - 1. Metal cover plates shall be used on all flush devices.
 - B. Receptacles:
 - 1. All receptacles in schools shall be tamper-resistant.
 - 2. Receptacles shall be 20A commercial grade. Duplex receptacles shall be extra heavy-duty tamper resistant type with nylon fronts and backs.

3. Corridor receptacles shall be High Abuse Type Hubbell, Arrowhart, or P&S on approximately 30' centers.
 4. Devices must be pigtailed from branch circuit for ease of device removal or replacement.
 5. Wires tying into existing receptacles must tie into the branch circuit pigtail and not the screw terminals of the receptacle.
 6. The ground wire shall be pigtailed to the box with a 10/32 green screw and wrapped on the grounding screw/ yoke of the device. Grounding clips or the bonded screw in the yoke are not considered sufficient for use in PSD.
 7. All unused screws on the receptacles or switches shall be in the tightened position.
- C. Switches:
1. Switches shall be extra heavy-duty type with nylon fronts and backs.
 2. Keyed switches shall be P&S 20AC1-L Series. No exceptions.
 3. Devices must be pigtailed from branch circuit for ease of device removal or replacement.
 4. Switches for life safety circuits shall be red.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 27 26

SECTION 26 32 00 – PACKAGED GENERATOR ASSEMBLIES

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

- A. Approved manufacturers: 1st Preference: Kohler, 2nd Preference: Onan.

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Poudre School District standard for providing emergency standby power; Package to include the following.
 - 1. Transfer switch equipped with an adjustable exercise clock that does not require the time/exercise to be programmed through a laptop computer.
 - 2. Remote annunciator – location to be approved by PSD Electrical Dept.
 - 3. Generator shall run on Natural Gas.
 - 4. Standby generators shall be located on the exterior of the building in an area that will provide adequate access for maintenance personnel and equipment.
 - 5. Generator shall be protected by a fenced enclosure, including a fenced roof.
- B. Emergency Power Systems:
 - 1. Emergency power shall operate the following systems:
 - a. Exit/egress lighting.
 - b. EM Lighting: Main Office, Electrical Room, and Telephone Room.
 - c. Telephone system.
 - d. Intercom system.
 - 2. Existing school remodel and expansions shall match existing systems with the following:
 - a. Provide a complete exit and emergency lighting system.
 - b. Locate all exit lights for maximum visibility.
 - c. Entire system shall comply with NEC.
 - 3. Paint red using enamel spray paint for following: cover-plates, J-boxes, load center, panelboards, and safety switches.

3.03

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 32 00

SECTION 26 51 00 – Interior Lighting

Part 1: General

1.01 Summary

- A. Daylighting and light quality are considerations. Brightness contrasts are to be avoided. Foot-candles can be less when proper design is achieved, which may change this specification. (See Sustainable Design Guidelines.)

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

A. Interior Lighting

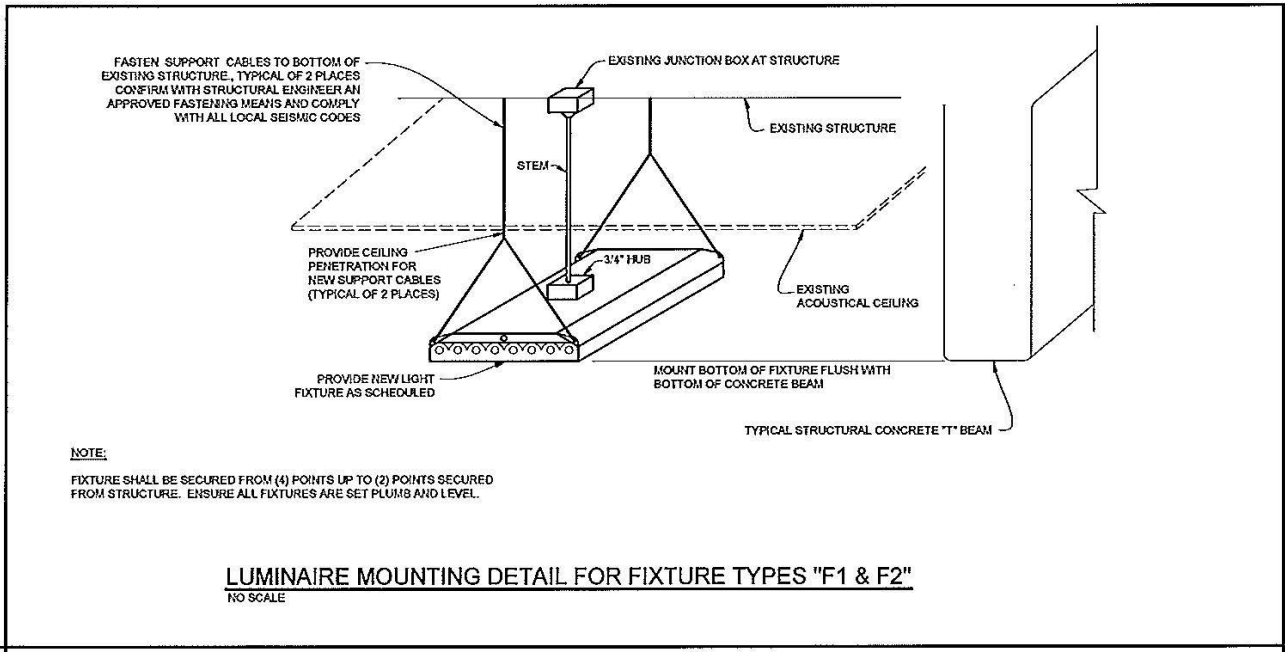
- 1. All new lighting shall be LED.
- 2. The maintained lighting levels in all areas is based on information found on-line in ESNA recommended levels.
http://eeprograms.net/docs/CLEARresult_Gen_Lighting_Recs.pdf

3. Lighting to be designed such that illumination levels fall within a given range, according to the space type. Average lighting levels are not to fall below the range's lower limit and not exceed the range's upper limit. This is to assure all spaces are adequately lit but are not over-lit. The ranges apply to all working areas in space, and should be sustained throughout lamp life. The following foot-candle (fc) ranges are derived primarily from IESNA recommended levels.

<u>Space Type:</u>	<u>Lighting Level Range (fc)</u>
Classroom	30-50
Science Lab	50-70
Library	30-50
Office	30-50
Computer Lab	3-30
Corridor/ Common Space	10-20
Gym (recreational)	30-50
Gym (competition)	50-100
Cafeteria	10-20
Kitchen	30-50
Restroom	5-15
Mechanical Room	20-50

Determined without any deration factors (e.g., dust/dirt, etc.)

4. Luminaire schedule: Provide a luminaire schedule on the design documents to give the following information.
- Luminaire identification.
 - Description (including ballast type).
 - Manufacturer and catalog number.
 - Voltage
 - Lamps (catalog number and type).
 - Mounting with required mounting depth.
 - Input Watts per fixture.
5. Consideration of fixture/ luminaire should include the following:
- Durability: Choose fixtures that will last for many years, and take the abuse of students.
 - Practical: Choose fixtures that can be maintained easily and parts available for many years. (Choose fixtures that will be easy to clean and will keep bugs, paper, pencils, etc...out).
 - Standardize: Choose fixtures with standard lamps and try to reduce the number of different types of lamps the school will have to stock.
6. Fixtures/ Luminaire: New and Replacement:
- New fixtures to be LED unless matching existing lighting fixtures is a consideration for the project area. Use listed fixtures approved by PSD Electrical Department. All others to be approved by PSD Electrical Department.
7. Gym, weight room, flex room, shops – areas with high bay/impact fixtures: Safety cable requirements shown in sketch below. Special install to be reviewed with PSD electrical department.
- If existing suspended lights are removed to be replaced: Contractor is NOT to assume use of existing cables/structure is appropriate for use. Current code to be met and adherence to preferred method of install per sketch below is to govern installation.



B. LIGHTING CONTROL

1. Lighting controls are to be determined in the design process per project. This is a minimal guideline only. (WattStopper standard)
2. Any lighting controlled by occupancy sensors shall have a standard toggle keyed or low volt type switch, located at standard switch location next to the entry door. This switch is to turn off the lights when necessary for the purpose of energy saving and maintenance.
 - a. Switch location mounted occupancy sensors shall not be used unless approved for use by PSD Electrical Dept.
3. Classrooms, instructional areas, and the library shall have multi-level switching. Or approved by PSD Electrical Dept.
4. Gang toilets and locker room lights shall operate from ceiling mounted motion switches overridden (to turn off) by keyed switches. Faculty restroom lighting shall be controlled by standard toggle switches.
5. Corridor lighting shall be controlled by toggle switches located in janitor closet or keyed switches in hallway. Gym lighting shall be controlled by local wall switch. Provide night lighting in corridors, un-switched, connected to emergency panel, and permanently identified on the interior of the fixtures.

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. Wall-pack fixtures shall be hung with metal or lead type expanding anchors with a minimum of ¼" machine screw to fasten on masonry walls; *plastic or drive-in 'button head' nail type wedge anchors are not to be used.
 - B. Fixtures mounted on drywall shall use toggle bolts or screwed into wall stud or other framing member. Use of screw-in type anchors is not permitted. (E.g.: E-Z anchor)

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 51 00

SECTION 26 51 13 – Incandescent Interior Lighting

Part 1: General

1.01 Summary

- A. Incandescent Lamps: Shall not be used in any areas.

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 51 13

SECTION 26 51 16 – Fluorescent Interior Lighting

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

- A. Lamps: Shall be 32w, 3500K or 4100K to match existing lamps in building.
- B. Ballasts: Shall be instant start electronic, Sylvania Quicktronic: QHEX32T/ UNV ISL-SC-B
- C. Ballasts shall be high efficiency per applicable rebate requirements.
- D. Gym Fixtures:
 - 1. Lithonia: I-beam, 24L WD SD125 LP740 DLC OUTCTR WGX, MVOLT
 - 2. GE: Albedo LED Luminaire, High Bay Lighting (ABV-Series)
- E. Troffer Fixtures: Lithonia 2x4 troffer, 3500k (LP835) or 4000k (LP840), LBL4
- F. Wraparound Fixtures: Lithonia 1x4, 3500k (LP835) or 4000k (LP840), LBL4
- G. Custodial closets and other smaller spaces: Lithonia LED Flush Mount, Versi Lite, FMML, 7" or 13", 830 (3000K) or 840 (4000K)
- H. All other fixture/ luminaire styles and types to be approved by the PSD Electrical Department.

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Stairways: No fixtures are allowed above the stairs.
 - 1. Mount fixtures on walls at landings 8'-0" max. above finished landing.

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 51 16

SECTION 26 51 19 – LED Interior Lighting

Part 1: General

1.01 Summary

- A. Fixtures/ Luminaire: New and Replacement:
 - 1. New fixtures to be LED unless matching existing lighting fixtures is a consideration for the project area. Use listed fixtures approved by PSD Electrical Department. All others to be approved by PSD Electrical Department.

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. All storage areas, custodial rooms, and other support areas shall use LED wraparound fixture
- 3.03 Cleaning and Protection
 - A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 51 19

SECTION 26 51 23 – HID Interior Lighting

Part 1: General

- 1.01 Summary
 - A. Metal Halide: Shall not be used unless approved by the PSD Electrical Department.
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
- 3.03 Cleaning and Protection
 - A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 51 23

SECTION 26 52 13.13 – Emergency Lighting

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

Part 3: Execution

3.01 Preparation

3.02 Installation

A. EM lighting fixtures shall not use built-in or remote battery pack batteries as a back-up power source: See exceptions below-

- *Exceptions:*

1. The building does not have an emergency generator used for a back-up EM power source.
2. The building is a modular building or a separate building away from the main building with no EM power run to the building from the generator.

B. All new EM lighting fixtures installed must tie into the building EM power or the automated building EM lighting control system, unless noted above in exceptions.

3.03 Cleaning and Protection

A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 52 13.13

SECTION 26 52 13.16 – Exit Signs

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

A. PSD standard: Light Fixture Industries 33EXST-GW (White Steel housing, Green lettering, AC only) (Note: PSD has ordered them on-line from 'exitlight.com'. 1-2 week delivery time.)

B. All other alternates/ substitutes shall be approved by PSD Electrical Department.

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Installed as required by IBC and NFPA
- B. Wire guards shall be installed around exit lights in gyms and multipurpose room.

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 52 13.16

SECTION 26 56 00 – Exterior Lighting

Part 1: General

1.01 Summary

- A. All complete building replacement of exterior fixtures shall be LED type approved by PSD Electrical Department.
- B. Remodel projects shall try to match existing exterior LED or High Pressure Sodium fixtures if possible or PSD Electrical Department approved.

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

A. AREA LIGHT CONTROL

1. Tie exterior light circuits into existing PSD 'Building Automation System'
2. IF there is not a 'Building Automation System' installed at the site, tie exterior light circuits into a central digital time clock. Lighting control shall be photo-cell "on" time clock, "off".
 - a. Parking Lot: "On" dusk, "Off" time clock
 - b. Building Security: "On" dusk, "Off" time clock
 - c. Or other method approved by PSD Electrical dept.
3. Photo-Cell:
 - a. Photo-cell shall be roof mounted or high on wall outside of electrical room (Location to be approved by PSD Electrical Department.)
4. Provide manual override in a convenient location for maintenance operation of exterior fixtures by School District Electrician during daylight hours, for maintenance purposes. (Location to be approved by PSD Electrical Department.)

Minimum Lighting Levels in Foot-candles (fc): Foot-candle levels are based on general information found on-line for IESNA recommended levels.

 - a. Building Exterior: 1fc
 - b. Main Entrance Areas: 5fc
 - c. Egress Emergency Lighting: 0.5fc
 - d. Parking Areas:
 1. High Schools-
 - * High Activity (Athletic/ Theatre): 3.5fc

- * Low Activity (General Parking): 1fc
- 2. Middle Schools-
 - * Medium Activity (Athletic): 2.5fc
 - * Low Activity (General Parking): 1fc
- 3. Elementary-
 - * Low Activity (All Parking): 1fc
- e. Average exterior lighting level shall be 1 foot-candle, and no areas shall be less than 0.5 foot-candles.
- 5. Exterior Lamps and Ballasts
- 6. Exterior lamps shall be dual element high-pressure sodium in HPS fixtures.

Part 2: Products

2.08 Manufactures

A. Lighting Contactors:

- 1. 120 or 277 volt, 20 amp, multipole, electrically held NEMA 1 enclosure.

B. Approved Manufacturers:

- 1. Square D, or approved equal.

2.09 Products

Part 3: Execution

3.08 Preparation

3.09 Installation

3.10 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 56 00

SECTION 26 56 13 – Lighting Poles and Standards

Part 1: General

1.01 Summary

- A. Parking lighting shall be pole mounted. 30' maximum, 12'-0" minimum pole height from finished grade. Install light poles on minimum 24" high concrete pedestals in landscaped areas, and 36" concrete pedestal in parking lots.

1.02 Related Sections

1.03 Definitions

1.04 Submittals

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products
 - A. (Head Only) RAB Lighting, ALED4T150N

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
- 3.03 Cleaning and Protection

END OF SECTION 26 56 13

SECTION 26 56 19 – LED Exterior Lighting

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufactures
- 2.02 Products
 - A. PSD approved LED exterior luminaires and pole light fixtures:
 - 1. Wallpacks:
 - a. MaxLite, maxLED 20 Series, 20W, 5000K
 - b. RAB Lighting, Slim26N, 26W, 4000K

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
- 3.03 Cleaning and Protection
 - A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 56 19

SECTION 26 57 00 – PROGRAMMABLE LIGHTING CONTROL SYSTEM

Part 1: General

1.01 Summary

- A. In general the system shall control all building lighting.
- B. Lighting control system shall utilize networking technology to be integrated with the Building Automation System. (BAS)
- C. Lighting control system shall have override switches. (The number and location of override switches to be determined in the design process) The override switches shall be capable of turning lights 'ON', bypassing the photo-cell and Building Automation System. (Previous Lighting Control System specs/systems used in the District are available by contacting PSD - PD&C representative.)
- D. Minimum lighting levels of all areas to be determined in design process.
- E. Electrical contractor shall be familiar with all system components and the associated requirements prior to submitting a bid.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

- A. Overall Building Shop Drawings
- B. System Component Shop Drawings
- C. Typical Wiring Diagrams
- D. Testing, Operation, Maintenance Data

1.05 Quality Assurance

- A. Source Limitations:
 - 1. Obtain lighting control devices from a single source.
- B. Manufacturers:
 - 1. Firms regularly engaged in manufacture of lighting control equipment whose products have been in satisfactory use in similar service for not less than five years.
- C. System Support:
 - 1. Factory-authorized technician or factory-authorized service representative shall be available for onsite training as well as telephone support.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

- A. Acceptable Manufacturer: Douglas Lighting Controls or approved equal.

2.02 Products

- A. Submit shop drawings on programmable lighting controller & components for approval.

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Provide all necessary software to integrate the lighting control system with the building automation system. (BAS)
- B. Program timeclock functions according to Owner representative(s) desired settings.
- C. Demonstration
 - 1. Provide a factory-authorized technician or factory-authorized service representative to train PSD Electrical Department personnel as specified below.

- a. Troubleshooting, servicing, adjusting, and preventive maintenance.
- b. Programming of the lighting control system.
- c. Provide a minimum of three hours training.

3.03 Cleaning and Protection

- A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 57 00

SECTION 26 58 00 – AUDITORIUM BLACK BOX THEATRE PERFORMANCE LIGHTING SYSTEM

Part 1: General

1.01 Summary

- A. The work shall include supply and installation of new equipment components and instruments for the performance lighting system, including house lighting control equipment.
- B. Furnish engineering checkout and instruction in the use of the lighting control systems specified herein.
- C. Support the Theatrical Systems Installing Contractor by providing demonstration and user training.
- D. Installation and integration of this equipment shall be by the Theatrical Systems Installing

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

- A. Shop Drawings
- B. Submit elevations of control room and dimmer room wall showing equipment locations to be coordinated the A/V System Installing Contractor, the Contractor and Electrical.
- C. On completion of installation, provide project record documents and complete operation manuals.

1.05 Quality Assurance

- A. The dimming, control and associated equipment specified herein shall have been continuously engaged in the manufacture of theatrical lighting, dimming and control equipment for at least ten (10) years.
- B. WARRANTY:
 - 1. Guarantee all components to be free of defects in material and workmanship for a period of two (2) year from date of final acceptance.
 - 2. Paint and exterior finishes, fuses and lamps are excluded from above guarantees except when damage or failure results from defective materials or workmanship covered by the guarantee.
- C. SERVICE:
 - 1. Replace defective materials and repair faulty workmanship within 48 hours of discovery at no cost to the Owner.
 - 2. If during a period of two (2) year from date of final acceptance, any component is out of service for more than one week, due to unavailability of parts or service within that period, supply and install an identical new component. If an identical component is not available, substitute equivalent equipment, but only with the approval of the Owner.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufactures

2.02 Products

A. The performance lighting system shall include, but not be limited to, the following:

1. Auditorium Dimmer and Control Equipment:

- a. Electronic Theatre Controls Sensor+ SineWave
- b. Electronic Theatre Controls Sensor+
- c. Strand Lighting C21 Advanced Technology Dimmer System
- d. Approved Equals meet the standards of SineWave or IGBT dimming

2. Distribution Equipment:

- a. All plug strip circuit members shall be identified by 2" high presson letters, silk screening or paint-filled engraving on the strip in 2-inch high contrasting numerals.
- b. All circuits shall have 18-inch pigtails, except as noted, 2 pole, 3 wire stage pin connectors and double pipe hangers. Provide junction boxes and terminal boxes as required. Field verify all dimensions prior to fabrication.

3. Auditorium Lighting Instruments:

- a. Lighting instruments shall be complete with 2 pole, 3 wire stage pin connectors, color frame, lens, lamp, C-clamp and safety cables.
- b. Description Manufacturer Model No. Qty.
- c. Ellipsoidals: Electronic Theatre Controls Source 4 or approved equal
- d. Zoom Ellipsoidals: Electronic Theatre Controls Source 4 or approved equal
- e. Fresnels: Electronic Theatre Controls PARnel or approved equal
- f. PAR Altman PAR64/8 CF/P64 SS 24 or approved equal
- g. 12 Medium & 12 Wide
- h. Skycyc Altman SKY-CYC-03 4 or approved equal
- i. Followspot Lycian Midget 1209 2 or approved equal

4. Lamps:

- a. Provide one (1) lamp per instrument plus 20% spares, minimum of six (6) spares. For Xenon lamps provide 100% spares.

5. Miscellaneous:

Part 3: Execution

3.01 Preparation

3.02 Installation

A. DEMONSTRATION AND TRAINING:

1. The engineer in conjunction with the Theatrical System Installing Contractor shall provide at least four (4) hours of instruction on the programming, operation, maintenance and troubleshooting of the system.

3.03 Cleaning and Protection

A. See Section 26 01 00 – General Requirements, Part 3 – Cleaning and Protection, 3.03

END OF SECTION 26 58 00

Exhibit E

SECTION 11 40 00 – KITCHEN EQUIPMENT

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required
 - A. Shop Drawings
 - B. Contractor Rough-In
 - C. Cut Sheet Book
 - D. Start-up Demonstration and Manuals
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufacturers
- 2.02 Products
 - A. **All Equipment is to be approved by the PSD Plumbing Department. This section lists typical equipment used recently as a basis for design.**
 - B. MATERIALS
 - 1. Stainless Steel: Stainless steel shall be of U.S. Standard gauges, but not less than 20 gauge, Type 304 with No. 4 finish.
 - 2. Galvanized Steel: Galvanized Steel shall be of 14 gauge and shall be hot dipped galvanized. Galvanized steel may be used in all non-exposed areas, areas with no contact with food or serving items and in framework. When used in framework, galvanized steel shall be of welded construction (welding is to be done before galvanizing). Use of galvanized steel will be subject to final approval during submittal check.
 - 3. Insulation Materials: For normal temperature applications, such as custom fabricated under-counter refrigerators, use extruded polystyrene material 2 in. (50 mm) thick, bonded at all joints.
 - 4. For heated-type application, such as plate warmers, use block-type rock wool, minimum 1 in. (25 mm) thick.
 - 5. For low temperature applications, such as ice bins, cold pans, or custom fabricated under counter freezers, use urethane, rigid foam board or foamed-in-place, not less than 2 in. (50 mm) thick, except that vertical surfaces of cold pans and ice bins may be 1 in. (25 mm) thick. Bond insulation at joints to prevent condensation on exterior.
 - 6. At counter tops subject to heat from cooking equipment and/or refrigeration compressors, use 1 in. (25 mm) thick Manville Martinite 36, or equal, to insulate underside of top. Also add Martinite material between freezer or refrigerator and 14 gauge (1.98 mm) stainless steel top.
 - 7. Fiberglass insulation materials shall not be used. Insulation shall be bonded to all surfaces.

C. METAL TOP CONSTRUCTION

1. Metal tops to be one-piece 14 gauge stainless steel welded construction including field joints. Tops to be secured to a full perimeter galvanized steel channel frames except at wood top tables, drainboards and dishtable where channel frames shall be stainless steel and cross braced not farther than 30 in. (760 mm) on center. Fasten top with stud bolts or tack welds. Coat underside of tops with a minimum 1/16 in. (1.6 mm) thick approved hard-drying, sound-deadening, mastic material. Apply all coatings by spreading after top has been secured to frame, such that top and frame are covered and sealed. Table tops must not deflect or distort when fully loaded.

D. ENCLOSED CABINET BASES

1. Fabricate bases from not less than 18 gauge (1.27 mm) steel reinforced by forming metal ends and shelves. Partitions to be constructed of stainless steel. The ends and vertical partitions can be of single wall construction, with a 2 in. (50 mm) face partitions and sides shall be welded at intersections and be flush with the bottom edge of the bottom shelf.
2. Unexposed backs and structural members may be constructed of galvanized steel.
3. Intermediate shelves to be removable. Bottom shelves shall be non-removable.
4. All cabinet doors to be hinged left or right unless otherwise specified.

E. LEGS AND CROSS RAILS

1. Legs and cross rails to be of 1 5/8 in. diameter (941 mm), 16 gauge (1.59 mm) seamless stainless steel tubing. All crossrails to be continuously welded, ground and polished. Tack welds or other methods of connection are not acceptable. Bottoms of legs to be wedged inward and fitted with a stainless steel bullet-type foot with not less than 2 in. adjustment. Freestanding legs are to be pegged to floor with 1/4 in. (6 mm) diameter stainless steel rods.
2. Stainless steel gussets shall not be less than 3 in. (76 mm) diameter and 3/4 in. (95 mm) long. Outer shell to be 16 gauge (1.59 mm) stainless steel reinforced with 12 gauge (2.78 mm) mild steel insert welded to interior of shell. Gusset to be large enough to accommodate a 1-5/8 in. (41 mm) tube and shall have an Allen screw fastener.
3. Low counter legs shall be constructed of stainless steel exterior and shall be 5 3/4 in. (146 mm) minimum height or 7 in. (178 mm) maximum height with 3 1/2 in. (89 mm) square plate with four countersunk holes, welded to the top for fastening.
4. Adjustable feet to be constructed of stainless steel 1/2 in. (38 mm) diameter tapered at the bottom to 1 in. (25 mm) diameter, fitted with a 3/4 in. (19 mm) cold-rolled rod threaded for minimum of 1/2 in. (38 mm) for fitting into a threaded plug welded to leg. A push-in foot is not acceptable. Tables with utilities will have flanged feet and will be securely bolted to the floor with stainless steel fasteners as required by local code.
5. When legs are fastened to equipment, the following methods must be used:
 - i. Sinks: Gussets shall be welded to triangular stainless steel plates, which in turn shall be welded to the underside of sink.
 - ii. Metal Top Table or Dishtable: Gussetts shall be welded to 14 gauge or heavier channel reinforcing.
 - iii. Wood Top: Gusset shall be welded to a stainless steel channel of not less than 14 gauge stainless steel (1.98 mm), secured to the top with screws through slotted holes.

F. SHELVES

1. When shelves are part of the fixture, the following must take place:
 - i. Open base type shelf shall be notched around the leg and continuously welded to the leg.
 - ii. Cabinet base type shelf shall be turned-up 2" on the back side with a minimum of 1/4 in. (6 mm) radius to insure a tight fit to enclosure panels.
- G. WALL MOUNTED SHELVING, RACKS, AND CABINETS
1. Wall backing of sufficient size and strength to support the intended fixture when fully loaded or at full capacity.
- H. SINKS, STEAM TABLES AND BAIN MARIES
1. When multiple compartments are part of the design, they shall be continuous on the exterior without applied facing strips or panels. Bottoms of each compartment to be creased to ensure complete drainage to waste opening.
 2. Partitions between compartments to be double thickness, continuous and welded.
 3. Where sink bowls are exposed, the exterior shall be polished to a number 4 finish.
 4. Furnish following drains, wastes and faucets manufactured by Chicago Faucets with lever type handles, shipped loose for installation.
 5. Basket strainer drains shall be Fisher Model 6555 with 3 1/2 in. (89 mm) basket.
 6. Rotary drains shall Fisher Model 6100 rotary type waste with connected overflow. Valve to be 2 in. (50 mm) chrome plated.
 7. Water stand bain maries shall be fitted with 2 1/2 in. (50 mm) waste with basket strainer with connected overflow and adapter to connect to 1/2 in. (38 mm) drain line. Use Standard Keil box pattern basket, drain number 4161-Cp with 458-X overflow head.
 8. Furnish faucets for all sinks, bain maries, water stations and other fixtures per 'D' above. If not otherwise specified, all faucets will be backsplash mounted.
 9. Provide vacuum breakers on equipment.
 10. Floor sinks are to be made of cast iron with porcelain enamel coating to withstand 250 deg. Temperatures, and have secure grates to prevent falls. Floor sinks are to be level with the floor to prevent a trip hazard and to allow water to flow into them. They should be positioned out of the walkway portions of the kitchen; i.e.: under the steam table serving counter or dish machine. These must be under open counter areas or positioned so that they are accessible for cleaning. A trench drain or large square drain (24in.x24in) should be used in front of the steam kettle. A stainless steel anti-splash box should be provided for draining kettles.
- I. CUSTOM FABRICATED WORKMANSHIP
1. Items of specially custom fabricated equipment must be custom fabricated by an acceptable manufacturer, who is N.S.F. approved and custom fabricated in an approved manner.
 2. Welding and Soldering: Materials 18 gauge (1.27 mm) or heavier, shall be welded.
 3. Seams and joints shall be shop-welded or soldered as the nature of the material will require.
 4. Welds shall be ground smooth and polished to match original finish.
 5. Where galvanizing has been burned off, the weld shall be cleaned and touched up with high-grade aluminum paint.
 6. Fasteners and Joints: The following will not be accepted:

- i. Exposed screw or bolt heads. Rivets. Butt joints made by rivetting straps under seams and then filled with solder. All fasteners exposed to moisture will be stainless steel.
 - ii. Rolled Edges: Rolled edges with corners bullnosed, ground and polished.
- 7. Coved Corners: All stainless steel food service equipment shall have 1/2 in. (13 mm) or larger radius coves in all horizontal and vertical corners and intersections per N.S.F. standards.
- 8. Closures: Where ends of fixtures, backsplashes, shelves, etc. are open, fill by forming the metal, or weld sections, if necessary, to close entire opening flush to walls or adjoining fixtures.
- 9. Fabricated equipment having a specified manufacturer, if fabricated by another manufacturer; It shall be specifically understood that all standard accessories, construction details, and features, whether stated or not, will be met, and/or, provided by the current manufacturer.
- 10. All shelf, counter, or other penetrations will have properly sized grommets installed and secured to prevent accidental removal.
- J. OPERATION REQUIREMENTS
 - 1. Insure quiet operation of food service and related equipment. Provide sound deadening on all tables, counters, undershelves, sinks and drainboards.
 - 2. Insure bumper gaskets, stops, and any other protection is installed on all custom fabricated equipment as needed.
- K. CONNECTION TERMINALS
 - 1. All custom fabricated equipment shall be provided with standard connection terminals to make final connections on job site.
- L. EXHAUST HOODS, WALK-IN COOLERS AND DISHMACHINES
 - 1. Provide all stainless steel duct connections and collars.
 - 2. 22 Gauge Stainless Steel Wall Flashing is required from the lowest point of the Exhaust Hood to the top of the cove base, and full width of the hood. All seams and edges will be fully finished. Overlap seams or raw edges are not acceptable.
 - 3. Fire dampers may be required per project.
 - 4. Dish-machines should be Hobart model: AM-14 T (Tall) for elementary schools and Hobart C-line (C-44 or C-64) (all with 6 inch height extension) for Jr. High and High schools. These are to be hot water sanitizing, with Hatco gas fired booster heater for energy efficiency. Gas boosters are to be vented into draft hood above dishwasher using stainless steel vent pipe. A water connection (3/4 x 1/2 TEE) is to be installed on the rinse piping to dishwasher (above dish-counter) with a 1/2 x 1/4" compression stop for soap/rinse control connection.
- M. INSERT PANS
 - 1. All cut-outs, openings, drawers, and equipment to hold stainless steel insert pans shall be provided with a full complement of pans as follows:
 - 2. One (1) stainless steel, 20 gauge (.95 mm) minimum, solid insert pan for each space, sized per plans, details, and specifications.
 - 3. Provide one full-size pan to securely fit each opening.
 - 4. Provide a maximum depth pan to suit each application and space allocated for same.
 - 5. Provide 18 gauge (1.27 mm) removable stainless steel adapter bars where applicable.
- N. TRAY SLIDES

1. Configuration of all corners, turns, and shape of tray slides for proper support and safe guidance of trays.
 2. Size and shape of tray to be used in operation.
- O. ENCLOSURES
1. Provide and install enclosure panels secured or removable as specified for any item which houses equipment with movable parts, i.e. compressors, pumps, etc. Also, cover and provide protection for any exposed steam line or condensate line, which may be within reach of operating personnel.
- P. DISPENSER (SELF-LEVELING)
1. Verify make of ware, their dimensions, and weight and submit to the dispenser manufacturer at earliest possible date so that springs may be properly calibrated.
- Q. WATER FILTER-PURIFIER
1. Furnish in-line water filter-purifiers to remove contaminants, minerals, taste, or odors from beverage system, coffee urns, and icemakers, and steamers, manufactured by Everpure or equal. Provide proper size filter - purifier for equipment being supplied. Locate to insure easy access for cartridge replacement.
- R. CONVENIENCE AND POWER OUTLETS
1. Make cut-outs and install appropriate boxes or outlets in custom fabricated fixtures complete with wiring conduit, outlet and cover plate.
 2. All outlets and plugs shall conform to NEMA standards. Convenience (and all 120V outlets) will be NEMA 520R, horizontally mounted.
 3. All electrical outlets and devices shall be first quality "Specification Grade."
- S. PLUGS AND CORDS
1. Where cords and plugs are used, they must comply with National Electrical Manufacturer's Association (NEMA.) requirements.
- T. HEATING EQUIPMENT
1. Electric and heating equipment to be installed so as shall be readily cleanable or easily removable for cleaning.
 2. Steam-heated custom fabricated equipment shall be of self-contained assembly complete with control valves located in an accessible position.
 3. Convection Steamers are to be "Cleveland" brand. (Please verify size/model with owner prior to spec. so as to size to individual school's needs)
 4. Steam Kettles are to be "Cleveland" brand. (Self-contained, natural gas). A pre-rinse faucet combined with a fill faucet should be installed with the kettle, and have a backflow device.
 5. Hot holding cabinets/proofers should be "CresCor" brand.
 6. Stove-tops/Ranges should be Garland brand. These need to be electronic/spark ignition. (No open pilots)
 7. Convection ovens should be Blodgett: Model: DFG-100 with solid-state manual controls (not digital), casters, flexible gas hose with quick disconnect and restraining tether. Gas manifold to be installed with individual gas cocks for each oven (top and bottom).
- U. STARTERS, SWITCHES AND CONTROLS
1. Furnish all starters, motor controls, remote controls and transformers as required.
 2. Locate all switches out of heat zone.

3. All starters, switches and controls shall have white on black phenolic plastic identification plates with stainless steel screws conspicuously located on adjacent surfaces.

V. REFRIGERATION

1. Walk-In Coolers/Freezers are to utilize BOHN (brand) condensing units and Copeland components. Compressor Racks are to be on the roof in appropriate outdoor cabinets. All walk-ins should have a digital temperature display/alarm; it should be wired and connected to an alarm notification system to call maintenance in the event of high temperature conditions. Door latches should accommodate owner's padlock. Walk-in thresholds are to be a smooth or ramped surface to accommodate carts rolling in/out. Condensate drains are to be insulated and encased with plastic (washable surface). Drain shall not impede in walkway outside walk-ins.
2. Refrigeration systems shall include start-up and thirteen-month parts and labor guarantee as stated herein before plus an additional four-year guarantee on all condensing units and compressors. This includes refrigerators, ice cream cabinets, icemakers, freezers, dispensers, and all other refrigerated items. Service maintenance contracts are at the discretion of the Owner.
3. All refrigeration condensing units shall include pre-wiring, pre-piping, crankcase regulator, head pressure regulator, factory-installed suction line accumulator, phased loss protection, five year warranty, main fuse disconnect, structural steel frame and weatherproof carbon steel body panel with epoxy paint finish, and refrigerant detective alarm.
4. Compressors and related components must be fully accessible for service and maintenance.
5. Reach in Refrigerators: "True" is the recommended brand.

W. COLD PANS

1. Ice pans, refrigerated pans and cabinets to be provided with breaker strips where adjoining top or cabinet face materials, to prevent transfer of cold.

X. VENTILATION OF REFRIGERATED EQUIPMENT

1. Adequate air supply and exhaust shall be provided for all self-contained or remote refrigeration condensing units, both custom fabricated and standard, as required for proper operation.
2. If additional ventilation is required to ensure correct operating temperatures, so state in a letter for evaluation and decision before purchase/fabrication.

Y. COMPONENTS

1. Coils: Coils for standard and custom fabricated refrigerators to have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.
2. Expansion Valves: Standard reach-in refrigerators and freezers, for remote refrigeration systems, shall be complete with thermostatic expansion valves at the evaporator.
3. Thermometers: Refrigerated compartments, custom fabricated and standard shall be fitted with flush digital type thermometers with chrome-plated bezels. Thermometers to be adjustable and shall be calibrated after installation. Thermometers shall have an accuracy of + 2oF. (1oC). Walk-in boxes will have digital alarms as noted in itemized specifications.

4. Hardware: Refrigerator hardware for standard and custom fabricated refrigerator compartments shall be solid, heavy-duty components. Hinges must be self-closing. Latches shall be magnetic edge mount-type.
5. Locks: Doors and drawers for reach-in refrigerated compartments, both custom fabricated and standard, to be fitted with cylinder locking type latches, and provided with master keys.

Z. MISCELLANEOUS METALS

1. Provide and install 22 gauge stainless steel wall flashing from the top of floor cove base to under the lowest point of the exhaust hood(s). Flashing will extend the full width of the exhaust hood. 22ga stainless steel wall flashing will be installed from the top of the backsplash to the base of wall shelves at all sinks and work tables with sinks unless otherwise stated. Corner Guards (14ga Stainless Steel, 48' high, 4" x 4", broke at 90°, with a 5° return brake) will be installed at all outside corners of the foodservice areas. 90° brake angle will be adjusted to match the actual angle of the walls. Base of the corner guards will be at the top of the floor cove base. Provide and install all necessary trim panels and closures, including cosmetic coverings. Equipment closures will match the individual equipment finishes.

AA. MISCELLANEOUS EQUIPMENT

1. Can openers should be Edlund model: S-11
2. Garbage Disposals are to be In-Sink-erator brand with legs to the floor and should have splashguards installed. P-traps are to be chrome -plated cast-brass.
3. Ice Machines should be cubed ice (not crushed). Manitowoc Brand is recommended. A floor sink is needed under edge of machine to accommodate drain lines.
4. Island sinks are to have covered/protected water lines. Floor supplied water lines are not acceptable. Water supply to come from ceiling with stainless steel chase for piping. Accessible isolation valves for each sink are required.
5. Hand sinks should have no towel or soap dispensers incorporated in design of sink. These can be provided separately to accommodate district-wide standardization of paper towels, etc.
6. Mixers/slicers should be "Hobart" brand.
7. Kitchen should have a custodial closet with a mop sink (with a backflow device on faucet).
8. Casters must be installed on all gas appliances and have flexible gas hoses with quick disconnect and restraining tether. (front casters shall lock)
9. Grease trap is to be a one- piece design with two cast manholes level to grade and have cleanouts for inlet and outlet. Please check with health dept for sizing guidelines.
10. Exterior Kitchen doors shall be at least 48 inches wide to accommodate removal/installation of equipment.
11. Isle ways in kitchen shall be wide enough for removal/ installation of equipment and should be wide enough near ovens to allow room for cooks to safely remove pans from oven and pass by with oven doors open while carrying hot pans to a nearby counter that will accommodate hot pans.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. TRIMMING AND SEALING OF EQUIPMENT

1. Any space between units to walls, ceilings, floors and adjoining non-portable units shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material suitable to the nature of the equipment.
2. Sealer, when not exposed to extreme heat, shall be single part neutral curing silicone sealant.
3. Ends of hollow sections shall be closed.

B. CUTTING AND FITTING

1. Do all cutting and fitting required on the equipment during installation and hook up.
2. No cutting, notching, drilling, or altering of any kind will be done to the without first obtaining permission from the Owner.

C. QUALIFICATIONS

1. All work associated with kitchen equipment (moving, installing, unhook/hook up, gas/power/water, etc.) to be done by a kitchen equipment vendor/expert/specialized company. Work not to be done by the general contractor, electrician, plumber, etc.
 - i. PSD may be contacted as the first option but is not obligated to do work for construction projects.

3.03 Cleaning and Protection

END OF SECTION 11 40 00

SECTION 11 40 50 - ITEMIZED SPECIFICATIONS

- All fasteners will be stainless steel, and fastener heads will be burr free.
- Each of the following items is to be complete with all factory accessories and options included in the specified model as well as options, modifications, or accessories as listed.
- Equipment that attaches to walls, and has legs, will be attached to the wall under the backsplash with 'Z' clips every 32" or closer, and the legs pinned to the floor with stainless steel pins. All wall mounted equipment must have wall backing at the mounting points. Tables with utilities will have flanged feet bolted to the floor. Suitable wall backing required.
- Wall bumpers wherever impact damage from mobile equipment is possible. Wall bumpers will be by Boston Bumper.
- Gas connections will be 3/4" rear entry.
- Shelving will be assembled first shelf ten inches (10") off floor, or as required by local code, with the balance of shelves equally spaced to top of post.
- In every case the valves will be electrically tripped, and manually reset. Electric or automatic reset valves are not permitted.
- Coordinate NEMA configuration. • Provide shop drawings for approval prior to fabrication.

CASHIER COUNTER - mobile

1. Four (4) polyurethane, non-marking casters, two (2) with brakes.

2. Stainless steel top with knock out for the Cash Register cord.
3. 15" x 20" x 3" Keyed cash drawer.
4. Drop leaf tray slide on both sides.

MILK DISPENSER

1. True Model No.: TMC-49-SS Pertinent Data: ---Utilities Required: 120V/1PH; 8.2A
2. Forced Air, 12 Crates, S/S Drop Font/Hold-Open Flip-Up Lids, Lock
3. S/S Interior & Floor, 3 Heavy Duty Floor Racks
4. Digital Thermometer, 4" Castor, 1/3 HP, 115/60/1

MOBILE SALAD BAR

Manufacturer: Cambro Model No.: 5FBRSL 1.
Tray rails FBR5R on both sides of unit.

TRAY LOWERATOR DISPENSER

Manufacturer: Lakeside Model No.: 818 1.
Swivel casters, two (2) with brakes.

SERVING COUNTER

Manufacturer: Custom Fabricated Model No.: Stainless Steel

1. Adjustable stainless steel legs with flanged feet on front legs only.
2. Open shelving.
3. Chicago #349CP fill faucet.

VERTICAL SNEEZE GUARD

Manufacturer: Brass Smith Model No.: Z9500 Pertinent Data: Fixed, Adjustable Utilities

1. 1/4" tempered front adjustable glass.
2. 1" radius on all corners.
3. All supports and base shall be 1" diameter. Brushed aluminum finish.

CONDIMENT CART

Manufacturer: Lakeside Model No.: BC330

1. Swivel casters, two (2) with brakes.
2. Enclosed sides to conceal contents of cart.

HOT FOOD WELL

Manufacturer: Atlas Set-N-Serve Model No.: WIHL-2: 208V/1PH; 8.2A; 1/2" HW, 1" IW

1. Factory-installed manifold drain and valve.
2. Apron mounted remote controls.
3. Heavy duty cord and plug.
4. If skirting is used, skirting panels shall be removable for servicing equipment.

MOBILE PASS-THRU REFRIGERATOR

Manufacturer: True Model No.: TR1RPT-1S-1S: 120V/1PH, 8.3A

1. Stainless steel shelves.
2. Heavy duty cord and plug.
3. Heavy duty 6" high casters, two (2) with brakes.
4. Five year compressor warranty and 1 year Service/Labor warranty.

MOBILE HEATED TRANSPORT CABINET

Manufacturer: Cres Cor Model No.: H-137-PSUA-12C: 120V/1PH, 16.0A

1. Formed and welded .100 aluminum top, .190 aluminum base.
2. 11 sets extruded universal angles for multiple pan sizes.
3. Field reversible brushed .063 aluminum door.
4. Controls which are accessible without opening door.
5. Heavy duty 5" swivel casters, two (2) with brakes.
6. Corner bumpers.
7. Digital thermometer.
8. Heavy duty cord and plug.

WORK TABLE WITH DRAWER

Manufacturer: Custom Fabricated Model No.: Stainless Steel

1. Flanged feet on all legs.
2. 16 gauge stainless steel undershelf.
3. One (1) 20" x 20" self-closing drawer with 250-pound extension slides.

ICE MAKER WITH BIN

Manufacturer: Manitowoc Model No.: QR-0212A: 208V/1PH13.2A; 3/8" CW (from water filter); 3/4" IW

1. All stainless steel construction.
2. Produce cubes 7/8" x 7/8" x 7/8" thick.
3. Heavy duty cord and plug. 4. Install water filtration system

WATER FILTRATION SYSTEM

Manufacturer: Everpure Model No.: 9324-01: 3/8 " CW

1. Coordinate installation with Ice Maker With Bin.

WORK TABLE WITH DRAWERS

Manufacturer: Custom Fabricated Model No.: Stainless Steel

1. Flanged feet on all legs.
2. 16 gauge stainless steel undershelf.
3. Two (2) 20" x 20" self-closing drawer with 250-pound extension slide.

UTILITY RACK

Manufacturer: Cres Cor Model No.: 207-UA-13: Universal Angle Slides

1. Heavy duty extruded aluminum construction.
2. Verify tray size with owner.
3. Pan stop.
4. Perimeter bumper.
5. Four (4) 5" diameter, swivel, polyurethane tires.

FROST TOP

Manufacturer: Delfield Model No.: N8245 Pertinent: 120V/1PH; 7.0A

1. One piece 18 gauge stainless steel.
2. Drain trough and 2" overhang around perimeter.
3. Suspended condensing unit.
4. Heavy duty cord and plug.
5. If skirting is used, skirting panels shall be removable for servicing equipment.

EXHAUST HOOD

Manufacturer: Molitron Model No.: BFC/87-54: UL Listed, Modular Extractor: 120V/1PH; 15.0A; 2175 CFM Exhaust

1. Assembly to consist of two (2) section 87" long x 54" wide x 30" high wall mount. Construction to be 18-gauge, Type 304 stainless steel with No. 4 finish with an additional 12" on the right hand side, to mount Fire Suppression System.
2. UL-listed, NSF-approved grease extractor in compliance with NFPA 96, latest edition.
3. Modular high slot grease extractor to be easily removable with high-velocity, low-volume, sixturn design to extract grease with 95% efficiency. Exhaust slot opening to be located within 51/2" of top of hood for faster smoke capture, lower turbulence, and maximum grease extraction. Lower slot location is not acceptable.
4. Concealed grease trough with collection drawers at each end, to be accessible from top and full length for easy cleaning.
5. UL-listed incandescent light fixtures and bulbs pre-wired to one single connection point on each hood section.
6. Fire suppression system shall be wet chemical and shall be built onto the hood. All pre-piping for fire suppression system to be done in hood manufacturer's shop.
7. Fan, light, and gas reset station controls to be supplied in integral switch. Fan controls to automatically turn exhaust fan ON upon activation of the fire suppression system.
8. Hood manufacturer shall provide 12" x 54" x 30" high enclosure cabinet for Fire Suppression System.
9. Stainless steel matching closure panels from top of hood to finished ceiling, if required.
10. Unistrut hanger bars 3" on center from end of each section.
11. All exposed welds to be ground and polished.
12. Stainless steel wall flashing and window mullion trim below hood.
13. Exhaust and supply fans to be furnished in compliance with local and national codes, and sized for CFM and static pressure requirements.

FIRE PROTECTION SYSTEM

Manufacturer: Ansul Model No.: Piranha-7 Pertinent Data: Wet Chemical-Dual Agent: 120V/1PH; 20.0A

1. Surface appliance nozzles, hood and duct protection nozzles for Item #22, Exhaust Hood, as required by NFPA 96, latest edition and all governing codes.
2. Remote manual pull station and microswitches with two (2) sets of normally open, and two (2) sets of normally closed contact points.
3. Piping to be installed in hood manufacturer's shop. All exposed piping to be chrome-plated or stainless steel.
4. All components and labor necessary for a completely functional and installed system, per NFPA 96, latest edition, and all governing codes.
5. Automatic mechanical shut-off valves for gas equipment below exhaust hood (*not electric solenoid valves*).
6. Shunt trip breakers or disconnects at main electrical panel interconnected with micro-switches at fire system control panel for all equipment under exhaust hood.
7. Six month and twelve month inspections, servicing, and replacement of components per NFPA 96, latest edition, and governing codes.
8. Factory authorized certificate of fire system required upon completion of installation, connection, and testing.

TWO BURNER RANGE WITH CABINET BASE

Manufacturer: Garland Model No.: M4S: Cabinet Base: 3/4" Gas @ 70 MBTUs

1. 3/4" rear gas connection. Verify altitude and type of gas.
2. Quick-disconnect hose with 48" long restraint cable.
3. End caps and cover.
4. Flame failure on all burners.
5. Stainless steel on both sides.
6. Four (4) polyurethane, nonmarking, swivel casters, front two (2) with brakes.

DOUBLE CONVECTION OVEN

Manufacturer: Blodgett Model No.: DFG-100 Double: 120V/1PH, 6.0A (fans each); 3/4" Gas @ 110 MBTU or Cleveland model: 24CGA10.2ESnatural gas convection steamer. PSD Plumbing Department to verify model needed.

1. Solid state manual controls.
2. Four (4) 4" casters, two (2) swivel and two (2) with brakes.
3. Stainless steel exterior front and two (2) sides.
4. Gas manifold with individual gas cocks for each oven.
5. Stainless steel oven liner.
6. Extra oven racks.
7. Stainless steel draft diverter.
8. 48" gas quick connect and restraining cable.
9. Solid doors.
10. Heavy duty cord and plug.

DOUBLE CONVECTION STEAMER

Manufacturer: Cleveland Model No.: 24-CGP-10: 120V/1PH, 0.15 KW; 3/8" CW, 1/2" IW; 3/4" Gas @ 240 MBTU

1. Electronic timer with compensating load feature.
2. Stainless steel cabinet base and frame.
3. ON/OFF steam switch for compartment controls.
4. Compartment door steam shut off switch.
5. Dissolve liquid descaling kit.
6. Boiler descaling pump kit.

HAND SINK

Manufacturer: Advance Model No.: 7-PS-60: 1/2" HW, 1/2" CW; 1-1/2" DW

1. With Chicago Faucet #521.
2. Basket Drain.

UTENSIL POST

Manufacturer: Custom Fabricated Stainless Steel 1.
Coordinate installation next to 60 Quart Mixer.

60 QUART MIXER (OFCI)

208V 3PH accessories for 60 qt. mixer with 60 qt bowl:

1. Hobart Model M-24635.
2. Hobart Model M-73856.
3. Hobart Model P-10072.
4. Hobart Model M-78032-1.

PRE-RINSE UNIT

Manufacturer: Chicago Model No.: 510-GCLCP: Splash Mount Utilities Required: 1/2" HW; 3/4" CW (1/2" CW to disposer)

1. Mount on wall at 54" above finished floor.
2. Wall bracket.

FLOOR TROUGH AND GRATE

40-GALLON TILTING KETTLE

Manufacturer: Cleveland model: KGT-12T tabletop tilting kettle with Cleveland ST-28 equipment stand (preferred) or Cleveland Model No.: KGL-40-T: 120V/1PH, 10.0A (controls); 1/2" HW, 1/2" CW; 3/4" Gas @ 140 MBTU. PSD Plumbing department to verify selection per project.

1. Type 316 stainless steel kettle liner.
2. Pan carrier.
3. Kettle accessory kit.
4. 2" diameter tangent draw-off valve with drain strainer.

5. Hot and cold water faucet and pre-rinse faucet with swing spout and mounting bracket.
6. Spring assisted, hinged, rotatable, domed stainless steel cover.
7. Measuring strip.

WALL SHELF

Manufacturer: Custom Fabricated Stainless Steel

1. Mount over Prep Table with Sink.

PREP TABLE WITH SINKS

Manufacturer: Custom Fabricated Stainless Steel: 120V/1PH, 20.0A (Convenience Outlet); 3/4" HW, 3/4" CW; 2" IW

1. Flanged feet on front legs only.
2. Two (2) 20" x 20" x 18" deep sink with removable poly cutting board inserts and connected overflow and rotary waste assembly.
3. Chicago faucet #540LD14.
4. 16 gauge stainless steel undershelf with 2" turn-up at the rear.
5. Guides for Cutting Board.
6. Cutout for Disposer Cone.
7. One (1) 20" x 20" self-closing drawer with 250-pound extension slides.
8. Space for Trash Receptacle.
9. Bracket for control switch for Disposer.
10. Scrap trough between disposer cone and sinks, to comply with local health code.

DISPOSER

Manufacturer: In-Sink-Erator Model No.: SS-200-18-CC-101: 208V/3PH, 2 HP; 1/2" CW; 3" DW

1. Coordinate installation with Prep Table with Sinks.
2. Type C 18" Cone fully welded into Prep Table with Sinks.
3. Solenoid valve, syphon breaker, and time delay relay.
4. Model CC-101 control center.
5. Adjustable support legs.
6. Chrome plated cast-brass p-trap.

PRE-RINSE UNIT

Manufacturer: Chicago Model No.: 510-GCLCP: Splash Mount: 1/2" HW; 3/4" CW (1/2" CW to disposer)

1. Wall bracket.
2. Interconnect water line from pre-rinse unit to Disposer.

CUTTING BOARD

Manufacturer: Read Model No.: CB-141824: Woodfiber Laminate

CAN OPENER

Manufacturer: Edlund Model No.: S-11: Table Mounted

1. Stainless steel.

OVERSHELF

Manufacturer: Custom Fabricated Stainless Steel

WORK TABLE WITH DRAWER

Manufacturer: Custom Fabricated Stainless Steel: 120V/1PH, 20.0A (Convenience Outlet)

1. Flanged feet on front legs only.
2. 16 gauge stainless steel undershelf with 2" turn-up at the rear.
3. Space for Digital Scale.
4. Two (2) electrical outlets in splash.
5. One (1) 20" x 20" self-closing drawer with 250-pound extension slides.

OVERSHELF

Manufacturer: Custom Fabricated Stainless Steel

WORK TABLE

Manufacturer: Custom Fabricated Stainless Steel: 120V/1PH, 20.0A (Convenience Outlet)

1. Flanged feet on front legs only.
2. 16 gauge stainless steel undershelf with 2" turn-up at the rear.
3. Three tier unit with 20" x 20" self-closing drawers with 250-pound extension slides.
4. Two (2) electrical outlets in splash and one (1) 208V-1PH outlet for Microwave Oven.

MICROWAVE OVEN

Manufacturer: Amana Model No.: RC17S: 208V/1PH, 20.0A

1. Heavy duty cord and plug.

HAND SINK

Manufacturer: Advance Model No.: 7-PS-60: 1/2" HW, 1/2" CW; 1-1/2" DW

1. Chicago faucet #521.

SOILED DISHTABLE

Manufacturer: Custom Fabricated Stainless Steel

1. Flanged feet on front legs only.
2. One (1) 21" x 18" x 8" deep sink and weld in sink adaptor for Disposer.
3. Stainless steel switch bracket for Disposer controls.
4. Fully enclosed corner and 3/4" turndown at Dishwasher.
5. 22-gauge stainless steel wall flashing.

PRE-RINSE UNIT

Manufacturer: Chicago Model No.: 510-GCLCP: Splash Mount: 1/2" HW; 3/4" CW (1/2" CW to disposer)

1. Wall bracket.
2. Interconnect water line from pre-rinse unit to Disposer.

DISPOSER

Manufacturer: In-Sink-Erator Model No.: SS-200-7-CC-101: 208V/3PH, 2 HP; 1/2" CW; 3" DW

1. #7 Collar adaptor fully welded into Soiled Dishtable.
2. Solenoid valve, syphon breaker, and time delay relay.
3. Model CC-101 control center.
4. Adjustable support legs.
5. Chrome plated cast-brass p-trap.

CONDENSATE HOOD

Manufacturer: Custom Fabricated Stainless Steel: 1000 CFM Exhaust, 1" IW

1. 18 gauge stainless steel construction.
2. Gutter corner.
3. Fully welded vertical body, corners and top spot welded and sealed.
4. Hanger bracket is to be pre-punched at the factory.
5. Heavy duty lock nuts, one above and one below the hanger bracket.

DISHWASHER

Manufacturer: Hobart Model No.: AM-15T: 208V/3PH; 24.6A; 3/4" HW; 2" IW (Elementary Schools). Use Hobart Model: CL44E conveyor dishwasher with integral booster heater (Secondary schools)

1. Peg rack, combination rack, and sheet pan rack.
2. All Dishwashers to have a built in hot water booster.
3. Mounted circuit breakers for single-point electrical connection.
4. 3/4" pressure regulator valve.
5. Machine shall be all stainless steel construction, including legs and front panel.
6. Hot water sanitizing, and automatically timed tank fill.
7. Water hammer arrester.

BOOSTER HEATER (to be integral to dishwasher, no stand-alone booster heaters)

~~Manufacturer: Hatco Model No.: PMG-60: Floor Model: 120V-1PH; 2.0A; 1/2" Gas; 58 MTU; 3/4" HW; 3/4" IW~~

- ~~1. Inter-plumb booster heater with Dishmachine.~~
- ~~2. PMGH-60 Exhaust Hood, and high altitude orifice kit, vent to exterior.~~

POT SINK / CLEAN DISHTABLE

Manufacturer: Custom Fabricated Stainless Steel

Utilities Required: 3/4" HW, 3/4" CW; 2" IW

1. Standard fabrication SF-1B, SF-3C, SF-5A, SF-5C, SF-6A, SF-9, SF-12, SF-13, and SF-20.
2. Provide flanged feet on front legs only.
3. Provide three (3) 30" x 24" x 18" deep sinks with rotary waste and connected rear overflow.
4. Provide two (2) Chicago faucets #540LD14. Mount to splash behind sink compartments.
5. Provide 22-gauge stainless steel wall flashing from top of back splash to bottom of Pot Shelf.

6. Provide 3/4" turn-down at Dishwasher and a fully enclosed corner.
7. Provide 16 gauge stainless steel undershelf with 2" turn-up at rear and right side.
8. Provide shop drawings for approval prior to fabrication.

POT SHELF

Manufacturer: Custom Fabricated: Stainless Steel

EVAPORATOR COIL

Manufacturer: Bohn Model No.: LET140: Electric Defrost: 208V/1PH, 11.7A; 1" IW

1. Indirect waste to be terminated with a "P" trap.
2. Heater tape for walk-in freezer drain lines at 6 watts per foot.
3. Connect wires from the coil to the time clock on Compressor Rack for defrost cycle.
4. Drain lines to be insulated and encased with PVC.

DUNNAGE RACK

Manufacturer: Metro Model No.: HP31GX2: Open Grid Shelf

FREEZER SHELVING

Manufacturer: Metro Model No.: (20)1836GX (4)1842GX (8)1848GX (32)63PX: Metro Max

1. Verify room dimensions.

WALK-IN COOLER/FREEZER

Manufacturer: RMI Model No.: Custom Utilities Required: 120V/1PH, 20.0 A (for lights)

1. Wall panels to consist of 4" foamed in place Urethane foam insulated panels with less than 25 flame spread and less than 450 smoke density. All exposed finishes to be 18-gauge, Type 304 stainless steel with No. 4 finish. All unexposed panels to be 20-gauge galvanized steel.
2. Each refrigerated compartment shall be monitored by a Datalarm Monitoring Systems manufactured by Modularm Corporation. Single compartments (cooler-freezer combos or two compartments adjacent to each other), shall be monitored by a Datalarm 2, two point monitor. All Datalarms are to be connected to a Datahub, as manufactured by Modularm. Interconnecting wire from Datalarms to the Datahub will be CAT5E. The Datahub will connect to an on-premise network. System must be configured to be able to connect to the security system alarm network supplied by the school district.
3. All panels to have tongue and groove construction and be rigidly coupled with steel cam locks, foamed in place on 4'-0" centers, minimum of three (3) per joint for walls and two (2) for ceilings. Section lock ports to be furnished with PVC snap-in buttons. Panel joints to be sealed with continuous PVC gasket at interior and exterior panel edges, foamed onto panels at the factory.
4. Ceiling panels to have a maximum deflection of 1/240 of the clear span under uniform loading of 20 pounds per square foot. Exposed ceiling finish to be .040 aluminum with white acrylic. Ceiling support system shall use hanger network attached to hanger brackets, designed to engage with female lock pins and imbedded within foam core of ceiling panels.

5. Installation of panels to be: Floor Depression: non-insulated, level-smooth, clean, depressed floor and apply asphalt emulsion, vapor barrier of foil-coated kraft waterproof paper as determined by ASTM E96-80, and floor insulation of two (2) or more layers, joint staggered, of rigid foamboard with R-value equal to wall insulation and perm rating of 20 psi Vapor permeable separation of organic 15 pound felt protective slip sheet for applying over insulation with joints lapped 6" (min) and flashed up height of base.
6. Freezer and Cooler door to be 36" wide x 6'-6-1/4" high, hinged. Door to be flush fitting with 3" insulation and finish to be same type as wall panels. Door jambs to be 20-gauge stainless steel, all corners heliarc welded, ground and polished. Gaskets to be PVC with vulcanized and continuous magnetic core at sides and head of door jamb. Sill wiper to be adjustable neoprene, removable and held in place with stainless steel retainer strip and fasteners. Doors to accommodate PSD padlocks.
7. Each door to have three (3) hinges consisting of nylon cam, stainless steel pin, zinc die cast, polished chrome finish. Door pull to be high pressure die-cast zinc, highly polished chrome plated. Each exterior door to have mortise deadbolt, including inside release, with stainless steel components, chrome-plated exposed surfaces, and cylinders keyed alike.
8. Heated door gasket and 36" x 22" vision panel; 24" high kickplate of 1/8" aluminum tread plate on both sides of door, full width of door; and heated, removable threshold of 1/8" thick stainless steel plate.
9. Interior cart bumper of 1/4" x 2" aluminum bar at 2'-0" AFF. (Cooler)
10. Hydraulic rack and pinion door closer with automatic hold open. Three coat aluminum finish with lacquer final coat.
11. Hardware to be mounted with reinforced steel tapping plates and stainless steel machine screws.
12. Provide PVC, low-temperature strip curtains, transparent, 8" wide by 0.080" thick, at door openings.
13. Adequate fluorescent light fixtures installed in ceiling to accomplish 20 foot candle power at 6" above finished floor, fully enclosed and gasketed vapor tight with shatterproof diffuser sized for two (2) T-8 fluorescent tubes.
14. Switch covers: weatherproof neoprene with unbreakable red plastic lens for constant burning interior light and indicating exterior light. Rigid 3/4" conduit and wiring to be concealed in insulated panels, and terminated in vapor-tight splice box mounted on inside wall of compartment near ceiling, with 1-1/4" diameter hold in ceiling panel.
15. All electrical penetrations to the ambient of the walk-in require "EY" seal offs.
16. Unheated pressure relief port.
17. Matching closure panel and two (2) trim strips.
18. Coil supports or 2" diameter nylon threaded rods, plated steel nuts and washers to adequately support specified evaporator coils.
19. Escutcheon plates of 5" diameter stainless steel, to dress off utility penetrations, including drain lines.

EVAPORATOR COIL

Manufacturer: Bohn Model No.: ADT120: 120V/1PH, 3.6A; 1" IW Set in place per manufacturer's standard specifications and the following:

1. Evaporator shall be located and interconnected to Compressor Rack.
2. Indirect waste to be terminated with a "P" trap.
3. Drain lines to be insulated and encased with PVC.

COMPRESSOR RACK

Manufacturer: Kairak Model No.: KMR-1FN: 208V/3PH, 29.7A

1. Rack dimensions are 48" long x 42" wide x 36 " high, and weighs 625 pounds.
2. All core holes to be provided and fireproofed.
3. 4" housekeeping pad for the compressor
4. All copper tubing to be refrigerant grade Type "L". Hard copper joints to be sweat type fittings; mechanical bends are not acceptable.
5. All suction lines with vertical rise of 15 feet or more are to be trapped for proper oil return.
6. For steel to copper connections, use silver solder; for copper to copper connections, use sil-fos. Do not use soft solders on refrigerant lines.
7. All piping to be pressure tested with nitrogen at 300 psi.
8. All completed refrigeration systems must be evacuated to 300 microns or less with vacuum pump.
9. Furnish and install heater tape for walk-in freezer drain lines at 6 watts per foot.
10. UL-listed package with main fused disconnect, prepiped and pre-wired for single point connection.
11. Insulate suction lines back to all compressors.
12. Plastic isolation bushings for copper to metal contact to prevent leakage.
13. Copeland Compressors to be semi-hermetic with suction and discharge valves.
14. Copeland compressor with shut-off valves, electronic oil failure control, breakers, and wiring for each.
15. Head pressure relief valve on chilled water inlet lines.
16. Replaceable liquid line drier with valves, pressure controls fitted with "super hoses," sight glass, and oil separator.
17. Five-year compressor warranty and one-year parts and labor.
18. Certified, licensed Refrigeration Mechanic possessing a certification 40 CFR Part 82 sub-part F, as mandated by the E.P.A.

DUNNAGE RACK

Manufacturer: Metro Model No.: HP35GX2

COOLER SHELVING

Manufacturer: Metro Model No.: (16)1836GX (8)1842GX (8)1848GX (32)63PX: Metro Max

STORAGE SHELVING

Manufacturer: Metro Model No.: (8)1836BR (4)1842BR (44)1848BR (56) 74P: Super Erecta

CAN RACK

Manufacturer: New Age Model No.: 1250: Front Loading

DUNNAGE RACK

Manufacturer: Metro Model No.: HP35GX2

BREAD RACKS

Manufacturer: Contractor shall verify current model being used by Child Nutrition Department

END OF SECTION 11 40 50

DIVISION 21

Fire Suppression

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SECTION 21 05 00 – COMMON WORK RESULTS OF FIRE PROTECTION

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- 1.02 Related Sections
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- 1.04 Submittals Required
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- 2.02 Products: See Plumbing Sections

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
 - A. EXCAVATING, TRENCHING, AND BACKFILLING
 - B. PIPING INSTALLATION 1. General:
 - i. Arrange pipe in group runs where feasible. Coordinate locations with all trades.
Avoid traps in piping.
 - C. ELECTRICAL: See Electrical Sections
- 3.03 Cleaning and Protection

END OF SECTION 21 05 00

SECTION 21 11 00 – FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

Part 1: General

- 1.01 Summary
 - A. Work involved with remodeling existing systems shall be done in accordance with NFPA-13.
Provide new sprinkler heads in all locations where existing head layout is altered. Verify existing piping arrangement, conditions, and locations at site before beginning fabrication.
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required
- 1.05 Quality Assurance
- 1.06 Scheduling

- A. All drawings and sprinkler calculations are subject to Insurance Services Offices and/or Poudre Fire Authority review and approval as well as the Architect/Engineer's before installation.

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products

A. SIAMESE FIRE DEPARTMENT CONNECTIONS

- 1. Siamese connections shall be Croker Fire Equipment No. 6010, or equal, with clapper valve, FM approval, brass finish. Threads shall be identical to those used in the city in which system is being installed and shall meet requirements of local fire department. 2-1/2" x 2-1/2" x 4" with cast brass plugs and chains. Siamese connection for sprinkler system shall have a 4" underwriter's swing check valve with ball drip; extend drain from ball drip to a predetermined PSD location. Brand "Auto Sprinkler."

B. FLOW ALARMS AND SUPERVISORY VALVE SWITCH

- 1. Flow alarms shall be Autocall Type WF, Potter Model VSR, Grinnell E-1, or approved equal, DPST flow alarms with suitable adjustable retards. Flow alarms shall be suitable for 120-volt operation. Factory Mutual (FM) approved and UL listed.
- 2. Provide a UL-approved switch for main sprinkler valve(s) where indicated. Switch shall give alarm indication when main valve is closed. Switch shall be suitable for 120-volt operation.

C. SPRINKLER SYSTEM

- 1. Automatic sprinkler system shall be designed by the Contractor for hazard indicated. Entire system shall be in accordance with NFPA and as specified herein and/or indicated. Contractor is herein given the option of sizing sprinkler system per pipe sizing tables in NFPA-13 or by the hydraulic method.
 - i. Contractor is responsible for obtaining all necessary flow tests at site required for hydraulic calculations.
 - ii. No sprinkler heads shall be installed in air locks due to potential for freezing.
- 2. Hydraulic design methods shall conform to the methods outlined in NFPA No. 13 and shall provide for pipe sizes such that not more than a 10% variation will occur in sprinkler discharge. Hazen and Williams formula with C=120 shall be used in hydraulic calculations, and additional requirements specified herein. Design conditions shall be based on the most remote 1,500 square feet for each zone. Design shall be light hazard with a design density of 0.10 GPM per square foot, or as determined by the authority having jurisdiction.
- 3. Prior to starting fabrication or installation of sprinkler system, Contractor shall submit detailed 1/8-inch scale (minimum) shop drawings, stamped "Reviewed" by agency having jurisdiction, to Architect/Engineer for review and approval. At time of completion of work, obtain certificate of inspection and approval from same agency.
- 4. Approved Manufacturers:
 - i. Viking Sprinkler Corporation.
 - ii. Grinnell Company, Inc.
 - iii. The Automatic Sprinkler Corporation of America.
 - iv. Grimes Company.

- v. Approved equal selected from "List of Inspected Fire Protection Equipment and Materials" published annually by Factory Mutual Engineering and UL and shall bear UL approved stamp or label.
- 5. In rooms and/or spaces where sprinkler head locations are not indicated, locate sprinkler heads to avoid conflicts with other pieces of equipment such as lights, speakers, diffusers, etc., located in ceiling. Consult Architectural, Mechanical, or Electrical plans carefully to avoid conflicts.
- 6. System shall be provided complete with water supply connection, sprinklers, all piping, fittings, valves, seals, test connections, hangers, supports, sleeves, escutcheons, drain valves, test connections, signs, diagrams, etc., all as required for a complete and operating system.

All drain and test valves must be ball valves. Provide drain valves at all low points.

7. Fire Sprinklers:

- i. All sprinklers shall be automatic closed spray type sprinkler heads of ordinary degree temperature rating except where excess temperatures are anticipated; heads shall be of higher rating.
- ii. Sprinkler heads installed in areas which do not have suspended ceilings shall be of brass upright type. Sprinklers shall be installed with consideration being given to all ductwork, piping, etc., and heads shall be located above and/or below ductwork as required by NFPA Standards.
- iii. Sprinkler heads installed in areas which have suspended ceilings shall be of the concealed sprinkler type with flat white cover plate.
 - a. Braided stainless steel flex heads may be used
 - b. Corrugated flex heads are not allowed
- iv. Side wall sprinkler heads indicated shall be sidewall chrome plated with chrome plated flat type escutcheon plate.
- v. Provide sprinkler head protective cage to exposed heads in gyms, shop areas, mechanical rooms, storage rooms or other spaces where equipment movement or activities may damage unprotected heads.
- vi. Provide stock of spare heads, of each type installed, packed in a suitable cabinet. Number of each type of spare heads to be provided shall be as indicated in NFPA-13. The cabinet shall contain at least two sprinkler head wrenches.
- vi. Upright sprinklers located as to be subject to mechanical injury shall be protected with approved guards.

D. BACKFLOW PREVENTER

- 1. Shall be double check type.
- 2. Two independent "Y" type spring-loaded ductile check valves, two OS&Y shut-off valves, and four test clocks.
- 3. With stainless steel center-guided checks with soft elastomer discs for drip-tight closure against backflow.
- 4. UL-listed for fire line service.
- 5. Backflow preventer to be full line size.
- 6. Provide floor drain at all backflow preventor locations.
- 7. Febco Model 850 C. All other types of backflow preventors must be approved by PSD Plumbing Department.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 21 11 00**DIVISION 22 Plumbing**

Date of Revision	Description of Revision	Purpose for Revision	Revision Initiated By
Jan. 26, 2012	Pg 63-Toilet/Urinal fixtures & flush valves	Lower water use	Plumbing
Jan. 26, 2012	Pg 66-C.1-"close coupled" not a requirement for pumps	Maintenance	Plumbing
Nov. 9, 2012	22 05 00 2.02A, 4 thru 9	Modified	John Gossman
Nov. 9, 2012	22 05 19 3.02A, 3 added	With coil piping drawings	John Gossman
Nov. 9, 2012	22 05 19 3.02B, 2	Modified	John Gossman
Nov. 9, 2012	22 05 23 2.02A Many items BOLD	For clarity	John Gossman
Nov. 9, 2012	22 05 29 2.02, 1 and 2	Text added for clarity	John Gossman
Nov. 9, 2012	22 05 29 2.02B, 10iii BOLD	For clarity	John Gossman
Nov. 9, 2012	22 05 29 2.02D, 1 thru 3 BOLD	For clarity	John Gossman
Nov. 9, 2012	22 05 53 2.02D, 4 BOLD	For clarity	John Gossman
Nov. 9, 2012	22 07 19 3.02B2/B4 modified		John Gossman
Nov. 9, 2012	22 11 13 2.01, 4ii	Clarified model	John Gossman
Nov. 9, 2012	22 11 13 2.02,A1, ii modified	DEL solder/use brazed	John Gossman
Nov. 9, 2012	22 11 13 2.02C1/C2 modified	Balance cock clarified	John Gossman
Nov. 9, 2012	22 11 13 3.01D modified		John Gossman
Nov. 9, 2012	22 11 13 3.02D2 deleted. New D6		John Gossman
Nov. 9, 2012	22 11 13 3.02F 3/5/7 AND G2 modified. 3.02J1iii modified.		John Gossman
Nov. 9, 2012	22 11 23 2.02C, 4	Modified	John Gossman
Nov. 9, 2012	22 13 16 3.02A, 2	Modified	John Gossman
Nov. 9, 2012	22 30 00 2.02 D, 5	Clarified downspouts	John Gossman
Nov. 9, 2012	22 30 00 2.02H, 1	Clarified	John Gossman
Nov. 9, 2012	22 40 00 1.01 G/H/I added	Clarity	John Gossman
Nov. 9, 2012	22 40 00 2.02G-End of Classrm sink	Eyewash added	John Gossman
Nov. 9, 2012	22 40 00 2.02G- Shower Trim (handicapped)	Del power flush stool	John Gossman

Nov. 9, 2012	22 40 00 2.02G5	Chicago only	John Gossman
Nov. 9, 2012	22 70 00 2.02E, 1i, C added	Added Mnf.	John Gossman
Dec. 2, 2013	22 30 00 1.09 ADDED – hot water dispensers at classroom sinks NOT ALLOWED	LCHD clarification – acceptable locations listed in letter	Jim Tishmack

PSD TECHNICAL SPECIFICATION

DIVISION 22 Plumbing

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SECTION 22 05 00 – COMMON WORK RESULTS FOR PLUMBING

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Part 2: Products

- 2.01 Manufacturers
- 2.02 Products

A. PIPE AND FITTINGS

1. Pipe and Fitting Schedule:

2. Standpipe and fire sprinkler piping:

- i. Standpipe and fire sprinkler piping shall be black steel, Schedule 40, screwed, or grooved with mechanical joints, UL approved, 175 pound working pressure.

Miscellaneous drain lines receiving cooling coil condensate, drip for humidifiers, etc.:

- a. Piping shall be Type "DWV" or "L" copper, fittings wrought copper, solder joint.

ii. Compressed air piping in building above ground (shop air):

- a. Piping shall be type "L" hard copper with wrought copper or cast brass fittings.

iii. Refrigeration piping:

- a. Piping shall be ACR hard drawn copper tubing cleaned, dehydrated and sealed. Use soft drawn dehydrated and sealed seamless copper tube where bending is required except where subject to physical damage. Fittings wrought copper solder fittings. Joints: 15% silver brazing alloy and silver brazing flux or brazed with Surebraz. Support piping as required to prevent damage to pipe. Run nitrogen through pipes 1" and larger when silver soldering.

- iv. Domestic water piping: Domestic water piping above grade shall be Type "L" hard copper with wrought copper fittings.

V. Condensate Piping: Condensate piping above grade shall be Type "L" hard copper with wrought copper fittings.

3. Chemistry labs, Science labs, and photo labs:

i. Acid resisting waste in building underground must be used for science and photo labs:

- a. Piping shall be AB-5 or other acid resistant pipe such as Schedule 80 polyvinylidene fluoride (PVDF) or schedule 40 polypropylene (PP), mechanical joint, as designed and approved. Fittings with socket ends, same material as pipe. Provide flanged and/or threaded ends where required for connection to

- valves and equipment. Joints: Thermoseal fusion welding process in accordance with manufacturer's recommendations. Fuseal, Orion, or prior approved equal.
- b. Install neutralizing basin as close to the source of effluent as possible. Provide sufficient length of PVDF pipe downstream of basin to effect dilution in event of failure of the neutralizing basin.
 - c. Place neutralizing basin in cabinet under sink. Not allowed to be underground. Provide union connections at all connections to tank.
- ii. Acid resisting waste and vent in building above ground shall be the same as above except it shall be flame retardant.
4. Art Classrooms: Provide adequate solids interceptors to collect clay particles. Provide union connections on inlet and outlet of interceptors.
 - i. Acceptable Manufacturers:
 - a. Zurn.
 - b. Smith.
 - c. Josam.
 - d. Wade
 5. Provide standard weight IPS brass nipples and adapters where required between copper tubing and fixtures. Steel, Galvanized or iron nipples are not permitted between copper lines and brass valves or trim.
 6. Joints: Joints in all copper domestic piping systems shall be made using 95/5 tin/antimony or equal tensile strength solder that contains no lead. Engelhard "Silvabrite 100," Oatey "Safeflo," or Canfield "Watersafe" are all acceptable. Use flux recommended by solder manufacturer. Absolutely no lead containing solders or fluxes will be allowed in any portion of the work. The District reserves the right to inspect solders, fluxes and joints. Any joint found containing lead solder shall be cause for resoldering all joints made in all systems in the building. **Copper heating and chilling piping systems shall be brazed for 2" pipes and smaller**, except connections to valves and unit ventilators, etc., that may be damaged by the heat.
 7. All copper tubing to be reamed to full inside diameter of the tubing.
 - i. If copper pipe is found NOT reamed at any one location, contractor may be required to disassemble all piping and have a consultant approved by the engineer and school district to verify reaming. Cost for ALL deconstruction and put back to be paid by the contractor whether all locations are non-compliant or not.
 8. All welding fittings shall be Tube Turn, Taylor Forge, B&W, Ladish or Yolo.
 9. T-drill, Press Fit type fittings, Shark Bit Fittings, Copper Grooved, Grooved fittings are not acceptable in hydronic, chilled, or domestic water systems.
- B. PERMISSIBLE ASSEMBLIES FOR WELDED PIPING SYSTEMS
1. Service working pressure is limited to 160 psig.
 2. Weld all black steel piping 2-1/2" and larger except where flanges are required. End to end butt weld joints 3/4" through 2" pipe are allowed only with internal welding rings.
 3. Where welding rings are used, machine pipe ends for proper fit.
 4. Elbows: Use welding elbows.
 5. Tees: Use welding tees. Weldolets are allowed in shop prefabricated assemblies or in lines 5" and larger, providing all slag is removed from inside the piping.
 6. Reducers: Use welding reducers.

7. Caps: Use welding caps.
8. Prepare pipe ends in tees, laterals, and reducers for weld penetration in accordance with ASA standards.
9. Mitered elbows, tees, and reducers are prohibited in welded lines.
10. Elbows: Use long radius butt-welding elbows in expansion loops and bends.
11. Use long radius reducing butt-welding elbows at equipment where a 90-degree bend and size change is required.
12. National Certified Pipe Welding Bureau or AWS shall certify welders and procedures.

Part 3: Execution

3.01 Preparation

A. EXCAVATING, TRENCHING, AND BACKFILLING

1. Excavation: Trenches for all underground pipe lines shall not be carried below the required depths except as necessary for special pipe bedding or to remove unstable soil or rock.
2. When work is in public highway or street, paving repairs shall be equal to and comply with municipal agency requirements. If repairs are done by municipal agency, make necessary arrangement with such agency to make the repairs.

3.02 Installation

A. PIPING INSTALLATION 1.

General:

- i. Use straight round pipe. Reamed to full size after cutting. Remove all chips from reaming.
 - ii. Arrange pipe in group runs where feasible. Coordinate locations with all trades. Avoid traps in piping.
 - iii. Install piping to take advantage of every available means to facilitate thermal expansion of pipe. Provide anchors and guides to control direction of travel. Guides shall be Keflex type B with BH hanger, or Adesco, or type P, for insulated pipe. Provide ample length to maintain 25% engagement with maximum pipe travel. Provide anchors for domestic water piping serving automatic dishwashers.
 - iv. All domestic water, hydronic, gas lines to be installed plumb, level, or graded as directed by code or contract documents.
 - v. Waste and vent, storm drainage, and condensate lines to be installed plumb and pitched per code or as directed per contract or documents.
2. Expansion loops shall be used for expansion compensation. Install anchors at both ends of pipe lengths served by expansion loops so that pipe movement due to expansion is directed toward the expansion loop without damaging the building construction. Both sides of the expansion loop shall be anchored. As a minimum, locate one guide 4 pipe diameters and the second guide 14 pipe diameters from each side of the expansion loop. Both sides of the expansion loop shall have two guides.

3.03 Cleaning and Protection

A. DISINFECTING AND SPECIAL CLEANING

1. When a new system is to be connected to an existing system, isolate the new system for cleaning and flushing if applicable. Reaming chips must be removed by flushing, cleaning strainers, etc.

END OF SECTION 22 05 00

SECTION 22 05 19 – METERS AND GAUGES FOR PLUMBING PIPING

Part 1: General

1.01 Summary

- A. Comply with MSS-92-1980, Valve Users Manual.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products

A. PRESSURE GAUGES

1. Pressure Gauges: Three-inch minimum face diameter, 1/4" pipe thread bottom mount, steel case, accuracy 1% of full scale or better.
2. Pressure gauges in pipelines shall be phosphor bronze bourdon tube with stainless steel movement.
3. Gauges shall be compound, pressure or vacuum as required with 4-1/2 inch diameter dial. Each gauge shall be complete with pulsation dampener, and 1/4" or 3/8" ball valve. Gauges on steam and steam condensate lines shall also have a siphon loop.
4. The gauges shall be located and mounted to be conveniently read by a person standing on the equipment room floor. Accuracy shall be 1/2 percent. Case shall be aluminum.
5. For water or air services, use a bronze bourdon tube, steam services, a stainless steel tube, and materials for corrosive services shall be custom selected by the Engineer.
6. Maximum Range: Approximately double the expected working pressure of the service.
7. Install with an isolation valve and a drain valve between the gauge and the isolation valve.
8. Install a pressure snubber and needle valve in services with rapid pressure pulses at pump locations.
9. White face with black lettering.
10. Have the capacity to be calibrated with a screwdriver.
11. Acceptable Manufacturers:
 - i. Ashcroft.
 - ii. Dwyer.
 - iii. Foxboro.
 - iv. Honeywell.
 - v.

- Johnson. vi.
- Marsh. vii.
- Marshalltown.
- viii. Meriam.
- ix. Mueller Brass. x. U.S. Gauge.
- xi. Weiss. xii.
- Trerice.
- xiii. Or approved equal

12. Manometers and gauges calibrated in pressures less than 50 inches of water shall be by Dwyer or Meriam.

B. THERMOMETERS

1. Painted vertical metal case at least 8" long with a glass or Lucite face.
2. Furnish and install thermometers in pipe lines and equipment as scheduled and/or indicated. Thermometers shall be Taylor, Moeller, Rochester, Weiss, Trerice, or approved equal. Nine inch scale with separable socket, cast aluminum case, red reading mercury, adjustable industrial type complete with thermometer wells. Scale range shall be 30°F to 240°F with 2-degree divisions.
3. Thermometer installation will not be accepted unless easily read by an operator standing on the floor.
4. Bottom or back pipe thread connection.
5. Use thermal wells with heat transfer enhancement compound in piping services.
6. Range: At least 50% higher than the highest expected temperature of the service and at least 20 degrees lower than the lowest expected temperature.
7. Accuracy: 1% of full scale or better.

C. PRESSURE AND TEMPERATURE SENSING PLUGS*

1. Provide where indicated 1/4" NPT fitting to receive either a 1/8" O.D. temperature or pressure probe. Fittings shall be brass with valve core suitable for 275°F. Plugs shall be complete with gasketed cap and units shall be rated for 1000 psi. "Pete's Plug" by Peterson or Nordel, Model 45PT-N- 1-1/2".
2. Provide for use with Pete's Plug, two 2" dial pocket testing thermometers, having a range of 0 to 250°F, and two 2" pressure gauges having a range of 0 to 150 psi. (Acceptable manufacturers are the same as above.)

Part 3: Execution

3.01 Preparation

3.02 Installation A. SPECIAL DEVICES

1. Install a pressure-temperature tap on each side of each pump and heat transfer device such as coils, heat exchangers, radiators and radiant panels.
2. Install one hydronic balancing valve as defined above in series with each air handling unit coil, heat exchanger, each section of fin tube radiators or radiant panels. A section is defined as that assembly controlled by one stat/temperature control valve combination. Provide isolation valves and unions on each side of control valve. Circuit setters are not to be used as isolation valves.
3. See following coil piping details.

4. Expansion tanks, air separators and other devices heavier than 200 pounds may not be suspended from overhead without written permission from the Structural Engineer.
5. Provide a wrench operated main gas shut off valve, for Fire Department use, outside the building and upstream of the meter. Coordinate with PSCo for location and who provides valve.
6. Flow (paddle) Switches shall be used where required to prove flow through low head pumps, usually boiler and coil circulators. The Engineer shall carefully and fully detail flow switch installation. Provide isolation valves and unions on both sides of flow switches.

B. IDENTIFICATION

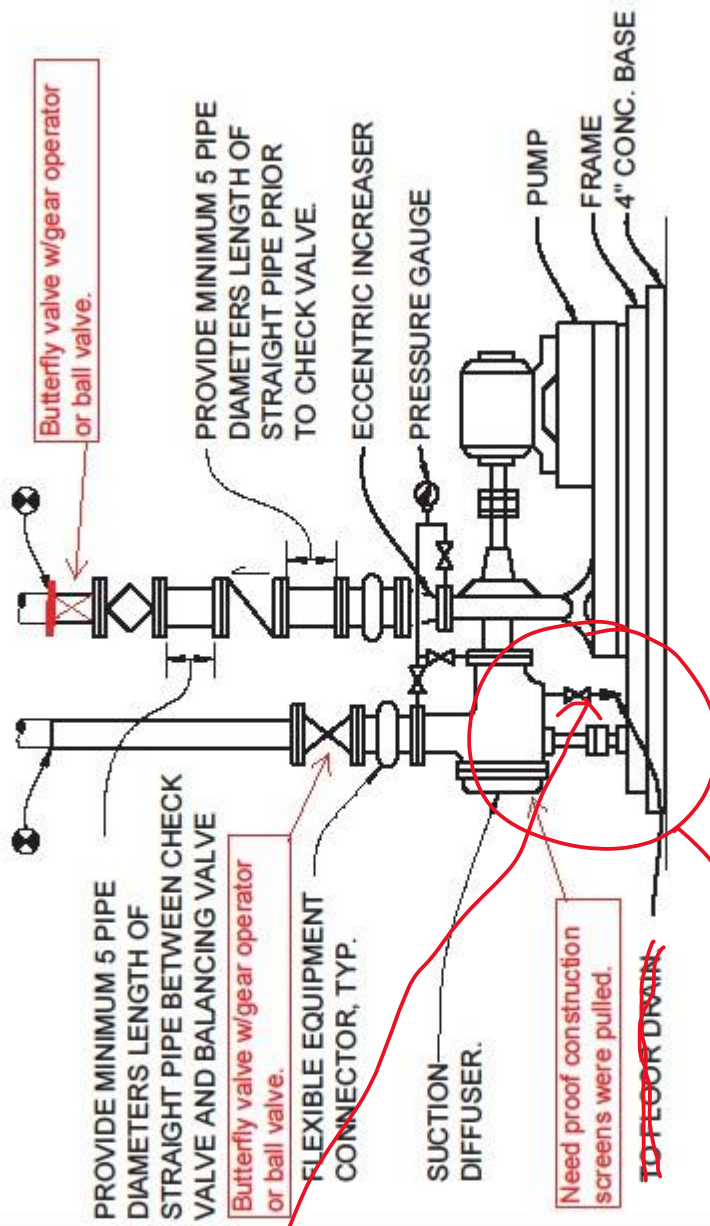
1. Label all mechanical devices in accordance with ANSI Standards.
2. Label all valves with tags indicating service and number. Tags 1-1/2" in diameter, brass, with 1/4" high black letters. Securely fasten with chain and hook. Match service abbreviations given on mechanical drawings. Show all valve tag numbers on red line drawings at valve locations. All valves located behind access panels or located above ceiling tiles are to be labeled per section 22 05 53 2.02, D, 4.
3. Do not paint or insulate over nameplates.
4. Label mechanical equipment with 4" x 6" engraved plastic laminate signs with 1" high letters.

1. Test all operating devices. Keep written records of all tests, at minimum: the date of the test, system or subsystem tested; test medium and pressure used; duration of test; test results; name and signature of individual performing test.

3.03 Cleaning and Protection

CONTI

CO
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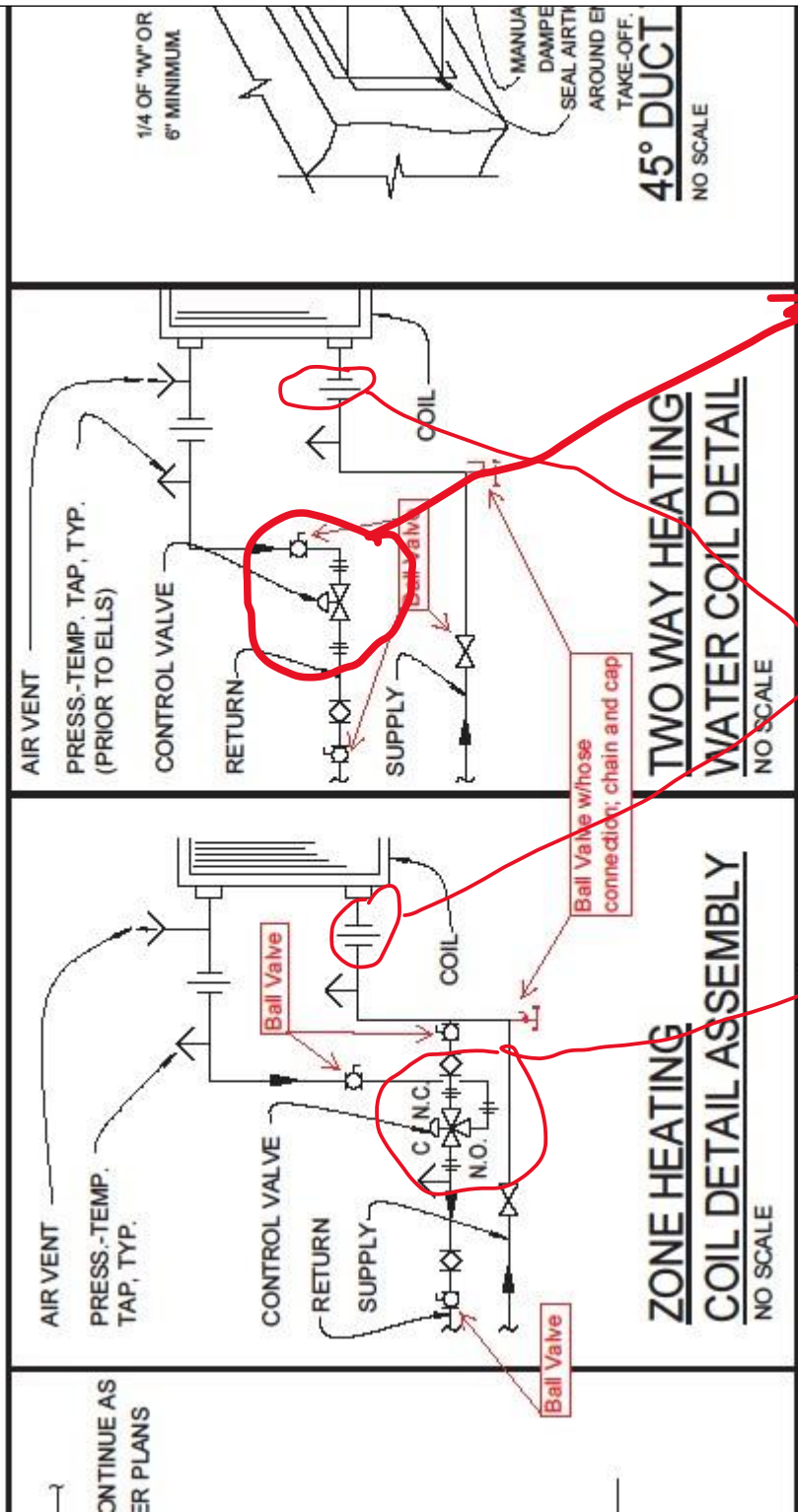
SINGLE SUCTION PUMP ASSY.

NO SCALE

Hose end ball valve

Support Suction Diffuser

These details apply to valving installed in cabinet units or outside units (contactor or factory)



Add hose end drain connection with cap on low side return

No Dielectric Unions permitted.

END OF SECTION 22 05 19

SECTION 22 05 23 – GENERAL-DUTY VALVES AND UNIONS FOR PLUMBING

Part 1: General

1.01 Summary

A. Comply with MSS-92-1980, Valve Users Manual.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products A.

Valves

1. Provide shut-off valves in lines serving each piece of equipment such as wall hydrants and sill cocks. Provide ball valve isolation on each side of equipment such as mixing valves, control valves, circuit setters, pumps, coils, water heaters, plumbing fixtures, eyewash stations, etc. Also isolate each major zone, building wing, loop, etc. Circuit setters are not to be used as isolation valves. Provide isolation valves on all branches off mains.
2. Globe and check valves shall be manufactured by the following:
 - i. Stockham
 - ii. Crane
 - iii. Nibco
 - iv. Red and White
 - v. Jenkins
 - vi. or Powell.
3. Butterfly valves shall be manufactured by the following:
 - i. Stockham
 - ii. Mueller
 - iii. Centerline
 - iv. DeZurik
 - v. Keystone
 - vi. Red and White
 - vii. Nibco
 - viii. or Crane.
4. Ball valves shall be full port and manufactured by the following:
 - i. Apollo
 - ii. Jomar
 - iii. Nibco
 - iv. or Red and White.
5. Wafer check valves shall be manufactured by the following:

- i. Stockham
 - ii. Centerline
 - iii. DuoCheck
 - iv. or Metraflex.
6. Valves by other manufacturers must have prior approval. **All butterfly valves shall have gear operators.**
7. Valve Schedule:
- i. Shut-off valves for domestic water, compressed air and heating water shall be full flow ball valves, rated at 600 psig WOG.
 - a. Apollo 77: Bronze Threaded or Soldered Ball Valve
 - b. Nibco 585: Bronze Threaded or Soldered Ball Valve
 - c. Red & White 5044/5049: Bronze Threaded or Soldered Ball Valve
 - d. Jomar Bronze Threaded or Soldered Ball Valve
 - ii. Where ball valves are used in insulated piping, handle extensions shall be provided. Extension shall be manufactured as an option for the valve furnished and shall extend the handle a minimum of 1/4" beyond the insulation jacket. Handles cannot be altered to allow for insulation.
 - iii. Swing check valves shall be spring type, bronze, with swing regrinding seat and renewable disc. Class 125.
 - a. Stockham Fig. Number:
 - 1. B-309: Bronze Soldered End
 - 2. B-310: Bronze Threaded End
 - 3. B-340: Flanged End
 - 4. Or approved equal
 - iv. Wafer check valves shall be Stockham Fig. Number WG-970 or approved equal.
 - v. Balance valves for domestic water and heating water shall be rated at 200 psig minimum working pressure, 250 deg. F. minimum working temperature. The body shall be bronze with pressure differential ports, positive shut-off and memory stop.

Balance valves are not to be used as isolation valves.

 - a. Armstrong: CBV-S or CBV-T
 - b. ~~Bell and Gossett:~~ ~~Circuit Setter Plus CB~~
 - c. Tour & Anderson: STA Series
 - d. Flowset FDI
 - vi. **Drain valves shall have 1/2" garden hose threaded adapter with brass cap (no plastic), ball valve only, and vacuum breaker installed.**
 - vii. All plug cocks must be serviceable.
 - viii. Shut-off valves for gas shall be lubricated eccentric plug valve ball, double seal seats, and seal, rated 175 pound WOG. DeZurik 400 series, Milliken 600 series or approved equal.
 - viii. Any hose bib or hose thread connection must have vac. breaker.
8. Manufacturers are listed only as examples to illustrate a type and establish a level of quality, not to limit the choice of supplier.
9. No copper alloy in steam or condensate services.
10. Globe valves for steam or condensate service: Cast steel bodies, stainless steel plugs and stellite seats.
11. Rising stems for globe valves. **All valves to be full port ball valves.**

12. UL and FM list valves intended for fire protection service.
13. Natural gas service: Iron body lubricated plug type with lever or gear operators. Must have ability to be re-lubricated.
14. Hydronic balancing valves: Integral flow measuring taps, memory set, and locking indicating handles, Barco, Gerand, Illinois, or engineer-approved equal.
15. Freeze proof wall hydrants for outdoor service, Woodford or engineer-approved equal.
16. UL list solenoid valves intended for fuel gas shut off. (ASCO brand)
17. Provide unions on inlet and outlet of valve, provide isolation valve on inlet side of solenoid valves.
18. Butterfly: Full flanged or lug—no wafers. **All butterfly valves are to have gear operators.**

B. UNIONS

1. Make connections at each piece of equipment with unions or flanges located for quick/easy disconnect for maintenance. Provide unions or flanges on:
 - i. Control Valves.
 - ii. Equipment. iii. Meters.
 - iv. Tanks.
2. Unions shall be installed at the coil connection for all unit ventilators.
3. Use the same materials and finish as the piping system.
4. Use dielectric nipples or flanges where copper or brass piping is connected to ferrous piping or equipment. Epcos Model FX, FB, EA. (All junctions of dissimilar metals)
 - i. Dielectric nipples are to be used between steel and copper piping on hydronic and chilled systems.
 - ii. **Dielectric unions are not to be used.**
5. Unions and flanges are not required at equipment where flanged valves, strainers, control valves, etc., are used.
6. Omit unions and flanges in straight pipe runs or in concealed locations, except for flanged valve applications.
7. Union Schedule:
 - i. Copper Piping:
 - a. All pipe sizes: Copper, ground joint union. Chase 402, Mueller WC407.
 - ii. Hot-water heating, compressed air, natural gas.
 - a. Piping sizes 2" and smaller:
 1. Malleable iron unions with ground joint brass to iron seat, 150 pound working steam pressure. Grinnell 463, Stockham 694, black or galvanized.
 2. Flexible gas connectors shall not be used. All ground joint unions must have upstream shutoff. Connectors to be heavy duty, quick couple type as approved by PSD and the Engineer, except:
 - i. Commercial grade braided gas connectors, with tether, shall be used for gas-fired cooking equipment in kitchens (as required by Health Dept,) Examples are ranges, fryers, etc.
 - ii. Stainless Steel braided flex gas connectors required on generators.
 3. Pipe sized 2-1/2" and larger (welded):

- i. Forged steel flanges, 150 pound, welding neck or slip on with raised faces and 1/16" Garlock 9712 EPDM or Gylon Style 3565 Envelon gaskets and carbon steel bolts. Grinnell Fig. 1911 and 1921. Tube Turn Series 15, Walworth.
- 4. Pipe sizes 2-1/2" and larger (screwed):
 - i. Cast iron flanged unions, threaded, galvanized or black, 175-pound water, gasket type with carbon steel bolts. Grinnell 487, Stockham 489. **Part 3: Execution**

3.01 Preparation

3.02 Installation: A.

Valving:

1. Provide valves on all water and gas piping lines before they enter and after they leave a basement, crawl space or trench. Install shut off valves for all plumbing groups. Install an accessible wrench operated plug valve on the gas main outside before it enters the building.

3.03 Cleaning and Protection

END OF SECTION 22 05 23

SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

Part 1: General 1.01

Summary

- A. Types of supports and anchors specified in this section include the following:
 1. Horizontal-Piping Hangers and Supports.
 2. Vertical-Piping Clamps.
 3. Hanger-Rod Attachments.
 4. Building Attachments.
 5. Saddles and Shields.
 6. Spring Hangers and Supports.
 7. Miscellaneous Materials.
 8. Roof Equipment Supports.
 9. Anchors.
 10. Equipment Supports.
- B. Supports and anchors furnished as part of factory- fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

- B. Shop Drawings:
- C. Product certificates.
- D. Maintenance Data:

1.05 Quality Assurance

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers and Supports:

- i. B-Line Systems Inc.
- ii. Carpenter and Patterson, Inc.
- iii. Fee & Mason Mfg. Co.; Div. Figgie International
- iv. Grinnell Corp.
- v. PHD Manufacturing, Inc.
- vi. Elcen Metal Products Company
- vii. Michigan Hanger Company
- viii. ITT Grinnell Corp.
- ix. Unistrut Metal Framing Systems
- x. Hubbard Enterprises (Supports for domestic water piping)
- xi. Specialty Products Co. (Supports for domestic water piping).

2. Saddles and Shield:

- i. Grinnell Corp.
- ii. Pipe Shields, Inc.
- iii. Insulation Pipe Supports Manufacturing
- iv. Insulated Saddle Shield Insert Product Inc.
- v. Future Market Industries, Inc.
- vi. Michigan Hanger Company
- vii. Component Products Co.
- viii. Value Engineered Products, Inc.

3. Roof Equipment Supports:

- i. Custom Curb, Inc.
- ii. Pate Co.
- iii. Thycurb Div.; Thybar Corp.

2.02 Products A.

General

1. Provide pipe hangers, supports, anchors, and guides as specified herein, conforming to manufacturer's standardization society specification SP-69. Locate at changes in direction and at concentrated loads. Hanger design shall permit vertical adjustment and lateral movement to allow pipe expansion. Double nut hangers where piping is subject to water hammer, i.e. near flush valves and solenoid valves. All insulated pipe will have insulation inserts with shield at all hanger locations.
2. Bear hot piping directly on insulation shields and cold piping on insulation, shielded as described under article for insulation. All insulated pipe will have insulation inserts with shield at all hanger locations.
3. Provide pipe hangers of ample diameter for cold piping insulation and vapor barrier jacket.
4. Use carbon steel adjustable hangers as follows:

- i. Steel / cast iron, 2-1/2" and larger. Grinnell Fig. 260, Fee and Mason Fig. 239, Elcen Fig. 12.
 - ii. Steel, plastic and cast iron, 2" and smaller. Grinnell Fig. 69, Fee and Mason Fig. 400, Elcen Fig. 202.
 - iii. Copper pipe 2" and smaller. Grinnell Fig. CT-69, Fee and Mason Fig. 389, Elcen Fig. 389.
5. Three or more pipes may be supported on trapeze hangers. Isolate copper pipe from bearing on the cross member with an electrically insulating material.
- i. Trapeze hangers shall be "Unistrut" or equal, double channel with drop rods. Where pipes are to be supported on trapeze hanger, provide "Unistrut" or equal speed clamps. Isolate copper pipe from cross member as specified above. Clamps may be placed over insulation.
 - ii. All insulated piping supported by a trapeze hanger to have 360 degree insulation inserts and clamped with Unistrut type pipe clamps.
6. Support horizontal steel piping per SP-69 or as follows, whichever is more stringent:
- | <u>Pipe Size</u> | <u>Rod Diameter</u> | <u>Maximum Spacing</u> |
|------------------|---------------------|------------------------|
| Up to 1-1/4" | 3/8" | 8 ft. |
| 1-1/2" to 3-1/2" | 1/2" | 8 ft. |
| 4" & 5" | 5/8" | 12 ft. |
| 6" | 3/4" | 12 ft. |
7. Support horizontal copper piping per SP-69 or as follows, whichever is more stringent:
- | <u>Nom. Tubing Size</u> | <u>Rod Diameter</u> | <u>Maximum Spacing</u> |
|-------------------------|---------------------|------------------------|
| Up to 1-1/2" | 3/8" | 6 ft. |
| 2" to 2-1/2" | 3/8" | 8 ft. |
| 3" | 1/2" | 9 ft. |
8. Support horizontal hub and spigot pipe at every hub, 10 ft. max. spacing.
9. Support horizontal hubless cast iron pipe at every joint and at each horizontal branch connection. Sway brace to prevent shear.
10. Support plastic every 4 feet.
11. Support vertical piping as follows:
- i. Steel: Every other floor.
 - ii. Cast Iron and Copper: Every floor, 10 ft. max. intervals.
 - iii. Plastic: Every floor plus 5' spacing between floors.
12. In existing concrete frame structures, support pipe hangers from the sides only of beams or joists using austempered ramset fasteners or Phillips red head concrete anchors. Follow manufacturer's load recommendations.
13. In reinforced concrete structures, support pipe hangers and ducts from concrete inserts as follows:
- i. Loads to 400 pounds light weight concrete inserts, Grinnell Fig. 285, Elcen Fig. 86, Fee and Mason Fig. 186.
 - ii. Loads 400 to 1430 pounds: Universal concrete insert, Grinnell Fig. 282, Elcen Fig. 64, Fee and Mason Fig. 2570.
 - iii. Set inserts in concrete forms obtain approval of their locations in ample time to permit pouring of concrete as scheduled; provide reinforcing rods for pipe sizes over 3" and for duct sizes as directed.
 - iv. In areas where concrete slab will form finished

ceiling, take care to have inserts finish flush with concrete slab surface and to make neat appearance.

14. In steel framed structures, support pipe hangers from beam clamps, attachments and brackets bolted to steel joists or beams. Use steel washer plates for pipe supported from steel joists, Grinnell Fig. 60, Elcen Fig. 84, Fee and Mason Fig. 91. Hang near joist panel point, where possible. Bolting to steel deck is prohibited. Hang pipes over 5" diameter from more than 1 joist. Absolutely no piping shall be supported directly on the roof joists.
15. Hanging from one pipe to another is prohibited.
16. Anchor pipe with steel collars or saddles fitted with lugs and bolts, Keflex BA or AdSCO. Install anchor braces and turnbuckles as required for stability. Attachment in a manner injurious to the structure is prohibited.

B. PIPE HANGERS & SUPPORTS

1. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
 - i. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
 - ii. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
2. Adjustable Clevis Hanger: MSS Type 1.
 - i. Steel Pipe, size 3/8" thru 12", Grinnell fig. 260.
 - ii. Copper Pipe, size 1/2" thru 4", Grinnell fig. CT-65.
 - iii. Cast Iron Pipe, size 4" thru 24", Grinnell fig. 590.
3. Adjustable Swivel Ring: MSS Type 10.
 - i. Steel Pipe, size 1/2" thru 2", Grinnell fig. 69; size 2-1/2" thru 8", Grinnell figs. 69 or 70.
 - ii. Copper Pipe, size 1/2" thru 4", Grinnell fig. CT-69.
4. Pipe Clamps: MSS Type 8.
 - i. Steel Pipe, size 3/4" thru 20", Grinnell fig. 261.
 - ii. Copper Pipe, size 1/2" thru 4", Grinnell fig. CT-121.
5. U Bolts: MSS Type 24.
 - i. Steel Pipe, size 1/2" thru 36", Grinnell fig. 137.
 - ii. Copper Pipe, size 1/2" thru 8", Grinnell fig. 137C.
6. Straps: MSS Type 26.
 - i. Steel Pipe, size 1/2" thru 4", Grinnell fig. 262.
7. Pipe Stanchion Saddle: MSS Type 37.
 - i. Steel Pipe, size 4" thru 12", Grinnell fig. 259.
8. Yoke & Roller Hanger: MSS Type 43
 - i. 2-1/2" thru 20", Grinnell fig. 181.
9. Hanger Rods: Continuous threaded steel.
10. Hangers:
 - i. Hot Pipes:
 - a. 1/2" through 1-1/2": Adjustable wrought steel ring.
 - b. 2" through 5": Adjustable wrought steel clevis.
 - c. 6" and Over: Adjustable steel yoke and cast iron roll.
 - ii. Cold Pipes:

- a. 1/2" through 1-1/2": Adjustable wrought steel ring.
 - b. 2" and Over: Adjustable wrought steel clevis.
 - iii. Multiple or Trapeze: Structural steel channel (with web vertical), with welded spacers and hanger rods. Provide cast iron roll and stand for hot pipe sizes six inches and over. Provide hanger rods one size larger than for largest pipe in trapeze. If the deflection at center of trapeze exceeds 1/360 of the distance between the end hangers, install an additional hanger at mid-span or use a larger channel. **On trapeze type hangers, provide pipe clamps on all piping. Clamps on insulated piping shall be sized for the insulation O.D. to allow for pipe movement.**
11. Wall Supports for Horizontal Pipe:
- i. 1/2" through 3-1/2": Steel offset hook.
 - ii. 4" and Over: Welded steel bracket and wrought steel clamp. Provide adjustable steel yoke and cast iron roll for hot pipe 200°F and over and sizes six inches and over.
12. Upper Attachments:
- i. For attaching hanger rods to structural steel I-beams:
 - a. Provide adjustable beam clamp, Elcen No. 95 with No. 235 rod socket or equal. Attach to bottom flange of beam.
 - ii. For attaching hanger rods to bar joists:
 - a. When bottom chord is constructed of structural steel angles, provide Elcen No. 84H square washer or equal with nut. Place hanger rod between backs of the two angles and support with the washer on top of the angles. Spot weld washer to angles.
 - b. When bottom chord is constructed of round bars, provide Elcen No. 137 bar joint washer or equal.
 - iii. All hanger rods to be supported by bar joist or structural steel. Thread rod not to be secured from roof deck.
- C. FLOOR, WALL, AND CEILING PLATES
1. Plates shall be installed on all exposed pipe passing through walls, floors, or ceilings. Plates shall be as manufactured by Ritter Pattern and Casting Company, 120 Walker Street, New York, New York 10013, or approved equal, chrome plated steel plates with set screw and concealed hinge. Cut plates to fit flush at close-spaced piping locations.
- D. SADDLES AND THERMAL SHIELD INSERTS
1. **General: Provide saddles [thermal shield inserts] under all insulated piping hangers and thermal shield inserts on all piping through floors, wall and roof construction penetrations. Size saddles and shields for exact fit to mate with pipe insulation or a minimum of 1" thick for uninsulated pipe thermal shield inserts.**
 2. **Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.**
 - i. Grinnell Figs 160-165.
 3. **Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.**
 - i. Grinnell Fig. 167.
 4. Thermal Shield Inserts: Provide 100-psi average compressive strength, waterproof, asbestos free calcium silicate, encased with a sheet metal enclosure. Insert and shield

shall cover the entire circumference or the bottom half circumference of the pipe and shall be of length recommended by the manufacturer for pipe size and thickness of insulation or the thickness of the wall, roof or floor construction.

E. MISCELLANEOUS MATERIALS

1. Steel Plates, Shapes, and Bars: ASTM A 36.
2. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

F. ROOF EQUIPMENT SUPPORTS

1. General: Construct roof equipment supports using minimum 18-ga galvanized steel with fully mitered and welded corners, 3" cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, 18-ga galvanized steel counterflashing and rigid insulation.
2. Configuration: Compensate for slope in roof so top of support is dead level.

Part 3: Execution

3.01 Preparation A.

INSPECTION

1. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 Installation

A. INSTALLATION OF BUILDING ATTACHMENTS

1. Install building attachments on structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

B. INSTALLATION OF HANGERS AND SUPPORTS

1. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Arrange for grouping of parallel runs of horizontal piping to be supported together on field fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
2. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
3. Support fire-water piping independently from other piping systems.
4. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
5. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, to facilitate action of expansion joints, expansion loops, expansion bends and similar units and within 1'-0" of each horizontal elbow.
6. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

7. Pipe Slopes: Install hangers and supports to provide slopes, and so that maximum pipe deflections allowed by ANSI B31.9 Building Services Piping Code is not exceeded.
8. Insulated Piping: Comply with the following installation requirements.
- i. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - ii. On trapeze type hangers, provide pipe clamps on all piping. Clamps on insulated piping shall be sized for the insulation O.D. to allow for pipe movement.
 - iii. Saddles: Install Protection saddles MSS Type 39 where insulation without vapor barrier. Fill interior voids with segments of insulation that match adjoining pipe insulation.
 - iv. Thermal Shield Inserts: Install thermal shield inserts MSS Type 40 on all insulated piping. Thermal shield inserts shall span an arc of 360 degrees and shall have dimensions in inches not less than the following:
 - v. Insert material shall be at least as long as the protective shield.
 - vi. Thermal Hanger Shields: Install, with insulation of same thickness as piping.

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
	12	0.060
5 & 6	18	0.060

9. Install hydronic piping (copper and steel) hangers with the following minimum rod sizes and maximum spacing:

SIZE (NPS)	MAX. SPAN IN FEET	MIN. ROD SIZE INCHES
1	7	3/8
1-1/2	9	3/8
2	10	3/8
3	12	1/2
4	12	5/8

10. Support vertical runs at each floor.

11. Install steel natural gas piping with the following minimum rod size and maximum spacing:

SIZE (NPS)	MAX. SPAN IN FEET	MIN. ROD SIZE - INCHES
1/2	6	3/8
3/4 TO 1	8	3/8
1-1/4 or larger (horizontal)	10	1/2
Vertical, all sizes	every floor level	

12. Install horizontal water distribution piping with the following maximum spacing and minimum rod sizes:

Nom. Pipe Size Inches	Steel Pipe Max. Span-Ft.	Copper Tube Max. Span-Ft.	Min. Rod Dia. Inches
Up to 1/2	6	6	3/8
3/4 & 1	8	6	3/8
1-1/4	10	6	3/8
1-1/2	10	6	3/8
2	10	10	3/8
2-1/2	10	10	1/2
3	10	10	1/2
4	10	10	5/8 (1/2 for copper)

13. Install sanitary drainage and vent systems with the following maximum spacing and minimum rod sizes:

Pipe Material	Max Horizontal Spacing in Ft.	Max Vertical Spacing in Ft.
Cast-Iron Pipe	5	15
Copper Tubing - 1-1/4" and smaller	6	10
Copper Tubing - 1-1/2" and larger	10	10

14. Support horizontal cast iron pipe as follows:

- i. Hub & Spigot: All sizes - One hanger to each joint.
- ii. No-Hub: All sizes
 - a. With Clamp-All and Anaheim Series 4000 stainless steel couplings and MG cast iron couplings: one hanger to each joint.
 - b. With all other stainless steel band type couplings: one hanger to each side of joint.
 - c. Support all horizontal cast iron pipe within 18 inches of each joint and with 5 feet maximum spacing between hangers, except that pipe exceeding 5 feet in length shall be supported at intervals no greater than 10 feet.
 - d. Use hanger rods same size as for steel.
 - e. Support vertical cast iron pipe at each story height and at its base. Secure vertical hub and spigot pipe immediately below the hub. Support vertical nohub pipe so that the weight is carried from the pipe to the support and not from the joint to the support.

15. Provide copper or copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping. All insulated piping to have insulation inserts.

16. Place a hanger within one foot (0.305 m) of each horizontal elbow.

17. Use hangers which are vertically adjustable 1-1/2 inch (38.1 mm) minimum after piping is erected.
18. Support vertical steel and copper piping at every story height but at not more than 15 foot intervals for steel and 10 feet for copper.
19. Where several pipes can be installed in parallel and at same elevation, provide uni-strut trapeze hangers. Provide pipe clamps on all pipes supported on trapeze hangers, sized for the O.D. of the pipe insulation insert and shield, to allow for pipe movement.
20. Where practical, support riser piping independently of connected horizontal piping.
21. All insulated pipes shall have thermal shield insert [insulation protection saddles] at all support points. All piping shall have thermal shield inserts at each penetration thru wall, floor and roof.
22. Each pipe drop to equipment shall be adequately supported. All supporting lugs or guides shall be securely anchored to the building structure.
23. Install all couplings with torque wrench, torqued to inch pounds as specified by the manufacturer.
24. Securely anchor and support plumbing domestic water piping in chases or walls. Use factory manufactured clamps and brackets connected to fixture carriers, waste/vent piping or brackets connected to studs. Wires or straps will not be permitted.
 - i. When copper supplies are connected to flush valves, support the tubing by the studs or by a fixture carrier, not by clamping to waste/vent piping.
 - ii. Prevent copper tubes from making contact with steel brackets using duct tape, fire retardant polyethylene inserts or other dielectric insulating material.
 - iii. Place supports every ten feet on vertical pipe and every five feet on horizontal pipe.
25. Hang all insulated pipe at the point of support in the following manner:
 - i. Thermal Shield Insert: Provide thermal shield insert of the same thickness as adjoining insulation for insulated pipe. The entire 360 degrees shall be waterproof, asbestos free, calcium silicate.
 - a. If the pipe hanger spacing exceeds ten (10) feet or if there are to be pipe rollers, utilize a double thick shield on bearing surface.
 - b. On domestic cold water, chilled water and horizontal roof drain pipe the thermal shield insert shall extend 2 inches beyond the construction material and the sheet metal shield shall span an arc of 360 degrees. All hangers shall be properly sized to accommodate the thermal shield insert and no hanger shall penetrate or crush any of the insulating material.
26. Install anchors and fasteners in accordance with manufacturer's recommendations and the following:
 - i. In the event a self-drilling expansion shield or machine bolt expansion shield is considered to have been installed improperly, the Contractor shall make an acceptable replacement or demonstrate the stability of the anchor by performing an on-site test under which the anchor will be subjected to a load equal to twice the actual load.
 - ii. Powder-driven fasteners may be used only where they will be concealed after the construction is complete. Where an occasional fastener appears to be improperly installed, additional fastener(s) shall be driven nearby (not closer than 6 inches) in undisturbed concrete. Where it is considered that many fasteners are improperly

installed, the Contractor shall test load any 50 successively driven fasteners. If 10 percent or more of these fasteners fail, the Contractor shall utilize other fastening means as approved and at no additional cost to the Owner.

- iii. Hangers for piping and ducts shall be attached to cellular steel floor decks with steel plates and bolted rod conforming to the steel deck manufacturer's requirements. Where the individual hanger load exceeds the capacity of a single floor deck attachment, steel angles, beams or channels shall be provided to span the number of floor deck attachments required.
- iv. Welding may be used for securing hangers to steel structural members. Welded attachments shall be designed so that the fiber stress at any point of the weld or attachment will not exceed the fiber stress in the hanger rod.

C. SLEEVES AND SEALS 1. General:

- i. Encase all insulated pipes penetrating fire rated walls and floors in 360 degree metalshielded insulation inserts as manufactured by Pipe Shields, Inc. or equal. Extend insulation insert on all domestic cold water, chilled water and refrigerant lines 1" beyond sheet metal shield.

2. Pipes:

i. Pipes

- a. Pipes penetrating fire rated concrete or masonry construction, whether insulated or not, shall be provided with sheet metal or pipe sleeves fitted into place at time of construction. In poured concrete, the sleeves shall be steel pipe with a full circle, continuously welded water stop plate to also act as a sleeve anchor. When installing Link-Seal (see paragraph f) the sleeve and Link-Seal shall be of matched sizes. Otherwise, sleeves shall be of such size to provide all around clearance of 1/4" to 1". Seal entire space between pipe and sleeve with fire stopping as specified in paragraph A.
- b. Sleeves in non-fire rated or non-bearing walls, floors or ceilings, new or existing construction, shall be steel pipe or galvanized sheet metal with lock-type longitudinal seam. Pack all open spaces on each end with mineral wood or other non-combustible material, positively fastened in place. Asbestos is not acceptable.
- c. Where a pipe of any description passes through a concrete floor, the sleeve shall extend at least 2" above the finished floor, except when using the ProSet Systems.
- d. At Contractor's option, where uninsulated pipes penetrate cast-in-place concrete floors, the "ProSet Systems", Atlanta, Georgia, sleeving may be employed.
- e. For pipes penetrating foundation walls, water-proofing membrane floors or other places where water leakage could be encountered, install Link-Seal wall sleeves by Thunderline Corporation in manner recommended by the manufacturer.

3. Seals:

i. General:

- a. Seal all holes or voids where mechanical systems penetrate fire rated floors and walls with a fire stopping sealant having a fire rating equal to or greater than that of the

construction being penetrated, but not less than 2 hours. The sealant shall meet the requirements of ASTM E-814, ASTM E-119 and UL-1479. It shall be installed with strict adherence to the manufacturer's instructions and according to the product's UL Laboratory listing. The use of asbestos in any form is not permitted. ii. Types of Seals:

- a. Intumescent (3M Company CP25 Caulk and 303 Putty)
- b. Expanding Foam (Dow Corning 3-6548 Silicone RTV Foam)
- c. Refractory Putty (SOHIO Carborundum Fire Putty)

iii. Method of Use:

- a. Intumescent type: For insulated pipe, install insulation through the sleeve with a continuous vapor seal if required. Install intumescent seal in the annular space between the pipe insulation and the pipe sleeve. Refer to manufacturer's data sheets for maximum annular space allowable and thickness of material required to maintain the rating of the construction being penetrated in conformance with applicable UL Fire Stop Classification for the product.
- b. Expanding foam: For insulated pipe, terminate the insulation on both sides of the wall or floor being penetrated and fill the space between the construction and the bare pipe with the foam. For uninsulated pipe, continue pipe through the penetration and proceed as with insulated pipe.
- c. Refractory putty: For insulated pipe, provide a 360 degree metal-shielded calcium silicate insulation insert as specified in paragraph "A." Pack and seal the entire space between shield and sleeve with refractory putty. When sealing bare pipe, omit the metal-shielded insert.

iv. Escutcheons:

- a. In finished parts of the building, after painting is completed, install chromium plated escutcheons on all pipes passing through walls and floors.

D. METAL FABRICATION

1. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors.
2. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
3. Field Welding: For procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, comply with those listed on project drawings and the following:
 - i. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - ii. Obtain fusion without undercut or overlap.
 - iii. Remove welding flux immediately.
 - iv. Finish welds at exposed connections so no roughness shows after finishing and contours at welded surfaces match adjacent contours.

E. ADJUSTING

1. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve slope of pipe.
2. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.

- i. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous.
 - 3. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.
- 3.03 Cleaning and Protection

END OF SECTION 22 05 29

SECTION 22 05 48 – VIBRATION AND SEISMIC CONTROL FOR PLUMBING PIPING AND EQUIPMENT

Part 1: General 1.01

Summary

A. Types of vibration control products specified in this section include the following:

- 1. Neoprene Pads.
- 2. Vibration Isolation Springs.
- 3. All-Directional Anchors.
- 4. Neoprene Mountings.
- 5. Spring Isolators, Free-Standing.
- 6. Spring Isolators, Vertically-Restrained.
- 7. Thrust Restraints.
- 8. Fabricated Equipment Bases.
- 9. Isolation Hangers.
- 10. Flexible Pipe Connectors.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

B. Shop Drawings:

C. Maintenance Data:

1.05 Quality Assurance

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

- 1. Obtain vibration control products from single manufacturer.
- 2. Engage manufacturer to provide technical supervision of installation of support isolation units produced, and of associated inertia bases (if any).

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Vibration Control Products:
2. Mason Industries, Inc.
3. Peabody Noise Control, Inc.

2.02 Products

A. VIBRATION CONTROL MATERIALS AND SUPPORT UNITS

1. Neoprene Pads: Oil-resistant neoprene sheets of manufacturer's standard hardness and cross-ribbed or waffled pattern.
 - i. Mason Industries Type W.
2. Vibration Isolation Springs: Wound-steel compression springs, of high-strength, heat-treated, spring alloy steel with outside diameter not less than 0.8 times operating height; with lateral stiffness not less than vertical stiffness and designed to reach solid height before exceeding rated fatigue point of steel.
 - i. Color coated springs for ease of identification.
 - ii. Spring shall have a minimum of 50% additional travel to solid.
3. Neoprene Mountings: Provide neoprene mountings consisting of neoprene element bonded between 2 steel plates that are neoprene-covered to prevent corrosion. Provide minimum rated deflection of 0.35". Provide threaded hole in upper plate and 2 holes in base plate for securing to equipment and to substrate.
 - i. Mason Industries Type ND.
4. Spring Isolators, Free-Standing: Provide vibration isolation spring Type C between top and bottom loading plates, and with pad-type Type B isolator bonded to bottom of bottom loading plate. Include studs or cups to ensure centering of spring on plates. Include leveling bolt with lock nuts and washers, centered in top plate, arranged for leveling and anchoring supported equipment as indicated.
 - i. Include holes in bottom plate for bolting unit to substrate as indicated.
 - ii. Mason Industries Type SLFH.
5. Spring Isolators, Vertically-Restrained: Provide spring isolators Type C in housing that includes vertical limit stops. Design housing to act as blocking during erection, and with installed height and operating height being equal. Maintain 1/2" minimum clearance around restraining bolts, and between housing and springs. Design so limit stops are out of contact during normal operation.
 - i. Mounting used out of doors shall be hot dipped galvanized, spring shall be cadmium plated.
 - ii. Mounting used out of doors shall have certified calculation by a registered professional engineer showing ability to withstand 109 MPH wind load in 3 principal axis.
 - iii. Mason Industries Type SLR.
6. Thrust Restraints: Provide horizontal thrust restraints consisting of spring elements in series with neoprene pad. Select spring deflection same as for equipment loading. Design so thrust restraints can be pre-set and adjusted in field. Attach horizontal restraints at centerline of thrust and symmetrically on either side of unit.
 - i. Provide same deflection as isolated equipment.
 - ii. Select load to provide 1/4" maximum displacement under full system operating pressure.
 - iii. Mason Industries Type WBI.
7. Isolation Hangers: Hanger units formed with brackets and including manufacturer's standard compression isolators. Design brackets for 5 times rated loading of units.

Fabricate units to accept misalignment of 15 deg. off center in any direction before contacting hanger box, and for use with either rod or strap type members, and including acoustical washers to prevent metal-to-metal contacts.

- i. Provide vibration isolation spring Type C with cap in lower pad-type isolator rubber hanger element in bottom, securely retained in unit.
 - ii. Provide neoprene element, with minimum deflection of 0.35", securely retained in hanger box.
 - iii. Mason Industries Type 30N.
8. Riser Isolators: Suspend risers from, or support risers by, spring hangers Type ND or spring isolators Type F. Wherever possible, anchor risers at central point with resilient anchors, Type D. Provide hanger or mounting deflection of 0.75" except in those expansion locations where additional deflection is required to limit deflection or load changes to +25% of initial deflection. Provide sliding guides held in position by resilient anchors, located between anchor points and end of piping.
9. Flexible Pipe Connectors:
- i. For non-ferrous piping, provide bronze hose covered with bronze wire braid with copper tube ends or bronze flanged ends, braze-welded to hose.
 - a. Mason Industries Type BBF.
 - ii. Flexible Pipe Connectors: Provide EDPM construction consisting of multiple plies of nylon tire cord fabric and elastomer molded and cured in hydraulic rubber presses. Provide straight connector, rated at 125 psi at 220 deg. F (104 deg. C).
 - a. Mason Industries Type MFNC.

Part 3: Execution

3.01 Preparation A.

INSPECTION

1. Examine areas and conditions under which vibration control units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner or his representative.

B. PERFORMANCE OF ISOLATORS

1. Manufacturer's Recommendations: Comply with manufacturer's recommendations for selection and application of vibration isolation materials and units to achieve minimum static deflection and displacement requirements.

C. APPLICATIONS

1. General: Select vibration control products in accordance with ASHRAE Handbook, 1991 HVAC Applications Volume, Chapter 42 "Sound and Vibration Control", Table 34.
2. Piping: For piping connected to equipment mounted on vibration control products, install isolation hangers Type N, for first 3 points of support for pipe sizes 4" and less, for first 4 points of support for pipe sizes 6" through 8", and for first 6 points of support for pipe sizes 10" and over.
 - i. Where applicable, apply restraint system in accordance with SMACNA GFSR 1982.
3. Fan Sets: All fan sets should have thrust restraints when operating over 2" W.C. S.P. unless they are mounted on a concrete inertia base in which case the inertia base will not allow fan movement. The fan position at operating and stop positions should not move more than 1/4" displacement at these two conditions.

4. Earthquake Restraint: IF NEEDED install Type H seismic snubber.

3.02 Installation A.

INSTALLATION

1. General: Comply with manufacturer's instructions for installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.
2. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces.
3. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.
4. For air handling equipment, install thrust restraints and also wherever thrust exceeds 10% of equipment weight.
5. Locate isolation hangers as near overhead support structure as possible.
6. Weld riser isolator units in place as required to prevent displacement from loading and operations.
7. Flexible Pipe Connectors: Install on equipment side of shutoff valves, horizontally and parallel to equipment shafts wherever possible.

B. EXAMINATION OF RELATED WORK

1. Installer of vibration isolation work shall observe installation of other work related to vibration isolation work, including work connected to vibration isolation work; and, after completion of other related work (but before equipment startup), shall furnish written report to Engineer listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:
 - i. Equipment installations (performed as work of other sections) on vibration isolators.
 - ii. Piping connections including flexible connections.
 - iii. Ductwork connections including provisions for flexible connections.
 - iv. Passage of piping and ductwork which is to be isolated through walls and floors.
2. Do not start-up equipment until inadequacies have been corrected in manner acceptable to vibration isolation installer.

C. DEFLECTION MEASUREMENTS

1. Upon completion of vibration isolation work, prepare report showing measured equipment deflections theoretical floor deflection and isolation efficiency for each major item of equipment.

3.03 Cleaning and Protection A.

ADJUSTING AND CLEANING

1. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short-circuit unit isolation.

END OF SECTION 22 05 48

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

Part 1: General 1.01

Summary

A. Types of identification devices specified in this section include the following:

1. Plastic Pipe Markers.
2. Plastic Tape.
3. Plastic Duct Markers.
4. Valve Tags.
5. Valve Schedule Frames.
6. Engraved Plastic-Laminate Signs.
7. Equipment Markers.
8. Plasticized Tags.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

B. Schedules:

1.05 Quality Assurance

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years. B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A 3.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

B. Mechanical Identification:

1. Westline Products
2. Brady (W.H.) Co.; Signmark Div.
3. Seton Name Plate Corp.

2.02 Products

A. MECHANICAL IDENTIFICATION MATERIALS

1. General: Provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

B. PLASTIC PIPE MARKERS

1. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
2. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 deg. F. (52 deg. C.) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
3. Small Pipes: For external diameters less than 6" (including insulation if any), provide fullband pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - i. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - ii. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
4. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - i. Steel spring or non-metallic fasteners.
 - ii. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1 1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
 - iii. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
5. Lettering: Comply with piping system nomenclature or to match existing building lettering nomenclature system and abbreviate only as necessary for each application length.
6. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

C. PLASTIC TAPE

1. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
2. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
3. Color: Comply with ANSI A13.1.

D. VALVE TAGS

1. Brass Valve Tags: Provide 18-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 - i. Provide 1-1/2" diameter tags.
 - ii. Fill tag engraving with black enamel.
2. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), and solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
3. Access Panel Markers: Provide mechanical equipment identification as indicated in this section.
4. **Identify all valves located above ceilings or behind access panels using Dymo embossing Tape punched with M-3 Dymomite hand embossing tool. Punch out 3/32" holes at each side of label and secure with Parker-Kalon self-taping screws in addition to adhesive.**

E. VALVE SCHEDULE FRAMES

1. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with non-yellowing Plexi-glas.

F. EQUIPMENT IDENTIFICATION

1. Identify all key equipment, thermostats, controls, relays, dampers, valves, etc., using Dymo embossing Tape punched with M-3 Dymomite hand embossing tool. Punch out 3/32" holes at each side of label and secure with Parker-Kalon self-taping screws in addition to adhesive.
 - i. Embossing tape equipment identification specified shall apply to identification labeling of mechanical equipment above ceilings or ceiling access doors. Provide this type of labeling at the ceiling to locate equipment from the occupied space.
2. For mechanical equipment exposed to view throughout the building, located in mechanical rooms or on the roof, provide engraved plastic laminate identification, black with white core, minimum size 2" x 4", with 1" high lettering. Equipment labels shall be fastened with self-tapping stainless steel screws. Provide contact-type permanent adhesive where screws should not penetrate the substrate.

G. PLASTICIZED TAGS

1. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large- size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

H. LETTERING AND GRAPHICS

1. General: Provide numbers, lettering and wording as indicated and approved by the Owner/Engineer for proper identification and operation/ maintenance of mechanical systems and equipment.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. GENERAL INSTALLATION REQUIREMENTS

1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. PIPING SYSTEM IDENTIFICATION

1. General: Install pipe markers of the following type on each system and include arrows to show normal direction of flow.
2. The requirement of labeling the mechanical system components and the quality of the identification shall be emphasized in areas exposed to the student population, including, but not limited to, the stairways, the gymnasium, the cafeteria, the mechanical yard, the art room, the music room and roof areas visible from the second floor.
3. Plastic pipe markers. Install on pipe insulation segment where required for hot non-insulated pipes.

4. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
5. Near each valve and control device.
6. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
7. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
8. At access doors, manholes and similar access points which permit view of concealed piping.
9. Near major equipment items and other points of origination and termination.
10. Spaced intermediately at maximum spacing of 25' along each piping run, except reduce spacing to 15' in congested areas of piping and equipment.
11. On piping above removable acoustical ceilings.

C. VALVE IDENTIFICATION

1. General: Provide valve tag on valves in each piping system. List each tagged valve in valve schedule for each piping system. List valve tag locations on redline drawing at location of valves.
 - i. Building services main shut-off valves.
 - ii. Each individual system main shut-off valves.
 - iii. Each individual system floor shut-off valves.
 - iv. Each individual system major branch shut-off valves.
2. Mount valve schedule frames and schedules in mechanical equipment rooms where directed by Owner.

D. MECHANICAL EQUIPMENT IDENTIFICATION: See Section 23 05 53.

3.03 Cleaning and Protection

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 22 05 53

SECTION 22 07 16 – PLUMBING EQUIPMENT INSULATION

Part 1: General

1.01 Summary

- A. Equipment Insulation: Fiberglass. Calcium Silicate

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

- B. Samples:

1.05 Quality Assurance

- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:

- 1. Mechanical Insulation:
 - i. Schuller (formerly Manville Corp.)
 - ii. Owens-Corning Fiberglas Corp.
 - iii. CertainTeed Corp.
 - iv. Knauf Fiber Glass
 - v. Manson
 - vi. Armstrong World Industries, Inc.
- 2. Jacketing & Covering Products:
 - i. Childers
 - ii. Ceel-Co (PVC for interior applications)
 - iii. Zeston (PVC for interior applications)

2.02 Products

- A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Class 2. "K" factor shall be maximum 0.28 at 200°F. mean temperature, 3.0 lb. density, 850oF temperature limit.
- B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type I, "K" factor shall be maximum 0.45 at 250°F. mean temperature. 850oF temperature limit.
- C. Calcium Silicate Equipment Insulation: ASTM C 533, Type I, Block. "K" factor shall be maximum 0.87 at 1000°F. mean temperature, compression strength 200 psi for 5% compression, transverse strength 60 psi.
- D. Jacketing Material for Equipment Insulation: Provide pre- sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option. E. Provide Zeston type fittings. No mitered joints.

Part 3: Execution

3.01 Preparation A. INSPECTION

3.02 Installation

- A. EQUIPMENT INSULATION: All standard locations.
 - 1. Insulate each item of equipment specified above with the following types and thicknesses of insulation:
 - i. Flexible Elastomeric Sheet: 3/4" thickness for surface temperatures above 35°F (2°C), 1" thickness for surface temperatures below 35°F (2°C).
 - 2. Insulate each item of equipment specified above with the following types and thicknesses of insulation:
 - i. Fiberglass: 2" thick. Do not use for equipment above 450°F (232°C).
- B. INSTALLATION OF EQUIPMENT INSULATION

1. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
 2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
 3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
 4. Do not apply insulation to equipment, mufflers, breechings, or stacks while hot.
 5. Apply insulation using staggered joint method and double layer construction. Apply each layer of insulation separately.
 6. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
 7. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
 8. Provide removable insulation sections with aluminum jacket and stainless steel bands to cover parts of equipment which must be opened for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
 9. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of aluminum jacketing, as recommended by manufacturer.
- C. EXISTING INSULATION REPAIR
1. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation, install new jacket lapping and sealed over existing.

3.03 Cleaning and Protection

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 07 16

SECTION 22 07 19 – PLUMBING PIPING INSULATION

Part 1: General 1.01

Summary

- A. Piping System Insulation: Fiberglass.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

- B. Samples:

1.05 Quality Assurance

- A. Manufacturer's Qualifications: not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:

1. Mechanical Insulation:

- i. Schuller (formerly Manville Corp.)
- ii. Owens-Corning Fiberglas Corp.
- iii. CertainTeed Corp.
- iv. Knauf Fiber Glass
- iv. Manson
- v. vi. Armstrong World Industries, Inc.

2. Jacketing & Covering Products:

- i. Childers
- ii. Ceel-Co (PVC for interior applications)
- iii. Zeston (PVC for interior applications)

2.02 Piping Insulation Materials:

A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated, "K" factor shall be maximum 0.24 at 75f mean temperature, jacket with tensile strength of 35 lbs/in, mullen burst 70 psi, beach puncture 50 oz. in/in, permeability .02 perm factory applied vapor barrier jacket and adhesive self-sealing lap joint.

B. Jackets for Piping Insulation: ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at installers option.

1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.

2. All exterior piping insulated shall be encased with aluminum jacketing. The jacketing shall be manufactured from T3003 (or T/5005) H14 to H19 aluminum alloy with 3/16" corrugations and shall have a factory attached 1 mil thick polyethylene moisture barrier continuously laminated across the full width of the jacketing. Jacketing shall be .016" thick minimum. Provide matching factory fabricated covers for 90 and 45 degree elbows, tee fittings, flange fittings, valve bodies, blind ends, reducers, and other fittings necessary to make the covering system complete, waterproof and weatherproof.

3. Where piping is specified to be exposed in finished areas and mechanical rooms, all insulated piping shall have PVC jacketing and fitting covers as manufactured by Ceel-Co 550Z with a 25/50 flame/smoke rating not less than 15 mil thick.

C. Staples, bands, wires, and cement: As recommended by insulation manufacturer for applications indicated.

D. Adhesives, sealers, and protective finishes: As recommended by insulation manufacturer for applications indicated and additional finishes as specified.

2.03 Products

A. PIPE AND DUCT SLEEVES

1. Provide sleeves for all pipes and ducts passing through floors, roofs, walls, and full height partitions. Ducts passing through gypsum board walls do not require sleeves.
2. For sleeves passing through fire rated walls/floors, fill void with fire stop material.
3. At points where a duct passes through a fire rated wall/floor and a fire damper is being installed, the duct sleeve can be eliminated.
4. Pipe Sleeves:
 - i. Floor Sleeves in Exposed Areas: Schedule 40 PVC pipe, reamed, extending 2" above floor in equipment rooms and wet areas and 1/4" above the floor in all other locations.
 - ii. Masonry Wall Sleeves: Schedule 40 PVC pipe reamed, and finished flush with wall.
 - iii. Gyp Wall Sleeves and Sleeves through Existing Construction: Schedule 40 PVC ends terminating flush with the wall.
 - iv. Roof Sleeves and Floor Sleeves in Concealed Locations (chases): Schedule 40 PVC.
 - v. Make pipe sleeves 1/2" larger inside diameter than the outside diameter of the pipe or pipe insulation, where insulated. Fabricate sleeves from new materials, with ends cut square.
 - vi. Floor Sleeves, where water is to be kept out: Fill with graphite packing and caulking compound.
 - vii. Exterior Wall Sleeves: Schedule 40 steel pipe reamed, welded flange in the middle of the wall, ends finished flush, or Schedule 40 PVC, finished flush. Pack void annular space with oakum and lead to provide a watertight joint. viii. Where plastic pipe passes through fire rated shaft walls and fire rated partition walls having a fire rating of 2 hours or more, provide Schedule 40 steel or cast iron pipe sleeve extending 12" or more on each side of wall.
5. Duct Sleeves for round ducts up to 12" in diameter.
 - i. Roof, floor and partitions sleeves: Schedule 40 PVC; terminate flush with wall, or 2" above floor in equipment rooms and wet areas; 1/4" above floor in all other areas.
 - ii. Sleeves through bearing walls: Schedule 40 PVC pipe reamed and finished flush with wall.
 - iii. Make sleeves 1/2" larger inside diameter than the outside diameter of duct.

6. Provide prepared openings for rectangular ducts and round ducts over 12" diameter. Furnish exact locations and sizes of boxing forms for these openings in masonry, concrete, and other building construction. Openings shall be 1" larger than outside dimensions of ducts.
7. Sleeve Flashing, Caulking: For sleeves passing through membrane waterproofing or lead safe, provide 16 oz. soft sheet copper of 4 pound lead per square foot flashing extending 9" beyond sleeve in all directions; secure to waterproofing or lead safe; turn down flashing into space between pipe and sleeve, insert oakum gasket, pour lead, caulk water tight. Over air plenums caulk all sleeves with polysulfite base sealing compound conforming to ASA A116.1 (Thiokol).
 - i. Where sleeves are indicated with flashing flanges provide Josam, or equal, 26420 series threaded riser sleeve with anchor lugs, flashing flange, steel pipe extensions.
8. Pipe and Duct Sleeves through Existing Construction:
 - i. This Contractor shall provide all openings for pipes and ducts passing through existing walls, footings, roofs and floors.
 - ii. Openings for pipes shall be core drilled 1/2" larger than the outside pipe or insulation diameter. After installation, seal around pipes. Coordinate opening locations such that no structural members are damaged.
 - iii. Where larger portions of existing construction are removed for a number of pipes, provide individual sleeves for each pipe. This Contractor shall then grout around sleeves to match existing construction. Reinforce mesh, angles, etc., shall be used to provide structural stability to the new grouting.
 - iv. Openings for ducts shall be neatly cut to the shape of the duct and 1" larger than the outside dimension. After installation, seal around ducts. Coordinate opening locations such that no structural members are damaged.
 - v. Where larger rough openings are made, Contractor shall provide sleeve and grout as stated above.

Part 3: Execution

3.01 Inspection:

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.
- B. Workmanship shall be first class and of the highest quality, poor installation or bad appearance as determined by the engineer shall be due cause to reject the entire project in whole and retainage will be withheld until corrective action is completed to the engineer's satisfaction.

3.02 Installation:

A. Plumbing Piping System Insulation

1. Insulation Omitted: Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, balance cocks, flow

regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

2. All damaged insulation shall be replaced in whole, repair of damaged insulation will not be accepted.

3. Cold Piping: Application Requirements: Insulate the following cold water piping systems with fiberglass 1" insulation.

- i. Potable and non-potable cold water piping.
- ii. Interior above ground horizontal storm water piping.
- iii. Roof drain bowls.

4. Hot Piping: Application Requirements: Insulate the following hot water piping systems with fiberglass 1" thick for pipe sizes up to and including 2", 1-1/2" thick for pipe sizes over 2".

- i. Potable hot water and tempered piping.
- ii. Potable hot water and tempered recirculating piping.
- iii. Hot drain piping.

B. INSTALLATION OF PIPING INSULATION

1. Do not insulate cleanouts and access openings. Neatly bevel and finish up to edges of such openings.

2. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded. Use PVC Zeston type covers. Mitered joints are not acceptable.

3. Extend piping insulation without interruption through walls, floors and similar piping penetrations.

4. Provide insulation inserts with shields at all supports. Butt pipe insulation against pipe hanger insulation inserts. For all piping apply wet coat of vapor barrier lap cement on butt joints and seal all joints and seams with 3" wide vapor barrier tape or band.

5. Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective jacketing as recommended by manufacturer.

- i. All longitudinal joints shall be installed so they are directed downward. All joints shall be sealed.
- ii. Provide color-coded insulation jacketing on all interior piping exposed in finished areas and in mechanical rooms.

C. EXISTING INSULATION REPAIR

1. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation, install new jacket lapping and sealed over existing

3.03 HVAC Piping System Insulation:

A. Insulation Omitted: Omit insulation on unions, flexible connections. And expansion joints. Insulation may be omitted inside of cabinet unit heaters, and fan coils for hot piping. Hot and cold piping routed inside air handler units shall be insulated.

B. Cold Piping (40 deg. F to ambient):

1. Application Requirements: Insulate the following cold HVAC piping systems with fiberglass 1-1/2" thick for pipe sizes up to and including 4", 1-1/2" thick for pipe sizes over 4".

- i. Chilled water supply and return piping.
- ii. Cold condensate drain piping.

- C. Hot Low Pressure Piping: (to 250 deg. F):
 - 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (water piping up to 250 deg F) with fiberglass 1" thick for pipe sizes up to and including 2", 1-1/2" thick for pipe sizes over 2".
 - i. Hot water supply and return piping.
- D. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather.
 - 1. Jacket shall be factory applied aluminum, 0.016" thick, and laminated vapor barrier. Jacket shall have "Z" groove weathertight seal and each joint shall be sealed with snap straps containing permanent plastic sealing compound and secured by ½" wide stainless steel bands located on 24" centers. Fittings shall be insulated and mitered sections of the same kind of material. All joints shall be sealed with a sealing compound and preformed aluminum bands. All joints and seams shall be caulked with clear silicone. Locate all longitudinal seams at the bottom of piping to minimize joint exposure to weather.
- E. All Piping Exposed to Exterior:
 - 1. Application Requirements: Insulate the following sub-freezing HVAC piping systems with fiberglass 3" thick for pipe sizes up to and including 8", 4" thick for pipe sizes over 10".
 - a. Exterior Chilled Water Piping.
 - 2. Install insulation over the top of heat cable.
 - 3. Provide weatherproof jacketing as specified. Seal all joints water tight.

END OF SECTION 22 07 19

SECTION 22 11 13 – FACILITY WATER DISTRIBUTION PIPING

Part 1: General

- 1.01 Summary
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required A.
 - Product Data.
 - B. Shop Drawings
 - C. Certification of Compliance
 - D. Test Reports
 - E. Manufacturer Data. F. Maintenance Data
- 1.05 Quality Assurance
 - A. Welding Materials and Procedures: Conform to ASME BPV SEC IX, except to conform to ANSI/ASME B31.1 for systems with operation temperature over 250 degrees F (121 degrees C).
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
 - A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.08 Regulatory Requirements A.

EXTRA STOCK

1. Maintenance Stock: Furnish one valve key for each key operated wall hydrant, hose bibb, or faucet installed.

Part 2: Products

2.01 Manufacturers

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

1. Balance Cocks:
 - i. Flowset FDI
2. Hose Bibbs and Faucets:
 - i. Chicago 952-CP for exposed locations.
 - ii. Bathrooms to use concealed box type Woodford B24/B79 Chrome or approved equal.
3. Wall Hydrants:
 - i. Josam Mfg. Co.
 - ii. Smith, (Jay R.) Mfg. Co.
 - iii. Woodford Mfg. Co.
 - iv. Zurn
4. Backflow Preventers:
 - i. Watts Regulator Co. Watts 909 QT only.
5. Relief Valves:
 - i. A.W. Cash Valve Mfg. Corp.
 - ii. Watts Regulator Co.
 - iii. Conbraco Industries, Inc.
6. Water Hammer Arresters:
 - i. Josam
 - ii. Woodford
 - iii. J.R. Smith Mfg. Co.
 - iv. Precision Plumbing Products
 - v. Wade
 - vi. Watts Regulator Co.
7. Dielectric Waterway Fittings:
 - i. Victaulic Company of America
8. Water Tempering Valves
 - i. ~~Powers~~
 - ii. Leonard Dual Stage Hydrostatic
9. Vacuum Breakers For Hose Connections:
 - i. Cash (A.W.) Valve Mfg. Corp.
 - ii. Conbraco Industries, Inc.

iii. Watts Regulator Co.

2.02 Products

A. PIPE AND TUBE MATERIALS

1. Water service and water in building underground including service to fire riser:
 - i. Piping 3" and larger shall be Ductile-iron, AWWA C-15076, with cement mortar lining. Fittings: Cast iron, conforming to ASA 21.10, cement mortar lined. Join pipe and fitting with mechanical fittings.
 - ii. Piping 2-1/2" and smaller, Type "K" soft drawn copper water tube. Fittings: wrought copper, silver brazed. There shall be no buried fittings under the building.
2. Domestic Water Distribution Piping:
 - i. All unnecessary traps in circulating lines shall be avoided.
 - ii. All water pipe underground outside of building shall be buried a minimum of 5'-0" deep. Where waste and water piping is run in the same trench, installation shall conform to all governing codes. Install tracer wire on all exterior utilities. Terminate in an approved termination box.

B. GENERAL DUTY VALVES

C. SPECIAL DUTY VALVES

1. Balance Cocks: 400 PSI WOG, 2 piece, ball valve, handle, memory stop. Balance Cocks are not to be used as isolation valves.
2. Balance Cocks: Flow measuring valves shall consist of a 300 psi rated ball valve with bronze body, chrome plated ball, teflon seats and heavy duty steel handle with vinyl grip. The venturi section of the valve shall be integrally designed with the ball section and sized for maximum flow accuracy and pressure recovery. The flow section shall be furnished with two dual-core temperature/pressure taps with color coded removable retained safety cap assemblies. The unit shall have a ground-joint union especially designed for minimum turbulence and to allow for full service. Valves shall be furnished with shipping/insulation sleeve for ease of access to the temperature/pressure test ports and also to allow adjustments of the valve handles without removing the insulation. Balance cocks are not to be used as isolation valves.

D. PIPING SPECIALTIES

1. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
 - i. Install water hammer arresters with isolation valve in accessible location.
 - ii. Provide lockable access doors located in accordance with architectural recommendations.
 - iii. Units shall be sized in accordance with the following schedule.

Designation	Fixture Unit Rating	Model or Figure Number		
		J.R. Smith	Josam	Wade
SA-1	1-11	5005	75001	W-5
SA-2	12-32	5010	75002	W-10
SA-3	33-60	5020	75003	W-20

2. Strainers:
3. Hose Bibbs

- i. HB-1 -Unfinished and Equipment Rooms: Rough chrome plated bronze body, renewable composition disc, tee handle, 3/4 inch NPT inlet, 3/4 inch hose outlet.
 - a. Chicago Faucet No. 998, Woodford No. 24 or Y24
- ii. HB-2 - Finished Rooms with Floor Drains: Concealed box type hose bib, polished chrome plated bronze body, with renewable composition disc, tee handle, 3/4 inch NPT inlet, 3/4 inch hose outlet, backflow protected.
 - a. Woodford Model B79, or equivalent.

4. Wall Hydrants

- i. WH-1 Concealed box-type type non-freeze wall hydrant; all brass with polished bronze face plate, "T" handle loose key, integral vacuum breaker, self draining body and shank, 3/4" male hose thread outlet, 3/4" male or female thread inlet, renewable seat; shank length to extend thru primary exterior wall sufficient distance to prevent freezing.
 - a. Woodford Model B65 5.

Backflow Preventers:

- i. BFP-1 (Reduced pressure type): All bronze (3/4"-2")/ductile iron (2-1/2" - 10") body with two independently operating, spring loaded check valves and one differential relief valve with automatic intermediate atmospheric vent. Pressure in intermediate zone to activate relief valve when there is a 2 psig. differential between the zone and the upstream side of the first check valve. The relief valve shall remain open until a positive pressure differential is re-established. Assembly to be furnished with fullport, positive shut off isolation valves, in-line strainer, union connections, funnel, and all test cocks.

Assembly to have approval of National Sanitary Foundation, U.S.C. Foundation for Cross Connection Control,

- a. State and or Local Authorities.
- b. Watts No. 909 QT (only)

6. Pressure Reducing Valves - Air/Water (Direct Acting)

- i. PRV-1 and PRV-2 Low and High Capacity (15 to 120 GPM): All bronze pressure reducing valves, sensitive spring and diaphragm for accurate pressure control; manual adjustment for outlet pressure integral strainer, female thread connections. See detail on mechanical plans for size, capacity and piping arrangement.
 - a. Watts No. 223

7. Thermostatic Mixing Valves

- i. TMV-1: Exposed type, all bronze thermostatically controlled mixing valve with stainless steel piston, fail safe automatic shut-down if either hot or cold water pressure fails; union connection.
 - a. Leonard TM Series dual stage for high usage. Leonard High Low TM Series.

8. Pressure/Temperature Relief Valves (PTRV):

- i. Fully automatic, all bronze pressure/temperature relief valve with test lever and extension thermostatic element; temperature relief setting at 210 deg. F and pressure setting at 150 psig; valve to meet ASME Standards and comply with the latest AGA ratings. Relief opening to be piped to an indirect connection at nearest floor drain.

9. Use point of use tempering valves at all sink locations as required by code. All point tempering valves must meet ASTM 1070. The Powers type thermostatic mixing valve will not be required.
- E. HEATING WATER AND GLYCOL PIPING, ABOVE GROUND
1. Copper Tubing: ASTM B88, Type L, hard drawn.
 - i. Fittings: ASME or B16.22, solder wrought copper.
 - ii. Joints:
 - a. 2 inch (75mm) and Under: ASTM B32 solder, grade 95TA or ANSI/AWS A5.8, BcuP-6 silver braze.
 - b. 2-1/2" or larger steel shall be welded.
 2. All Hydronic copper piping shall be silver brazed. Silver brazing material to equal Harris Stay Silver with minimum 5% silver content or equal. The only exception is when connecting to equipment that could be damaged by excessive heat.
- F. HEAT PUMP PIPING, BURIED
1. PIPE AND FITTINGS
 - i. Hot water heating in building below ground:
 - a. Piping shall be Type "K" soft drawn copper tubing. There shall be no buried fittings under the building.
 2. Single Wall Type.
 - i. Pipe:
 - a. High Density Polyethylene Pipe manufactured to controlled dimensions, specifications, and requirements per ASTM D3035. Resins shall be pipe grade resin, possessing ASTM D3350 cell classification No. 345464C. Resin shall be listed in PPI TR4. Pipe shall be virgin resin with an allowance for on-site manufacturer re-processed resin. Recycled resin shall not be permitted.
 - b. Marking. Each pipe shall be permanently indent marked with the manufacturer's name, nominal pipe size, pressure rating, relevant ASTM standards, cell classification number, and date of manufacture.
 - ii. Fittings:
 - a. Molded fittings shall be manufactured to the dimensions, specifications, and requirements of ASTM D2683 (for socket fusion fittings), ASTM D3261 (for butt/saddle fusion fittings), or ASTM F1055 (for electrofusion fittings). The material used in the manufacture of the fitting shall be the same approved base resin material as the connecting pipe.
 - b. Marking. Each fitting shall be permanently marked with the manufacturer's name, nominal pipe size, pressure rating, relevant ASTM standards, and lot number.
 - iii. Joints. Joints shall be made using heat fusion, flanging, transition fittings, and prooftested, approved mechanical couplers. Trained and qualified construction crew staff shall make all fusion joints.
- G. HEAT PUMP PIPING, ABOVE GROUND
1. PIPE AND FITTINGS
 - i. Domestic water (hot, circulating hot and cold water) in building above ground:

- a. 3" and smaller: Piping shall be Type "L" hard drawn copper water tube, per ASTM B88. Fittings wrought copper, solder joint. There shall be no water lines run in exterior walls.
 - b. All underground piping to be insulated with armoflex type insulation, insulation size to be determined by engineer.
 - ii. Heating Water and Chilled Water Piping:
 - a. 2 Inches and smaller:
 - 1. Type L hard drawn copper, wrought copper fittings. Silver solder with 5% silver content (Harris StaySilv 5 Silver Brazing Alloy, or equal) for all brazed joints except when connecting to equipment that could be damaged by excessive heat. No heating or chilled piping to be located in exterior walls.
 - b. 2-1/2 Inches and Larger:
 - 1. Schedule 40, black steel with flanged or welded joints.
 - 2. Fittings: Standard weight, seamless steel, butt weld type.
 - 3. Flanges: 150 lb. forged steel slip-on or welding neck type.
 - 4. Bolting: Regular square head machine bolts with heavy hexagonal nuts. H. Gaskets: Thickness, material type suitable for fluid to be handled, design temperatures, and pressures
1. 2" and smaller to be Copper Tubing: ASTM B88, Type L, hard drawn.
 - i. Fittings: ASME B16.18, cast brass or B16.22, solder wrought copper brazed.
 - ii. Joints:
2. 2-1/2" and larger to be steel pipe with welded fittings.
- I. EQUIPMENT DRAINS AND OVERFLOWS
- 1. Copper Tubing: ASTM B88, Type L, hard drawn.
 - i. Fittings: ASME B16.22 solder wrought copper.
 - ii. Joints: Solder, lead free, ASTM B32, Grade 50 TL.
 - iii. Provide unions at all equipment drain points.

Part 3: Execution

3.01 Preparation

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation. C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Ream pipe and tube ends. Remove burrs. Bevel plain and ferrous pipe. If pipe at any point in the project is found not reamed, contractor may be required to disassemble all piping installed and have a 3rd party (approved by engineer and PSD) verify reaming is complete. Costs for destructive research, whether more areas are found defective or not, shall be the responsibility of the contractor.
- E. Remove scale and dirt on inside and outside before assembly.

- F. Provide piping connections to equipment with flanges or unions.
- G. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- H. After completion, fill, clean, vent, and chemically treat systems. Notify PSD Plumbing department before all cleaning/flushing and schedule them to be onsite to witness clean and flush.
- I. Condensate drains to be run to floor drain. If possible, avoid using condensate pump. Condensate pump only allowed as las resort.

3.02 Installation

A. PIPING INSTALLATION

1. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
2. Install piping to conserve building space, and not interfere with use of space and other work. Install piping so ceiling tile can be removed for access.
3. Do not install underground piping when bedding is wet or frozen.
4. Group piping whenever practical at common elevations.
5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
6. Provide clearance for installation of insulation and access to valves and fittings.
7. Provide access where valves and fittings are not exposed.
8. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level, for hydronic systems; bottom of pipe level for steam and refrigeration systems.
9. Where pipe support members are welded to structural building framing, scrape, brush, clean, and apply one coat of zinc to rich primer to welds.
10. Prepare pipe, fittings, supports, and accessories, for finish painting.
11. Install valves with stems upright or horizontal, not inverted.
12. Install polyethylene tape on buried fittings and joints, extending 4 inches (100 mm) each side of fitting or joint. Clean area to receive tape with solvent.
13. ~~Underground Steel Pipe.~~ Do not use steel pipe underground. Use PE pipe and transition fittings. Provide sleeves where piping comes through the ground. Provide tracer wire on all underground utilities.
 - i. ~~Holiday test 100 % of underground coated steel piping systems with high voltage test device. Ensure zero voids and holidays prior to backfilling. Submit written report.~~
 - ii. ~~Provide cathodic protection; provide supervision by anode manufacturer's representative.~~
 - iii. ~~Provide isolation fittings (dielectric) at building.~~

B. PIPE AND TUBE JOINT CONSTRUCTION

C. HOT WATER HEATING SYSTEMS:

1. The hot water heating system shall have manual air vents at all high points and at all points where drops occur in lines. Actual locations of manual air vents shall be marked on As Built Drawings.
2. Provide low point drains at all low points in system. Note all low points on As Built Drawings.

D. GENERAL APPLICATION

1. Install union downstream of valves and at equipment or apparatus connections.
2. Install ball or butterfly valves for shut-off and to isolate equipment part of systems.
3. Install ball valve, or butterfly valve for balancing/throttling, bypass, or manual flow control services; however, ball valves shall be specifically shown in manufacturer's published product data as being suitable for continuous throttling.
4. Provide spring loaded non-slam check valves on discharge of condenser water pumps.
5. Use butterfly valve operators as follows:
 - i. All sizes to have gear operators.
6. Provide ¾ inch (20 mm) ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest drain.

E. VALVE APPLICATIONS

1. General Duty Valve Applications:
 - i. Shut-off duty: Use ball valves only.
 - ii. Throttling duty: Use ball valves only.

F. INSTALLATION OF VALVES

1. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections. For sectional valves 2" and smaller, use ball valves; for sectional valves 2- 1/2" and larger, use ball valves only.
2. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture. For shutoff valves 2" and smaller, use ball valves; for shutoff valves 2- 1/2" and larger, use ball valves only.
3. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system. For drain valves 2" and smaller, use ball valves; for drain valves 2-1/2" and larger, use ball valves only. All drains that are not piped to a drain are to have a ¾" hose connection with chain and cap. (Apollo 78-200-01).
 - i. All Drain valve caps to be brass. Plastic caps are not permitted.
4. Check Valves: Install swing check valves on discharge side of each pump.
5. Balance Cocks: Install in each hot water recirculating loop, discharge side of each pump. Balance cocks are not to be used as isolation valves.
6. Hose Bibbs: Install on exposed piping, with vacuum breaker.
7. Wall Hydrants: Install with vacuum breaker. All hose bibs are to have an isolation valve installed for maintenance and repairs.

G. INSTALLATION OF PIPING SPECIALTIES

1. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet thru air gap and without valves, full-size to nearest floor drain. Provide floor drain at each backflow preventer, size as required to meet backflow. (i.e. – 1" device requires 2" drain; 2" device requires 4" drain.
2. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gauge on valve outlet. Provide unions on both sides of PRV.

H. EQUIPMENT CONNECTIONS

1. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures AS CODE REQUIRES.
2. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment. Provide shutoff valve and union for each connection, provide drain valve on drain connection. For connections 2-1/2" and larger, use flanges instead of unions.

I. FIELD QUALITY CONTROL

1. Inspections: Inspect water distribution piping as follows:
 - i. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - ii. During the progress of the installation, notify the plumbing official having jurisdiction, at least 48 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official. PSD Plumbing department to be notified 48 hours before all testes and inspections.
 - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
 - iii. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
 - iv. Reports: Prepare inspection reports, signed by the plumbing official.
2. Test water distribution piping.

J. Hose Bibbs and Wall Hydrants:

1. Locations:
 - i. Each mechanical room where there is cold potable water service.
 - ii. Inside Kitchen
 - iii. Gang toilet rooms. (Key closed wall hydrant – box type.)
 - iv. Mechanical penthouses, if heated.
 - v. Boiler room.
 - vi. Wall hydrant every 200 feet of exterior perimeter.
 - vii. Wall hydrant outside at the kitchen service entrance.
 - viii. Custodial closets.
2. Provide freeze-proof outside wall hydrants with inside ball and drain valves in heated areas for winter shut off.

K. Minimum Locations of Floor Drains:

1. Mechanical rooms.
2. Kitchen.
3. Every toilet room.
4. Mechanical penthouses.
5. Emergency drench showers.
6. Custodial closets.
7. **All backflow preventor locations.**

3.03 Cleaning and Protection A.

ADJUSTING AND CLEANING

1. **Flushing and cleaning of water distribution piping shall be witnessed by a Poudre School Representative. Provide minimum of 24 hours notice prior to performing work.**
2. Clean and disinfect water distribution piping as follows:
 - i. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
 - ii. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:
 - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
 - b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
 - c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming for the system.
 - e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
3. Prepare reports for all purging and disinfecting activities.
4. Domestic Water Systems:
 - i. General: All new potable water systems shall be cleaned as herein specified prior to testing or application of insulation. Testing must be witnessed by District and State Department of Health personnel and report filed with the District to receive final payment.
 - ii. Notification: Notify State Department of Health in writing, 48 hours in advance of the beginning of the cleaning process.
 - iii. Witness: The cleaning process will not be deemed acceptable unless witnessed and approved by the State Department of Health's representative.
 - iv. Procedure: Comply with City of Fort Collins standards or Colorado State Department of Health requirements, whichever is more stringent.
 - v. Report: The report shall contain the following and be submitted to the District's Project Manager within 24 hours of the cleaning:
 - a. Date, time, and place of cleaning.
 - b. Duration.
 - c. Person responsible.
 - d. Solutions concentration and temperature.
 - e. Signature of State Department of Health representative.
 - f. Results.
 - vi. The report and its timely submission shall be required for final payment.
5. Heating Water System:

- i. **Notification: Notify District's Project Manager and PSD Plumbing Department 24 hours in advance of the beginning of the cleaning process. The cleaning process will not be deemed acceptable unless witnessed and approved by the District's representative. This shall be a requirement for final payment.**
- ii. Procedure: Flush all systems with clean city water until the discharge is clear. Clean or replace the baskets of all strainers after cleaning.
- iii. Drain system, and fill system with clean water, mixed with propylene glycol with inhibitors to 30% by volume. If there is excess propylene glycol, turn remaining over to Owner.

END OF SECTION 22 11 13

SECTION 22 11 23 – FACILITY NATURAL GAS PIPING

Part 1: General

1.01 Summary

- A. This section includes distribution piping systems for natural gas and manufactured gas within the building and extending from the point of delivery to the connections with gas utilization devices.
Piping materials and equipment specified in this section include:
 - 1. Pipes, fittings, and specialties.
 - 2. Special duty valves.
- B. This section does not apply to LP-gas piping; industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen and nitrogen; gas piping, meters, gas pressure regulators and other appurtenances used by the serving gas supplier in distribution of gas.
- C. Gas pressures for systems specified in this section are limited to 5 psig.
- D. Products installed but not furnished under this section include gas meters which will be provided by the utility company, to the site, ready for installation.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required.

- A. Product data
- B. Shop drawings C. Record Drawings:
- D. Maintenance data E.
- Welders' qualification
- F. Test reports.

1.05 Quality Assurance

- A. Manufacturer's Qualifications: not less than 5 years.
- B. Installer Qualifications: minimum of 5 previous projects similar in size and scope to this project

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

A. EXTRA MATERIALS

1. Valve Wrenches: Furnish to Owner, with receipt, 2 valve wrenches for each type of gas valve installed, requiring same.

Part 2: Products

2.01 Manufacturers

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Gas Cocks:
 - i. Jenkins Bros.
 - ii. Lunkenheimer Co.
 - iii. Stockham.

2.02 Products

A. PIPE, TUBING AND JOINTING MATERIALS

1. Natural gas in building above ground:

- i. Piping shall be black steel, Schedule 40, plain ends for welding for 2-1/2" and above. Fittings welded, standard weight. Joints welded as recommended by AWS or NCPWB.
- ii. For 2" and smaller, piping shall be black steel, Schedule 40, screw ends. Fittings black malleable iron screwed, standard weight 150 lb. banded. Minimize gas piping inside the building by running pipe on the roof wherever possible. Support pipe on roof with Bison Pipe Jacks, or as per manufacturer's recommendations for single ply membrane roofs. Entire pipe shall be primed and painted by the painting contractor to prevent rusting. Support pipe at 10 ft. intervals for 1-1/4" pipe and larger, and at 8 ft. intervals for 3/4" or 1" pipe. Pipe installed in a return air plenum must be welded. No screwed fittings.

2. Natural and LP gas buried in ground:

- i. Polyethylene pipe (PLEXCO Yellow pipe PE 2406 or approved equal) with iron pipe transition risers. Install tracer wire in trench above poly pipe before backfilling. -or-
- ii. ~~Piping shall be black steel, Schedule 40, plain ends for welding. Fittings welded, standard weight. Joints welded as recommended by AWS or NCPWB. Tape all joints and mill wrap all pipe and fittings.~~ Steel pipe underground is not permitted.

B. NATURAL GAS PIPING SPECIALTIES

1. Protective Coating: Provide factory applied polyethylene tape, having the following properties:

- i. Overall thickness; 20 mils.
- ii. Synthetic adhesive.
- iii. Water vapor transmission rate.
- iv. Gallons per 100 square inch: 0.10 or less.
- v. Water absorption, percent: 0.02 or less.
- vi. Prime pipe and fittings with a compatible primer prior to application of tape.
- vii. Pipe wrapping shall conform to the following schedule:
- viii. During application of wrap, if the ambient temperature is 40oF or less, use only Scotchwrap No. 40 tape. If ambient temperature is 40oF or more, use only Scotchwrap No. 50.

Pipe Size	Tape Width	Scotchwrap No.	
		Standard	Cold
1/4 - 3/4 inch	1 inch	50	40
1 - 1-1/2 inch	2 or 4 inch	50	40
2 inch and larger	4 inch	50	40
Color backing		Black	Green

2. Flexible Connectors: Corrugated type 304 stainless steel flexible pipe with stainless steel braid

and heavy flexible armor shield. Flexible connectors to be used on kitchen equipment connections only. C. VALVES

1. Special duty valves are specified in this section by their generic name. Refer to Part 3, "VALVE APPLICATION," for specific uses and applications for valve specified.
2. Gas Cocks 2 Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.
3. Gas Cocks 2-1/2 Inch and Larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.
4. Gas Line Pressure Regulators: Single stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends for 2-1/2 inch and larger; for inlet and outlet gas pressures, specific gravity, and volume flow. Provide gas cocks and unions on both sides of regulators.
5. Gas Safety Valves: Gas safety valve latched open when energized, free handle design, manual reset, and a visual position indicator.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. INSTALLATION OF PIPE

1. Gas Piping (Natural):
 - i. All gas piping shall be installed with plugged drip pockets at low points. Pipe shall be extended to all gas equipment in building. The entire gas piping installation shall be in accordance with the latest requirements of the AGA and NBFU. All gas piping in return air plenums must be welded—no screwed fittings.
 - ii. Valves or cocks and unions shall be installed on inlet pipe to all equipment, including safety valves where required or noted to be installed.
2. Compressed Air Piping:
 - i. Drip pockets shall be provided at low points of piping for eliminating moisture.
 - ii. Piping shall be connected near top of receiver with union and valve. Connections at equipment shall consist of a valve and union. iii. Install pipe tee at compressor, so that quick coupler may be added later to service condenser coil on air dryer.

3. Concealed Locations: Except as specified below, install concealed gas piping in an air-tight conduit constructed of Schedule 40, seamless black steel with welded joints. Vent conduit to the outside and terminate with a screened vent cap.
 - i. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to the approval of the authority having jurisdiction), whether or not such spaces are used as a plenum. Valves shall not be located in such spaces.
 - ii. Piping In Partitions: Concealed piping shall not be located in solid partitions. Tubing shall not be run inside hollow walls or partitions unless protected against physical damage. This does not apply to tubing passing through walls or partitions.
 - iii. Prohibited Locations: Do not install gas piping in or through a circulating air duct, clothes chute, chimney or gas vent, ventilating duct, dumb waiter or elevator shaft. This does not apply to accessible above-ceiling space specified above.
 4. Drips and Sediment Traps: Install a drip leg at points where condensate may collect, at the outlet of the gas meter, and in a location readily accessible to permit cleaning and emptying.

Do not install drips where condensate is likely to freeze.

 - i. Construct drips and sediment traps using a tee fitting with the bottom outlet plugged or capped. Use a minimum of 3 pipe diameters in length for the drip leg. Use same size pipe for drip leg as the connected pipe.
 5. Use fittings for all changes in direction and all branch connections.
 6. Install gas piping at a uniform grade upward to risers, and from the risers to the meter, or service regulator when meter is not provided, or the equipment.
 7. Connect branch outlet pipes from the top of horizontal lines, not from the bottom or sides.
- B. NATURAL GAS PIPING SPECIALTIES
1. Protective Coating:
 - i. Provide protective coating on piping and fittings that will be in contact with material or atmosphere exerting a corrosive action, or piping buried in floors. Protective coating shall be applied at the factory.
 2. Flexible Connectors:
 - i. Provide flexible braided stainless steel connectors with full size quick coupler for all kitchen gas appliance equipment only.
 - ii. Connectors shall be of lengths required to displace equipment for complete cleaning under and around gas appliance. Equip flexible connectors with quick couplers and tether.
- C. VALVE APPLICATIONS
1. Shut-off duty: Use gas cocks.
- D. VALVE INSTALLATIONS
1. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.
 2. Install a gas cock both sides of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.
 3. Install pressure relief devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position. Pipe atmospheric vent to outdoors.

4. Valves shall be installed with unions or other means to facilitate removal or repair without disassembly of connecting piping.
5. Gas Safety Valves:
 - i. Install gas safety valves in wall boxes.
 - ii. Coordinate electrical requirements with contractor. Provide neoprene grommets for all piping and electrical conduit entering and existing cabinets.

E. TERMINAL EQUIPMENT CONNECTIONS

1. Install gas cock upstream and within 6 feet of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of controls.
2. Sediment Traps: Install a tee fitting with the bottom outlet plugged or capped as close to the inlet of the gas appliance as practical. Drip leg shall be a minimum of 3 pipe diameters in length. Provide valve above drip leg so gas service does not have to be shut down. The valve can be used to isolate the equipment being served.
3. Flexible Hose Gas Connectors: For use connecting to vibrating equipment; corrugated Type 304 stainless steel flexible pipe with stainless steel braid.

F. ELECTRICAL BONDING AND GROUNDING

G. SPARE PARTS

1. Valve Wrenches: Furnish to Owner, with receipt, 2 valve wrenches for each type of gas valve installed, requiring same.

3.03 Cleaning and Protection

END OF SECTION 22 11 23

SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

Part 1: General

1.01 Summary

- A. This section specifies building sanitary drainage and vent piping systems, including drains and drainage specialties.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

- B. Shop Drawings:
- C. Record Drawings:
- D. Maintenance Data:

1.05 Quality Assurance

- A. Regulatory Requirements: Comply with the provisions of the following:
 1. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code.
 2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.
 3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.

4. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.
5. PVC Pipe: Only Contractor's personnel which have received training in the installation of this material and meet the manufacturer's qualifications shall do the assembly of such material.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:

1. Drainage Piping Specialties, including drains and cleanouts:
 - i. Josam Mfg. Co.
 - ii. Smith (Jay R) Mfg. Co.
 - iii. Zurn Industries Inc; Hydromechanics Div.
 - iv. Wade

2.02 Products

A. DRAINAGE PIPING SPECIALTIES

1. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
2. Vandal – Proof Vent Caps: Cast Iron dome secured with Allen Key set screws. J.R. Smith Model 1748 or equivalent. Vent cap must be compatible with type of vent flashing installed. Plastic vent caps are not permitted.

B. CLEANOUTS

1. Floor Cleanout: Round, cast iron body with recessed bronze closure plug; scoriated polished bronze frame and cover plate. No floor cleanouts in carpeted floors.
2. Wall Cleanout: Cleanout tee with raised head brass plug tapped for 1/4-20 thread; flat style chrome plated wall cover plate with holes for 1/4" bolt; 1/4-20 threaded bolt with chrome plated flat head.
3. Surface Cleanout: Cast iron body ferrule with raised head brass plug. Medium duty cast iron manhole cover and ring 12" diameter to be set in a minimum 24" X 24" X 4" thick concrete pad, Neenah No. R-1791-A.
4. Line Cleanout: Cast iron tapped cleanout ferrule with raised head brass plug.

C. FLOOR DRAINS

1. Floor drain.
 - i. FD-1 Toilet Rooms and Finished Areas
 - a. Round cast iron body with flashing collar and cast iron ring, 6 inch round nickel bronze adjustable strainer head with secured square hole grate, bottom waste outlet. Jay R. Smith Fig. 2005-A
 - ii. FD-2 Boiler and Mechanical Rooms

- a. Round cast iron, medium duty, shallow body drain with flashing collar and cast iron ring, 8" round tractor type non-tilt slotted grate, bottom waste outlet. Jay R. Smith Fig. 2210
 - 2. All floor drains will require a trap primer per code.
- D. FLOOR SINKS
 - 1. Floor drain.
 - i. FS-1 Indirect Waste Drain - Kitchen Sinks
 - a. Square, cast iron, porcelain enameled interior, sump body drain 8" deep x 12" square with flashing collar and cast iron ring, 12" square nickel bronze removable half top grate with cast aluminum dome bottom strainer, bottom waste outlet. b. Jay R. Smith Fig. 3120
 - ii. FS-2 Indirect Waste Drain - Kitchen Equipment
 - a. Square, cast iron, porcelain enameled interior, sump body drain 6" deep x 8" square with flashing collar and cast iron ring, 8" square nickel bronze removable half top grate, cast aluminum dome button strainer, bottom waste outlet. b. Jay R. Smith 3100

Part 3: Execution

3.01 Preparation

3.02 Installation

A. INSTALLATION

1. The installation of off-set closet flanges is prohibited.
2. All floor drains are to be provided with P-trap the same size as the floor drain. All floor drains are to have trap primers.
3. Provide flashing membrane for all floor drains in structure above slab on grade level.
4. Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, relubricate and reinstall using only enough force to ensure permanent leakproof joint.
5. Provide flashing for all floor drains, floor cleanouts and shower drains above grade. Make watertight with Chloraloy 240 underslab moisture vapor barrier as manufactured by the Nobel Co. of Grand Haven, Michigan. Flashing shall extend at least 24" from drain rim into floor membrane or on structural floor. Fasten flashing to drain clamp device and make watertight, durable joint. Provide flashing collar extension with all drains and cleanouts installed above grade.
6. Provide full-size clean-outs in all restroom groups. Do not locate floor clean-outs in carpeted areas.
7. **Cross-type drainage fittings shall not be installed in waste piping.**
8. All bathrooms to have floor drains.

B. HANGERS AND SUPPORTS: See specific section.

C. INSTALLATION OF PIPING SPECIALTIES

1. Install backwater valves in sanitary building drain piping. For interior installation, provide minimum 13" dia. cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service. Only install as required by code.
2. Above Ground Cleanouts:

- i. As required by plumbing code; ii. At each change in direction of piping greater than 45 degrees below slab; iii. At minimum intervals of 50';
 - iv. At base of each vertical soil or waste stack at 12" AFF; v. At sinks and urinals on grade; vi. At each upper terminal; vii. At egress of building (surface cleanout).
 - viii. At each water closet or toilet group.
3. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, and in accessible locations.
 4. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
 5. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.
- D. PIPE AND TUBE JOINT CONSTRUCTION
1. Install pipes and pipe joints in accordance with appropriate sections.
- E. INSTALLATION OF FLOOR DRAINS
1. Install floor drains at low points of surface areas to be drained. Set tops of drains flush with finished floor.
 2. Trap all drains connected to the sanitary sewer with minimum trap size that of drain connected.
 3. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
 4. Position drains so that they are accessible and easy to maintain.
 5. Provide trap primers for all drains.
- F. WASTE, VENT, AND STORM PIPING:
1. All waste, vent, and storm drain piping shall be properly pitched at 1/4 inch to the foot (or 2%) minimum for 4" and smaller pipe and 1/8 inch (or 1%) minimum for 5 inch and larger. Piping shall be properly supported so that it will not sag and form pockets. Exceptions must be approved in writing by Poudre School District, and approved by the Administrative Authority.
 2. The manufacturer's recommendations shall be carefully followed when installing pipe using neoprene gasket joints.
 3. Locate vertical hubs of underground piping below partition walls for concealment. In locations where hubs will project beyond finish partition wall, set hubs 1" below finished floor.
 4. All waste, vent, and storm pipe underground outside of building shall be buried a minimum of 3'-6" deep. Install tracer wire on all exterior utilities. Terminate in an approved termination box.
 5. Where waste lines from fixtures are to be acid resistant, the vents shall also be acid resistant through roof.
- G. CLEANOUTS:
1. Full size brass cleanout plugs.
 2. Wall cleanouts located 4" to 6" above floor with chrome-plated covers. Bottom of cleanout cover shall be 1" minimum above top of baseboard.
 3. Provide at 50 feet maximum intervals for all pipe sizes and wherever pipes change direction 45 degrees or more.

4. Scored brass cover for floor cleanout installed flush with the floor.
5. Outside of building starting 10 feet from perimeter wall:
 - i. Locate every 100 feet.
 - ii. Heavy cast iron tractor cover set in 2' x 2' x 6" concrete block.
 - iii. 4" size acceptable in pipes larger than 4".
6. Submit proposed locations of cover plates to PSD.
7. Do not install floor cleanouts in carpeted areas.
8. If a cleanout must be installed in a carpeted area, use a wall cleanout.

H. SERVICE CONNECTIONS

1. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

I. CONNECTIONS

1. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap; but in no case smaller than required by the plumbing code.
2. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

J. FIELD QUALITY CONTROL 1. Inspections:

- i. During the progress of the installation, notify the plumbing official having jurisdiction and PSD Plumbing Department at least 48 hours prior to the time such inspection must be made.
 - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection to observe the tests specified and to insure compliance with the requirements of the plumbing code.
 - ii. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection.
 - iii. Reports: Prepare inspection reports, signed by the plumbing official.
2. Post-Installation Inspection: **The installing contractor shall perform a visual inspection of all below-grade building drain mains using a video camera. Video tapes or CD's of each main shall be recorded, accurately labeled for review by the Owner's representative and the Engineer.** The Owner shall be provided with a copy of the video tapes/CDs. Owner to be notified of time of video inspection and have option to be present.

3.03 Cleaning and Protection

END OF SECTION 22 13 16

SECTION 22 13 23 – SANITARY WASTE INTERCEPTORS

Part 1: General

1.01 Summary

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A.

Product Data:

B. Shop Drawings:

C. Record Drawings:

D. Maintenance Data:

1.05 Quality Assurance

A. Manufacturer's Qualifications: not less than 5 years.

B. Codes and Standards:

1. PDI Compliance: Test and rate grease interceptors in accordance with PDI Standard G101, "Testing and Rating Procedure for Grease Interceptors."

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

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

1. Grease Interceptors:

- i. Copeland Enterprises, Inc.
- ii. Front Range Pre-Cast Concrete
- iii. Colorado Precast

2.02 Products

A. GREASE INTERCEPTORS

1. Unit shall be pre-cast concrete, as manufactured by Copeland Enterprises, Inc., 904 S. Lipan, Denver, CO 80223, Phone No. 936-4817, Front Range Precast Concrete, **Colorado Precast, or approved equal.**
 - i. **No multi-piece grease traps shall be accepted.** Grease traps must be one-piece vault with lid as per the Colorado Precast Concrete Specifications.
2. Variations: Provide the following construction feature variations:
 - i. Lift out sediment bucket.
 - ii. Enzyme opening.
3. Unit shall be complete with internal baffle for secondary compartment of one-third the total capacity, and concrete cover, with manholes.
4. Unit shall be reinforced with 6x6, 10/10 mesh and three No. 4 horizontal re-bar in walls. Cover reinforced with No. 5 re-bar at 8" o.c. and No. 5 around manholes.
5. **Install approved sill cock within 25' of all grease traps.**
6. Manholes to Grease Trap:

- i. Manholes shall be constructed of pre-cast concrete rings manufactured to ASTM specifications, and laid up in cement mortar. Construct to conform with City, **and State** Standards with the top to meet a 24" diameter cast iron manhole ring and cover. Cover must be flush with finish grade. Provide heavy duty type ring and cover, gas-tight, Model 1073.

Part 3: Execution

- 3.01 Preparation
- 3.02 Installation
- 3.03 Cleaning and Protection

END OF SECTION 22 13 23

SECTION 22 14 13 – FACILITY STORM DRAINAGE PIPING

Part 1: General

- 1.01 Summary
 - A. This section specifies storm drainage and vent piping systems, including drains and drainage specialties.
- 1.02 Related Sections
- 1.03 Definitions
- 1.04 Submittals Required A. Product Data:
 - B. Shop Drawings:
 - C. Record Drawings:
 - D. Maintenance Data:
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

- 2.01 Manufacturers
 - A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:
 - 1. Drainage Piping Specialties, including drains and cleanouts:
 - i. Josam Mfg. Co.
 - ii. Smith (Jay R) Mfg. Co. iii. Zurn Industries Inc; Hydromechanics Div.
 - iv. Wade
- 2.02 Products
 - A. PIPE AND FITTING

1. Building storm and sanitary sewer below grade: Cast iron bell & spigot with resilient gasket joints. **Schedule 40 solid core PVC pipe and fittings. Purple Primer must be used. Foam core pipe will not be accepted. Cross Fitting will not be accepted.**
 2. Sanitary, storm and roof drains above grade: Cast iron no-hub, bell & spigot, or copper type DWV. No drain shall be less than 2" nor any drain less than 3" extended more than 20'. Cross fittings are not to be used.
- B. STORM DRAINAGE, VENT AND SUBSURFACE DRAINAGE PIPE AND FITTINGS
- C. DRAINAGE PIPING SPECIALTIES: See Section 22 13 16.
- D. ROOF DRAINS
1. Roof drain.
 - i. RD-1
 - a. Cast iron body with sump, removable cast iron vandal-proof dome strainer, cast iron flashing flange and cast iron ring with integral gravel stop, underdeck clamp.
Jay R. Smith Fig. 1010
 - ii. OFD-1 Overflow Drain
 - a. Cast iron body with sump, removable cast iron vandal-proof dome strainer, cast iron flashing flange and cast iron clamp with integral gravel stop, cast iron underdeck clamp, 3-1/2" high water dam standpipe under dome strainer; where standpipe is set down in sump drill four 1/4" dia. holes, spaced evenly, at base of standpipe for sump drainage.
 - b. Jay R. Smith Fig. 1070

Part 3: Execution

3.01 Preparation

3.02 Installation A. INSTALLATION

1. Install overflow roof drains with the inlet flow line located a maximum 2" above the lowest point of roof.
- B. PIPE AND TUBE JOINT CONSTRUCTION
1. Install pipes and pipe joints in accordance with appropriate sections.
- C. INSTALLATION OF ROOF DRAINS
1. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.
 2. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
 3. Position roof drains so that they are accessible and easy to maintain. D. Building Sanitary and Storm Sewer:
 1. Locate sewer lines not closer than ten feet horizontally from potable water lines except that if the top level of the sewer is three feet or more below the bottom level of the water line, the horizontal distance between the lines may be reduced to six feet. **Provide tracer wire on all exterior utilities, terminated tracer wire in an approved termination box.**
 2. Where sewer lines cross potable water lines the distance between shall not be less than three feet and the sewer line constructed of standard weight cast iron or Class 50 ductile iron.

3. When encountering unstable soil or when the sewer excavation is through solid shale, slate, sandstone or similar hard material, bed the pipe in 3/4" to 1-1/2" crushed rock or gravel 6" all around the pipe. E. Roof Drains:
 1. Locate at the midspans of the roof steel.
 2. Provide flexible connections to risers.
 3. Drain to storm sewer or on-site above grade drainage.
 4. Where internal overflow drains are required. do not connect to the roof drain piping. Extend separate lines to the storm drain outside the building.
 5. Discharge roof drains into public storm sewers and not over sidewalks or at the tops of embankments, **do not locate at exterior door locations.** Locate effluent to preclude soil erosion.

3.03 Cleaning and Protection

END OF SECTION 22 14 13

SECTION 22 16 00 – KITCHEN PIPING

Part 1: General 1.01

Summary

- A. This section specifies kitchen piping systems.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

B. Shop Drawings:

C. Record Drawings:

D. Maintenance Data:

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

2.02 Products

A. PIPE AND FITTING

1. Exposed connections to equipment located in areas scheduled to have carpet or resilient floor coverings, as in a kitchen.

- i. Red brass, standard weight screwed ends, full iron pipe size chrome plated. Fittings brass standard weight, screwed, chrome plated.

- B. **NO KITCHEN WATER LINES ARE TO BE LOCATED IN EXTERIOR WALLS.** Pipes can be mounted to interior of walls (under counters) if they are insulated and have washable surface casing.

- C. Kitchen Hose bibs/hose connections must have appropriate backflow prevention devices. All outdoor hose-bibs are to be "Woodford" key-type with vandal-proof cover and have an access panel for isolation valves. Kitchen should have a Hose-bib outside of kitchen within 30 feet of grease trap.
- D. Kitchen Water Supply is to be 140 Degrees F., with the exception of hand wash sinks. (Check Larimer County health regulations on hand wash sink temps.)
- E. Kitchen Sanitary and grease cleanouts are to be installed in the floor (when not in carpeted areas) and made accessible. (Not behind disposal or dish machine, for example), if necessary cleanouts can be in exterior walls with a cover-plate.
- F. Kitchen Shut-off Valves are to be easily accessible either behind kitchen equipment or in ceiling or access panels. Plumbing is to be done so that valves are easily reached inside access panels. This applies to kitchen equipment and HVAC valves.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 22 16 00

SECTION 22 30 00 – PLUMBING EQUIPMENT

Part 1: General

1.01 Summary

A. SCOPE OF THE WORK

- i. Sanitary Drainage System.
- ii. Storm Drainage System.
- iii. Domestic Water System.
- iv. Plumbing Fixtures.
- v. Compressed Air System.
- vi. Natural Gas System.

B. CONNECTIONS TO MISCELLANEOUS EQUIPMENT

C. SANITARY AND STORM SEWER SERVICE

- 1. Provide minimum 3'6" cover over sewer line(s) outside of building. Provide main cleanout where sewer(s) leaves building. **All exterior utilities are to have tracer wire installed. Terminate in an approved termination box.**

D. NATURAL GAS SERVICE

- 1. All underground gas service shall be approved piping; i.e., (P.E.) by gas with tracer wire.

E. WATER SERVICE

- 1. Job specific. **All exterior utilities are to have tracer wire. Terminate in an approved termination box.**

1.02 Related Sections

- 1.03 Definitions
- 1.04 Submittals Required
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements
- 1.09 LCHD – letter at end of section regarding Instant Hot Water Dispensers.

Part 2: Products

2.01 Manufacturers

2.02 Products A. CLEANOUTS*

1. Provide cleanouts as manufactured by Josam, Jay R. Smith, Wade, or Zurn. Cleanouts shall be full line size through 4" pipe.
2. Cleanout covers shall be "brass," square raised or recessed caps.
3. Inside caulk or spigot connections, bronze cleanout plug, straight threaded with tapered shoulder and caulked lead seat. Plugs shall be removed, doped, and reinstalled just tight enough to prevent leakage.
4. Screwed pipe cleanouts-bronze pipe threaded plug with four raised square lugs or counter sunk plug.
5. Floor Cleanouts (FCO): Frame and cover threaded for 1-1/2" vertical adjustment, threads protected with shield to be removed when concrete is set. Covers: Nickel bronze round frame and cover, deep flange tractor type. Extra heavy type in heavy traffic areas, and with carpet retainer top for carpeted floors. **(Cleanouts will not be located in carpeted areas.)**
6. Wall Cleanouts (WCO): Square nickel bronze frame and cover with minimum opening of 6" x 6".
7. Grade Cleanouts (GCO): Cast iron cleanout with round, heavy-duty scoriated, non-tilt cast iron top, adjustable to finished grade level. Set GCO in 2' x 2' x 4" deep concrete pad, minimum.
8. Cleanouts: Located at changes in direction of pipe run and shall consist of 'Y' fittings and eighth bends. Cleanouts shall be provided at the base of all vertical stacks with the cleanout plug located approximately 12 inches above the floor and extended to wall access cover. Cleanouts in horizontal runs above ground shall consist of 'Y' fittings with cleanout plugs. Cleanouts must be provided in every 100 ft. of horizontal run, and as per the ***International*** Plumbing Code. Cleanouts in carpeted floors should be avoided if at all possible. Use wall C.O.'s or C.O.'s in adjacent floors not carpeted.

B. FLOOR DRAINS*

1. Provide floor drains of type specified herein. Sizes and locations shall be as indicated. Drains specified herein are Zurn. Josam, Wade, or J.R. Smith meeting specifications will be acceptable.
2. Floor drains shall be cast iron with double drainage flange, nickel-bronze rim and strainer. Provide clamping ring when installed in floors that have waterproof membrane. Drains connected to cast iron soil pipe shall have spigot outlets.
3. Trap primers shall be ***Used on all floor drains and floor sinks.***
4. Floor drains in slabs on ground.

- i. FD-1 Floor Drains shall be Z-415 with 6" diameter Type 'B' strainer and Z1000 cast iron deep seal P-trap.
 - 5. Floor, shower, and area drains in slabs above ground.
 - i. Floor drains shall be Z-415 with 6" diameter Type 'B' strainer and Z1000 cast iron deep seal 'P' trap. All exposed parts to be nickel bronze. Clamping ring will be required for floor drains in mechanical equipment room(s). Strainers for drains in equipment room may be brass in lieu of nickel-bronze.
- C. FLOOR SINK*
 - 1. Floor sink FS-1 shall be epoxy or porcelain coated cast iron, acid resisting, 12" x 12", acid resisting anti-splash dome strainer, **-Foot Traffic rated grate.** (acid resisting), 8" deep, 3" inside caulk bottom outlet, wrapped with water resistant wall covering 6" above faucets; i.e., tile or equivalent; Zurn Z-1901 or equivalent.
- D. ROOF DRAINS*
 - 1. Drains specified herein are Josam. Zurn, Wade, or J.R. Smith OR APPROVED EQUAL.
 - 2. No plastic domes shall be accepted. Domes must be bolted down. Tar is unacceptable. **With no-hub bottom outlet**
 - 3. Roof drains shall be cast iron, combination clamping ring and gravel guard, under deck clamp, aluminum or cast iron dome enclosing entire drain sump, insulation extension sleeve of the same thickness as insulation. Where metal deck is used, provide a steel roof sump formed to receive roof drain without any raise in insulation at roof drain.
 - i. RD-1: 21500-3-10. ii. ORD01: Same as above, except provide option 16 3" internal waterguard (standpipe) for drains used as overflow drains.
 - 4. Provide 42" x 42" 4 pound per square foot lead pan or 16 ounce cold rolled copper flashing flanges for each drain.
 - 5. Downspout nozzles shall be all bronze construction with threaded inlet and wall flange. Nozzles shall be similar to Josam 25010. Do not place downspouts where they could drain to exterior walking path.
- E. VENTS THROUGH ROOF
 - 1. Flash vents through roof with 24" x 24" x 4 lb. minimum size sheet lead. Extend lead five inches above the vent and turn down into vent pipe. Do not install vents within two feet of roof edge, parapet or wall line of an "on-the-roof structure."
 - 2. All plumbing vents through the roof shall terminate with cast iron vandal proof vent caps. Vent caps shall be similar to Wade W-3680, or equal by Josam, Smith, or Zurn.
- F. SHOCK ABSORBERS*
 - 1. Shock absorbers shall be furnished and installed at all solenoids and other quick closing valves and flush valves. Provide and install access doors for all shock absorbers. Each shock absorber shall have a shut-off ball valve for replacement. Shock absorbers shall be the gas filled stainless steel bellows type, sized and installed per requirements of PDI-WH-201. Josam, Smith, Wade, or Zurn.
- G. BACKFLOW PREVENTER*
 - 1. Shall be the reduced pressure type with atmospheric vent.
 - 2. Bronze body and accessory construction and replaceable seats.
 - 3. Bronze body ball valve test cocks and 1/4 turn ball valves on inlet and outlet.
 - 4. With bronze strainer, flanged adapter ends or unions, and air gap fitting.

5. Manufacturer and model:
 - i. Watts Model 909, all sizes, ***only***
- H. PRESSURE REDUCING VALVE*
 1. Where main pressure exceeds 80 psi, provide, a domestic water pressure reducing valve as manufactured by Watts, Fisher, or approved equal. Provide isolation valves and unions on both sides of all PRVs.
 2. Valve shall be of bronze body construction with renewable stainless steel seat, adjustable outlet pressure, and suitable for inlet pressures up to 150 psig. Valve shall be initially set for 60 psig discharge pressure.
 3. Install main shut-off valve not more than 5' AFF.
 4. Backfill:
 - i. Backfill within 2 feet of manhole shall be free from rocks and lumps. Dispose of excavated material promptly.
- I. ACID NEUTRALIZING BASIN*
 1. Centralized sinks to drain to tanks above slab or under cabinets must have unions on each side.
- J. EMERGENCY GAS SHUT-OFF*
 1. Provide a control panel near teacher's desk in each lab or shop designated on plans to include:
 - i. Push-button "Off" for gas solenoid valve.
 - ii. Key-operated valve open.
 - iii. Pilot light for valve open.
 2. Panel to be 8" x 6" x 4" deep, stainless steel front, as made by ASCO Model AEP 7200, 24 volt, or prior approved equal.
 3. Provide a 24V gas solenoid shut-off valve for each room wired to control panel by Mechanical Contractor. ASCO Model 8030 A17, 1/2" pipe size.
 4. Provide manual shut-off and union upstream solenoid shut-off.
- K. THERMOSTATIC MIXING VALVE*
 1. Acceptable Manufacturers:
 - i. ~~Powers Hydroguard No. 431.~~
 - ii. Leonard TM Series Dual Stage
 - iii. Approved Equal.
 2. Mixing valve shall be capable of instant compensation for fluctuations in supply pressure and/or temperature of either supply to provide constant mixed water temperature at variable flow rates. Valve shall have a thermostatic element capable of accurate control of water temperatures between 95 and 115 degrees F. Valve shall have automatic safety feature for safe shutdown in event of failure of either the cold or hot supply. Valve shall be bronze or copper construction and tested to 300 lb. working pressure. Mixing valve trim shall include spring loaded check valves, strainers and screwdriver stops. Polished chrome plated, less cabinet. ___ GPM at ___ psi pressure differential. With thermometer on outlet. Provide Leonard TM Series Dual Stage.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

END OF SECTION 22 30 00



DEPARTMENT OF HEALTH AND ENVIRONMENT

1525 Blue Spruce Drive
Fort Collins, Colorado 80524-2004
General Health (970) 498-6700
Environmental Health (970) 498-6775
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February 22, 2013

Mr. Jim Tishmack
Plumbing Department
Poudre School District
2407 LaPorte Avenue
Fort Collins, Colorado 80521

Dear Mr. Tishmack,

This letter is to follow up on our recent conversation concerning installation of Instant Hot Water Dispensers at classroom sinks and kitchen labs in schools within Poudre School District. As discussed, installation of these devices to supplement the school's existing water heating system would not be allowed due to the potential scolding hazards associated with them. In addition, Section 3-606 of the Rules and Regulations Governing Schools in the State of Colorado requires hot water delivered to sinks to be maintained between 90°F – 120°F.

The devices are not intended to supplement a water heating system, but to provide hot water, approximately 200°F, for the preparation of hot beverages and instant foods such as cereals and soups. A single device installed in a cafeteria, teachers lunchroom or kitchen lab would be allowed, if it is utilized for beverage of food preparation only.

Thank you for your inquiry and please feel free to contact me at 498-6780 if you have any additional questions.

Sincerely,

Jim Devore, REHS
Environmental Health Specialist

Cc J.Holcombe via jholcomb@psdschools.org

R

SECTION 22 31 00 – WATER TREATMENT

Part 1: General 1.01

Summary

- A. Includes necessary equipment, chemicals, and service for the following systems:
 - 1. Cleaning of Piping Systems
 - 2. Sterilization of Domestic Water System
- B. Provide service program, including chemicals if applicable, for a period of one year from start-up date of equipment, including the following:
 - 1. Initial water analysis and recommendations.
 - 2. Systems start-up assistance.
 - 3. Training of operating personnel.
 - 4. Periodic field service and consultation.
 - 5. Customer report charts and log sheets.
 - 6. Laboratory technical assistance.

1.02 Related Sections

1.03 Definitions

1.04 Submittals Required A. Product Data:

B. Record Drawings:

C. Maintenance Data:

1.05 Quality Assurance

- A. Manufacturers and Representative Qualifications. Not less than 5 years, and shall have full-time service personnel located within the trading area of job site.

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

A. EXTENDED MAINTENANCE SERVICES

- 1. Agreement to Maintain: Prior to time of final acceptance, submit four copies of "Agreement for continued Service and Maintenance" for water treatment system, for Owner's possible acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing, and including replacement of materials and equipment, for one-year period with option for renewal of Agreement by Owner.

Part 2: Products

2.01 Manufacturers

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

- 1. Water Treatment Vendors:

- i. U.S. Filter
- ii. H-O-H Chemical

- iii. Clearwater Systems Corporation

2.02 Products

- A. Consider systems that avoid use of chemical systems to achieve the water quality parameters.

Part 3: Execution

3.01 Preparation

3.02 Installation

3.03 Cleaning and Protection

A. CLEANING OF PIPE LINES AND BOILERS

1. **All cleaning and flushing of hydronic systems shall be witnessed by a Poudre School District Plumbing Department Representative. Provide minimum 24 hours notice prior to performing work.**
2. The Water Treatment Contractor shall be responsible for furnishing the cleaning material and supervising the cleaning of the chilled and/or heating piping.
3. The system to be cleaned shall be filled with a solution of 10% by weight of a heavy duty alkaline liquid cleaner. The cleaner shall be capable of wetting and penetrating heavy soil deposits of oil or grease, and keeping these products in suspension, for removal through flushing the system to drain.
4. The cleaning solution shall be circulated for a minimum of 8 hours. At the end of the eight hours, the system shall be flushed to drain, and then refilled with fresh water, taking care to remove any entrapped air from the system.
5. At the end of the cleaning period, the system shall be chemically treated as specified. In no case shall the system being cleaned be left in an untreated condition for more than 8 hours.
6. At the conclusion of the cleaning operation, the Water Treatment Contractor shall certify in writing that the system was cleaned as specified.

B. CHLORINATION

1. Acceptable products are:
 - i. Liquid Chlorine Fed. Spec. BB-C120B Hypochlorite Fed. Spec 0-C-114, Type 11, Grade B Fed. Spec. 0-S-60D, Grade A or B
2. After all pressure tests have been performed and piping has been flushed clean, the chemical treatment contractor shall be responsible for sterilizing the domestic water lines.
3. Chlorination procedures shall comply with local code and health department regulations.
 - i. Before commencing the chlorination process, the Water Treatment Contractor shall post signs at each water fountain, and on each restroom door, stating that the water is not fit for drinking, and that the water is being chlorinated.
 - ii. Introduce sufficient chlorine into the domestic water system to provide a dosage of not less than 50 parts per million at each faucet and valve. The chlorine solution shall then be allowed to stand for a minimum of 24 hours in the system.
 - iii. At the end of 24 hours test shall be made for residual chlorine at the extreme end of the system from the point where chlorine was introduced. If chlorine residual is less than 10 ppm, the chlorination procedure shall be repeated.
 - iv. Flush the system with a clean supply of water until the chlorine residual in the system is reduced to less than 1 ppm, or to the chlorine residual of the supply water. During the flushing, each faucet and valve in the system shall be opened and closed a minimum of 4 times.
 - v. After 24 hours, the water treatment representative will have samples taken and tested by an independent laboratory. The system must be free of bacteriological

contamination. If the system is contaminated, it shall be re-chlorinated until a satisfactory test is made.

- vi. The Water Treatment Contractor shall write a letter, informing the Mechanical Contractor that the building has been successfully chlorinated, and that the water is fit for human consumption.

C. TESTING

1. Closed Systems:

- i. Provide a Nitrite "Drop Test" kit for determining the level of Nitrite or Molybdate in the closed system.

D. SYSTEM START-UP

1. The Water Treatment Supplier shall put the system into operation, and make adjustments necessary for proper operation.
2. The Water Treatment Supplier shall provide a written report indicating that the start-up has been completed and that all Water Treatment Equipment is operating properly.

E. TESTING AND CLEANING

1. Sample all treated water systems at one-week intervals after start-up for period of 4 weeks and prepare certified test report for each system being treated.
2. Start-up test, and adjust water conditioners in presence of manufacturer's authorized representative. Operate units including regeneration, back washing, rinsing and flushing. Adjust unit to maintain required steady state effluent water quality.
3. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

F. CLOSEOUT PROCEDURES

1. Provide services of manufacturer's technical representative for one 8 hour day to instruct Owner's personnel in operation and maintenance of water treatment systems.

END OF SECTION 22 31 00

SECTION 22 33 00 – DOMESTIC WATER HEATERS

Part 1: General

1.02 Summary

1.03 Related Sections

1.04 Definitions

1.05 Submittals Required A.

Product Data:

B. Shop Drawings:

C. Wiring Diagrams:

D. Record Drawings:

E. Maintenance Data:

F. Certificates:

1.06 Quality Assurance

A. Manufacturer's Qualifications: not less than 5 years.

B. SPECIAL PROJECT WARRANTY

1. Warranty on Heat Exchanger, and Burner: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, heat exchangers, and burners with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

i. Warranty Period: 10 years from Date of Substantial Completion for the pressure vessel 5 years from date of Substantial Completion for the heat exchanger.

1.07 Scheduling

1.08 Delivery, Storage, and Handling

1.09 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

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

1. Commercial Gas-Fired:

i. AERCO-

ii. Bradford White EF Series

iii. Lochinvar

iv. Navian Tankless Water Heaters

2.02 Products

A. COMMERCIAL GAS-FIRED WATER HEATERS

1. General: Provide certification of design by AGA under Volume III tests for commercial water heaters for delivery of 180 deg F (82 deg C) water.

2. The flame monitoring system shall incorporate a U/L recognized combustion safeguard system utilizing interrupted spark ignition and a rectification type flame sensor. An electrohydraulic double seated safety shall be an inherent part of the gas train.
3. Water heater shall incorporate electric probe type low water cutoff and dual over temperature protection including a manual reset in accordance with ASME and CSD-1. Remote fault alarm contacts and sensor failure detection shall be standard equipment. Heater shall operate on 120/1/60.
4. Water Heater shall include integral factory wired operating controls to control all operation and energy input. Control of discharge water temperature shall be set through an internal setpoint with a field adjustment of 100F to 200F. Units shall maintain discharge temperature within specified range through domestic water flow variations from 0 to 100%.
5. Heater shall be capable of maintaining the outlet temperature within an accuracy of +/-4F. This shall be accomplished by modulation of firing rate from 100% to 7% of rated input. Units shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input.
6. Accessories: Provide brass drain valve; 3/4" pressure and temperature relief valve; and radiant floor shield.
7. Controls: Provide gas pressure regulator; pilot gas regulator; thermostat; and temperature limit control.

B. GAS-FIRED WATER HEATER AND STORAGE TANK*

1. **Gas water heater to be Bradford White EF series minimum thermal efficiency of 92% provide separate storage tank and pumping system as needed.**
2. Provide check valve on DCW to DHW boiler systems to prevent backflow. (See Valve spec)
3. Centralize H₂O heating with HWC.
4. Tank shall be a separate vertical glass-lined tank, with heavy gauge steel jacket with baked enamel finish. R-16 foam insulation. Cathodic protection. Provide T/P rated relief valve, mercury industrial type thermometer and other accessories and connections as recommended by the manufacturer and/or as detailed.
5. Make taps accessible with union on drain outlet.
6. Units shall be as manufactured by Bradford White, 199,000 Btuh input, and 181 gph recovery at 100-degree temperature rise at sea level. Model TJV-120A tank, 119 gallon storage each, or equal.

Part 3: Execution

3.01 Preparation

3.02 Installation

A. INSTALLATION OF WATER HEATERS

1. Support: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.
2. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closest floor drain.
3. Gauges: Provide thermometers on inlet and outlet piping of water heaters, in accordance with Basic Mechanical Materials and Methods Section "Meters and Gauges."

4. Gas-Fired Water Heaters: Connect gas supply to gas line with drip leg, tee, gas cock, and union; full size of unit inlet connection. Locate piping so as not to interfere with service of unit.

i. Flue: Connect flue to draft hood with gas-tight connection. Provide flue of minimum size as flue outlet on heater. Comply with gas utility requirements.

B. FIELD QUALITY CONTROL

1. Start-Up: Start-up, test, and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and utility company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.

C. CLOSEOUT PROCEDURES

1. Training: Provide services of manufacturer's technical representative for 1-half day to instruct Owner's personnel in operation and maintenance of water heaters.

i. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

3.03 Cleaning and Protection

END OF SECTION 22 33 00

SECTION 22 40 00 – PLUMBING FIXTURES

Part 1: General

1.01 Summary

- A. Where there is a conflict between the International Plumbing Code and the International Building Code, the latter prevails.
- B. Locate a shut-off ball valve on the water main at the point where it enters the building. Clearly label it as the water main shut off.
- C. Provide a pressure-reducing valve, if required, on the water main just downstream of the main shut off ball valve to limit the pressure in the building to 80 psig.
- D. The potable water supply system including specialties, valves, pipe and fixtures shall meet the current *Primary Drinking Water Regulations* published by the Colorado Department of Health.
- E. Water Service Sizing: Given the enormous difference in the cost of fees for upsizing water tap and meter, careful consideration must be given to both plumbing and irrigation design and sizing. For example, Elementary Schools normally do not need more than a 2" service.
- F. Sink/Drinking Fountain Combination:
 - 1. *May be used outside toilet rooms provided the toilet rooms have separate hand washing sinks.
 - 2. *May NOT be used in science rooms, art rooms, or other spaces where toxic materials are present.
- G. No wrist blade handles
- H. No column showers
- I. No 8" spread Lav Faucets

1.02 Related Sections

- 1.03 Definitions
- 1.04 Submittals Required
- 1.05 Quality Assurance
- 1.06 Scheduling
- 1.07 Delivery, Storage, and Handling
- 1.08 Regulatory Requirements

Part 2: Products

2.01 Manufacturers

- A. Floor and Area Drains: Cast iron with a double drainage flange. Acceptable manufacturers:
 - 1. Josam.
 - 2. Zurn.
 - 3. J.R. Smith.
 - 4. Wade
 - 5. Or approved equal
- B. Roof Drains: Cast iron body with removable cast iron or aluminum dome strainer (no plastic). Acceptable manufacturers:
 - 1. Josam.
 - 2. Zurn.
 - 3. J. R. Smith
 - 4. Wade
 - 5. Or approved equal
- C. Outside sillcocks by Josam, Smith, Zurn, or Woodford.

2.02 Products

- A. Cleanouts of cast iron only.
- B. Grease, solids, or oil interceptors:
 - 1. Concrete only.
 - 2. Conform to UPC Chapter 7.
 - 3. Submit sizing calculations to the applicable water and sewer district.
- C. Provide one key operated switch and a natural gas normally closed solenoid valve in each lab that uses gas. Mount the key switch on a double gang box with a red pilot light to indicate that the valve is energized and open. Pipe the solenoid to shut off all gas to the lab gas jets. Valve, switch and pilot, 120 VAC. Valve UL listed. The key must be removable in either the on or the off position.
- D. Provide properly sized neutralization vessels for chemistry labs.
- E. Backflow Preventers: **Watts 909QTU only.**
- F. Shock Absorbers: Josam "Absorbotron" water hammer arresters or similar placed in appropriate locations near fixtures that have quick shut off.
- G. PLUMBING FIXTURE TYPES*
 - 1. The plumbing fixtures shall be Kohler, American Standard, vitreous china, white. The stainless steel sinks shall be Elkay or Just only.
 - 2. The exposed flush, waste, and supply pipes at the fixtures shall be chromium plated brass pipe, iron pipe size. Fittings and traps for brass pipe shall be cast brass, chromium plated.

3. Install chromium-plated brass wall or floor plates with setscrew where piping passes through walls or floors.
4. Chromium-plated brass, same shall mean polished brass, first nickel plated and finished with chromium plate.
5. Furnish faucets, key stops and traps for all fixtures and equipment; Chicago Faucet.
6. Toilet seats shall be Beneke, Bemis, Olsonite or approved equal. Solid plastic; white only.
7. All lavatories and sinks shall be furnished with 3/8" S.P.S. flexible tube supply pipes, key stops and escutcheons, **Tempered water shall be provided at all hand washing sinks and classroom sinks. Per ASSE1070 or CSA B125.3.**
8. All lavatories and sinks shall be furnished with 1-1/4" tailpiece, cast brass chrome plated 1 1/4" traps and tailpieces for lavatories and 1-1/2" traps and tailpieces for sinks with cleanout 1-1/2", 17-gauge tubing waste to wall and wall escutcheons.
9. All fixtures fitted to the walls or floor shall be ground square and true and be sealed with mildew resistant non-hardening clear or white silicon bead, with Engineer's approval.
10. The following schedule establishes the standards to which each type of fixture must conform and the plumbing fixture portfolios shall completely illustrate and describe each type.
11. Fixture Mounting Heights: Mount fixtures to the following heights above finish floor:
 - i. Water Closet:
 - a. Standard: 14 inches to top of bowl rim
 - b. Handicapped: 17 - 19 inches to top of seat
 - ii. Urinal:
 - a. Standard: 22 inches to top of bowl rim
 - b. Handicapped: 17 inches to top of bowl rim
 - c. Elementary schools iii. 17 inches to top of bowl rim
 - Lavatory:
 - a. Standard: 31 inches to top of basin rim
 - b. Handicapped: 33 inches to top of basin rim
 - iv. Drinking Fountain:
 - a. Handicapped: 36 inches to top of spout maximum
12. Wall hung fixtures from concrete block shall be supported by wall hangers and fixtures hung from stud partition walls shall have internal wall carriers (submit shop drawings for review) as manufactured by Josam, Wade, Zurn, or approved equal.
13. No off-set flanges shall be used for water closets. Shim with sheet lead if required.
14. Drinking fountains to be hydration station, Oasis Barrier Free Versacooler II, in all new construction and remodels.

PLUMBING FIXTURE TYPES: (Fixture examples from Kohler. American Standard is also approved by PSD Plumbing shop.)

SAMPLE FIXTURES FROM PAST PROJECTS:

Classroom Sink*

Fixture: Elkay LR-2219, Type 302 stainless steel, 18 gauge, self-rimming, and sound deadened. 22" x 19-1/2" O.D. and 18" x 14" x 7-1/2" deep bowl with faucet ledge. Drain shall be Elkay LK-35.

Faucet: **Chicago Faucet # 527 with DB6AJKCP spout, .5 GPM aerator and 369 handles. With ¼ turn ceramic cartridges.**

Bubbler: Chicago 748-665 CP self-closing, push-button, with adjustable stream regulation. Mount in front right side in faucet ledge.

Classroom Sink*

Fixture: Elkay DRKR-2220 single compartment, Type 302 stainless steel, 18 gauge, self-rimming,

Fixture: Kohler K-7827-K or K-16010-3.2-bowl, 18-gauge stainless sinks.

Faucet: **Chicago Faucet # 527 with DB6AJKCP spout, .5 GPM aerator and 369 handles. With ¼ turn ceramic cartridges.**

Chicago 748-665 CP

0.5 GPM aerator

Work Sink*

Fixture: Elkay LR-2022, Type 302 stainless steel, 18 gauge, self-rimming and sound deadened. 22" x 19" O.D. and 16" x 16" x 7-1/2" deep bowl with faucet ledge. Drain shall be Elkay LK-35.

and sound deadened. 22" x 19" O.D. and 13-1/2" x 16" x 7-1/2" deep bowl with faucet ledge. Drain shall be Elkay LK-35 **(4 holed punched, 3 for faucet and 1 for bubbler.)** Set sink so cold water is first handle reached.

Faucet: **Chicago Faucet # 527 with DB6AJKCP spout, .5 GPM aerator and 369 handles. With ¼ turn ceramic cartridges.**

Chicago 748-665 CP

Faucet: 1 rigid gooseneck spout, 0.5 GPM aerator and **369** lever handles.

Chicago 748-665CP

Bubbler: Self-closing, push-button, with adjustable stream regulation. Mount in front right side in faucet ledge.

Chicago 748-665CP

Art room sinks to have clay traps installed. Provide unions on inlet and outlet of traps. Do not install bubbler at art room sinks. Provide an eyewash in each artroom, science room, and tech ed room.

Teachers' Lounge and Home Ec Sinks* 3 HOLE

Faucet: Chicago 748-665 CP

Lavatory (Wall Hung, Handicapped)*

Fixture: Kohler Greenwich K-2027 with offset drain K-13885 or equivalent American Standard. White vitreous china, 20" x 27" O.D. Absolutely no wide-spread lavatory faucets.

Supplies/Drain: K-13885 1-1/4" offset drain with strainer. K-13711 3/8" I.P.S. supplies with loose key stop, 32753 tailpiece, and K-8998 1-1/4" brass P-trap.

Faucet: Chicago **802-VE2805CP with ¼ turn ceramic cartridges.** 0.5 GPM aerator.

Carrier: Concealed arm carrier Josam 17100-67.

Lavatory (Wall Hung)*

Fixture: Kohler Greenwich K-2032. White vitreous china, and 5" high integral back. 20" x 18" O.D. 14" x 10" bowl, with 4" faucet centers.

Faucet/Drain:

Chicago 802-VE2805CP with ¼ turn ceramic cartridges. Drain to be perforated grid drain. 0.5 GPM aerator.

Carrier: Concealed arm carrier Josam 17100-67.

Lavatory—Countertop (Oval)

Fixture: Kohler Pennington K-2196-4 20" x 17" vitreous china, self-rimming, countertop lavatory, 4" centers.

Faucet/Drain: Same as L-1 above.

Shower Trim (Handicapped)*

Delta 11T514

Valve: Pressure balanced valve with integral stops, lever handle, volume and temperature limit stops, 2.50 GPM flow restrictor, or equal by Moen Moentrol.

Head: Wall/hand shower with flexible metal hose, wall connection, and flange. 24" slide bar for hand shower mounting.

Water Closet (Floor Mounted, Siphon Jet)*

Fixture: Kohler Wellworth K-4406, 1.28 GPF elongated bowl, 1-1/2" top spud, rim at 15" AFF, White. No wall mounted water closet allowed. Equals by American Standard.

Flush Valve: Sloan Royal 111-1.28 toilet flush valve, 1.28 GPF. Equals by Zurn.

Seat: Olsonite #95, Solid Plastic.

Closet Bolts: 5/16" Solid Brass.

Water Closet (Floor Mounted, Siphon Jet, Handicapped)*

Fixture: Kohler Highline K-4405, 1.28 GPF elongated bowl. 1-1/2" top spud, 18" high, White. ADA

Flush Valve: Sloan Royal 111-1.28, 1.28 GPF toilet flush valve. Equals by Zurn.

Seat: Olsonite #95, Solid Plastic.

Closet Bolts: 5/16" Solid Brass.

Urinal*

Fixture: Kohler Bardon K-4904-ET, 0.125 GPF urinal. Wall hung with block wall type carrier, siphon jet with 3/4" inlet top spud. Outlet threaded 2" inside. Equals by American Standard or Crane. All urinals to have removable strainers.

Flush Valve: Sloan Royal 186- 0.125 exposed urinal flush valve. 0.125 GPF. Equals by Zurn.

Drinking Fountain (Wall Hung, Handicapped)*

Fixture: Haws 1118. Stainless steel one-piece fountain with rounded front and bottom cover plate. 6-1/2"H x 20"L x 12"W overall dimensions. With #5010 bubbler and mounting plate for CMU wall.

Fixture: Hydration Station

Single unit Oasis P8SBF with Oasis PWEBF bottle counter and bottle filler. Double unit standard and handicapped height Oasis P8SBFSL with PWEBF bottle counter and bottle filler.

Mop Service Basin (Terrazzo, Corner)*

Fixture: Stern-Williams EBC-150. 36" x 36" x 6". Cast brass drain with nickel bronze strainer. Provide with aluminum cap for exposed sides. Set in Durabond 90 or sand and cement. Wrapped with water-resistant wall covering 6" above faucet.

Faucet: **Chicago 897-RCF with 1/4 turn ceramic cartridges.**
Sink fitting with integral stops, bucket hook on spout, 3/4" hose thread end, vacuum breaker, adjustable top brace, inlets on 8" centers, chrome finish

Wash Fountain (Handicapped)*

Fixture: **WF-1 Bradley Model MG-3 Express Lavatory System. With powered infrared activation. .5 gpm flow rate. The infrared sensor to automatically shut water flow off after 30-45 seconds if sensor is covered or blocked. 110/24 VAC plug in transformer. Vernatherm thermostatic mixing valve with combination stop, strainer and check valves. Provide ball valve shut offs upstream of regulating equipment.**

Drinking Fountain (Cuspidor Combination)

Fixture: Haws Model 2403, semi-recessed, wall-hung, stainless steel drinking fountain cuspidor, self-closing bubbler, automatic volume regulator, piping to spreader furnished, flush is activated when fountain is used. Unit to be furnished with trap and cleanout to wall.

Service Sink–Floor Mounted

Fixture: Fiat Model MSB-3624 mop service basin, 36" x 24" x 10" molded stone with shelf, combination dome strainer and lint basket. Set in Durabond 90 or sand and cement. Wrapped with water-resistant wall covering 6" above faucet.

Faucet: **Chicago 897-RCF with ¼ turn ceramic cartridges.**
Service sink faucet with bucket hook, hose end, vacuum breaker, top brace, and stops in shank. Cast brass drain with strainer and socket for 2" outlet, caulk connection.

Shower (Trim)

Fixture: Pressure balancing valve with volume control, back-to-back capability, chrome lever handle and stops, adjustable shower head, arm, and flange. Valve same as SH-1.

Emergency Shower/Eyewash* **8300-8309**

Fixture: Haws Model combination emergency shower and eyewash. **SP829SS**

Shower Head: Model stainless steel 10" diameter.

Valve: Chrome-plated brass 1-1/4" self-closing ball valve.

Eyewash: **11" Diameter stainless steel bowl with Axion MSR eye/face wash head with inverted directional flow, antimicrobial protection, laminar flow, and integral flow control.**

Standard: 1-1/4" stainless steel pipe with 9" floor flange.

Other: Use brass fitting and pipe on eyewash water (no galvanized).

Or equal by Fisher Scientific, Guardian, or Bradley.

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Terminate vents with a vandal proof **cast iron** cap that prevents the insertion of obstructive objects. Install a check valve in each gas jet in labs to prevent water being injected into the gas line.

- B. Make no connection from the potable water lines to any service that contains ethylene glycol antifreeze or water treatment chemicals even if that connection is protected by a backflow preventer.
- C. Ethylene glycol is ONLY allowed in chilled water systems and must be protected by an approved pressure reduced Backflow Preventer.

3.03 Cleaning and Protection

END OF SECTION 22 40 00

SECTION 22 70 00 – PUMPS

Part 1: General 1.01

Summary

- A. For water or water/glycol pumping services.
- B. The Consultant shall specify and include in the Equipment Schedule two operating points for any pump that may operate under more than one condition; i.e., one pump or two pumps running.

1.02 Related Sections

1.03 Definitions

1.04 Submittals

- A. Two copies for each pump service offered.
- B. Certified dimensional drawings including locations, sizes and types of each piping connection, baseplate mounting details and electrical connections.
- C. Installation, maintenance, disassembly, operating and parts-list manuals.
- D. Recommended spare parts list.
- E. Characteristic design curve.
- F. Standard manufacturer's catalog data.

1.05 Quality Assurance

1.06 Scheduling

1.07 Delivery, Storage, and Handling

1.08 Regulatory Requirements

- A. HI - Hydraulic Institute - *Standard for Centrifugal Pumps*.
- B. ASTM - American Society for Testing and Materials.
- C. NEC - National Electrical Code.
- D. NEMA - National Electrical Manufacturer's Association.

Part 2: Products

2.01 Manufacturers

- A. Acceptable manufacturers for water pumps larger than 1/2 HP:
 - 1. Taco
- B. Acceptable manufacturers for water pumps 1/2 HP and less:

1. Taco. **Use cartridge pumps whenever possible.**

2.02 Products

A. SINGLE ASSEMBLY FRAME-MOUNTED ON A COMMON BASEPLATE:

1. Pump.
2. Electric drive motor.
3. Shaft coupling and guard.
4. Baseplate.
5. Pressure gauges and pressure/temperature taps.

B. SERVICE

1. Performance specified by the Engineer.
2. Vibration shall be such that the value of self-excited vibration velocity is less than 0.10 inch/second when measured with a vibration meter on the frame or bearings of the pump assembly in any of the three axes. The pump and motor assemblies shall be both statically and dynamically balanced so as not to exceed the vibration limits.
3. **All motors to be "Premium Efficiency."**
4. The nameplate horse power rating without consideration of the service factor, shall not be exceeded at any point along the performance curve of any pump at its rated rpm.

C. CONSTRUCTION DETAILS FOR PUMPS LARGER THAN 1/2 HP

1. Horizontal centrifugal end suction or split case, cast iron bronze fitted.
2. Constantly rising characteristic curve from design point to minimum flow.
3. Bronze impeller.
4. Regreasable ball bearings.
5. John Crane mechanical seals with carbon seal rings and ceramic seats.
6. Non-ferrous metal nameplate with manufacturer's name, model number, GPM, head, impeller diameter and RPM.
7. **Suction Diffusers to be used on base mounted pumps. Suction diffusers to be supported. Provide proof construction screen has been removed after system has been flushed.**

D. Bronze fitted in-line centrifugal pumps of 1/2 HP or less may be used as circulators or boosters in heating, hot potable or other closed loop water systems. In-line pumps larger than 1/2 HP are strongly discouraged. If space limitations do not permit base mounted pumps, the choice of inline pumps will be decided jointly by the Engineer and the District.

E. HOT WATER HEATING PUMP AND DOMESTIC HOT WATER CIRC PUMPS*

1. Pumps shall be of type and have characteristics as scheduled and shall be as specified herein. Pumps shall have mechanical seals designed for hot water service to 220 degrees F, steel shafts, renewable wearing rings, bronze impellers, and casings designed for 150 PSIG working pressure. Pumps, except close-coupled type, shall have flexible couplings of nonmetallic or single barrel spring design. Multiple spring couplers will not be accepted.
 - i. Acceptable Manufacturers:
 - a. Taco
 - b. Bell & Gossett
 - c. Armstrong
 - d. Grundfos
 - e. Willow

2. Pump manufacturer shall machine the pump impellers, if necessary, to meet capacities scheduled. Pumps shall be dynamically balanced prior to shipment.
3. Sump pump discharge above ground:
 - i. Piping shall be type "L" hard drawn copper water tube with directional fittings wrought copper solder joint. Valves to be rated for appropriate temperature.

Part 3: Execution

3.01 Preparation

3.02 Installation

- A. Place unions or flanges between the pump and the isolation valves on the suction and discharge lines so that the pump may be removed for service without cutting the piping. Provide for temporary "by-pass" when pump is removed.
- B. Include pressure gauges and P/T taps in the suction and discharge lines in locations that will provide a reasonably accurate check of pump performance, and on both sides of the strainer.
- C. Field level and alignment:
 1. Level and align pumps and motors on bases and foundation pads in accordance with the manufacturer's instructions and within their recommended tolerances using and indicating micrometer. Do this prior to connecting any piping or electrical to pump.
 2. Recheck levels and alignment after piping and electrical connections are made and prior to placing each pump in operation. Make adjustments to assure that the thrust is balanced, that the shaft rotates freely when turned by hand, and that the pump is quiet.
 3. **Verify alignment and vibration with PSD Plumbing department.**
 4. When adjustments are complete, tighten bolts and grout pump and motor. Lubricate pumps in accordance with manufacturer's recommendations after completion of system installation and prior to startup.

3.03 Cleaning and Protection

END OF SECTION 22 70 00

Exhibit F

DRAFT AIA® Document B305™ – 1993

Architect's Qualification Statement

DATE: <>
SUBMITTED TO: <>
ADDRESS: <>
NAME OF PROJECT (If Applicable): <>

1 BASIC INFORMATION

§ 1.1 Architect: (Firm Name and Legal Status)

<><>

§ 1.2 Business Address:

<>

§ 1.3 Telephone Number:

<>

§ 1.4 Person to Contact:

<>

§ 1.5 Type of Organization: (Check one)

- [<>] Individual or Sole Proprietorship
[<>] Professional Corporation/Association
[<>] Corporation
[<>] Partnership
[<>] Joint Venture*
[<>] Other*

*If Joint Venture or Other, give details.

<>

2 GENERAL STATEMENT OF QUALIFICATIONS

<>

3 GENERAL INFORMATION

(This information may be provided via the Architect's brochure which may be attached and listed in Article 8.)

§ 3.1 Names of Principals:

<>

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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§ 3.2 Professional History:

<< >>

§ 3.3 Registration Status:

<< >>

§ 3.4 Professional Affiliations:

<< >>

§ 3.5 Key Personnel:

<< >>

§ 3.6 Total Number of Staff:

<< >>

§ 3.7 Number of Registered Architects:

<< >>

§ 3.8 Honors and Awards:

<< >>

§ 3.9 Professional and Civic Involvement:

<< >>

4 RELATED PROFESSIONAL SERVICES
(List proposed consultants, if applicable.)

<< >>

§ 4.1 Structural:

<< >>

§ 4.2 Mechanical:

<< >>

§ 4.3 Electrical:

<< >>

§ 4.4 Interior Design:

<< >>

§ 4.5 Others:

<< >>

5 PROJECTS

(Projects for which personnel of this firm had responsible charge while associated with other firms are indicated by an asterisk.)

§ 5.1 The following projects are representative of the Architect’s recent work. A brief description of each project is attached.

« »

§ 5.2 Other representative projects with dates of completion:

« »

6 REFERENCES

« »

7 STATEMENT OF POTENTIAL CONFLICTS OF INTEREST

« »

8 ADDITIONAL INFORMATION

(If attachments are provided, list them here.)

« »

ARCHITECT:

By:

I hereby certify that, as of the above date, the information provided in this Architect’s Qualification Statement is true and sufficiently complete so as not to be misleading.

(Signature)

« »« »

(Printed name and title)



ARCHITECT:

« »

PROJECT:

« »

Size: « »

Cost: « »

Owner: « »

Owner Contact: « »

Completion Date: « »

Contractor/Construction Manager: « »

Brief Description: « »



ARCHITECT:

« »

PROJECT:

« »

Size: « »

Cost: « »

Owner: « »

Owner Contact: « »

Completion Date: « »

Contractor/Construction Manager: « »

Brief Description: « »



ARCHITECT:

« »

PROJECT:

« »

Size: « »

Cost: « »

Owner: « »

Owner Contact: « »

Completion Date: « »

Contractor/Construction Manager: « »

Brief Description: « »



ARCHITECT:

« »

PROJECT:

« »

Size: « »

Cost: « »

Owner: « »

Owner Contact: « »

Completion Date: « »

Contractor/Construction Manager: « »

Brief Description: « »



Exhibit G

FEE SCHEDULE & HOURLY RATES

CONTRACT AMOUNT:

Base Fee for Architectural, Structural, Mechanical, and Electrical :

\$3,620,000 (Construction Budget) x percent \$

Subtotal of Base Architectural Services: \$

Additional Architectural Services:

FF&E Assistance to District TBD \$

Presentation Modeling/Rendering TBD \$

Coordination of Additional Consultants TBD \$

Subtotal of Additional Architectural Services: \$

Additional Consultants:

Acoustical/ Audio TBD \$

Civil TBD \$

Cost Estimator TBD \$

Daylighting TBD \$

Energy Modelling TBD \$

Roofing TBD \$

Subtotal of Additional Consultants: \$

TOTAL BASIC COMPENSATION: \$

Estimated Reimbursable Expenses:

Direct costs billed at 1.1 times not to exceed TBD \$

Printing TBD \$

Subtotal of Estimated Reimbursable Expenses: \$

TOTAL COMPENSATION: \$

HOURLY RATES:

Principal \$ per hour
Project Manager \$ per hour
Project Architect \$ per hour
CAD Technician \$ per hour
Interior Designer \$ per hour
Clerical \$ per hour

Exhibit H

DRAFT AIA® Document B101™ – 2017

Standard Form of Agreement Between Owner and Architect

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Architect's client identified as the Owner:
(Name, legal status, address and other information)

« »
« »
« »

and the Architect:
(Name, legal status, address and other information)

« »
« »
« »

for the following Project:
(Name, location and detailed description)

« »
« »
« »

The Owner and Architect agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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TABLE OF ARTICLES

1	INITIAL INFORMATION
2	ARCHITECT'S RESPONSIBILITIES
3	SCOPE OF ARCHITECT'S BASIC SERVICES
4	SUPPLEMENTAL AND ADDITIONAL SERVICES
5	OWNER'S RESPONSIBILITIES
6	COST OF THE WORK
7	COPYRIGHTS AND LICENSES
8	CLAIMS AND DISPUTES
9	TERMINATION OR SUSPENSION
10	MISCELLANEOUS PROVISIONS
11	COMPENSATION
12	SPECIAL TERMS AND CONDITIONS
13	SCOPE OF THE AGREEMENT

ARTICLE 1 INITIAL INFORMATION

§ 1.1 This Agreement is based on the Initial Information set forth in this Section 1.1.

(For each item in this section, insert the information or a statement such as "not applicable" or "unknown at time of execution.")

§ 1.1.1 The Owner's program for the Project:

(Insert the Owner's program, identify documentation that establishes the Owner's program, or state the manner in which the program will be developed.)

« See Exhibit "A" »

§ 1.1.1.1 The Architect shall assist the Owner in the preparation of a facility program document that includes site data; spatial programs; and building architecture. This facility program document will act as a guide for the schematic, design development, and construction document phase of this project.

§ 1.1.2 The Project's physical characteristics:

(Identify or describe pertinent information about the Project's physical characteristics, such as size; location; dimensions; geotechnical reports; site boundaries; topographic surveys; traffic and utility studies; availability of public and private utilities and services; legal description of the site, etc.)

« See Exhibit "A" »

§ 1.1.3 The Owner's budget for the Cost of the Work, as defined in Section 6.1:

(Provide total and, if known, a line item breakdown.)

« See Exhibit "A" »

§ 1.1.4 The Owner's anticipated design and construction milestone dates:

- .1 Design phase milestone dates, if any:

« »

- .2 Construction commencement date:

« »

- .3 Substantial Completion date or dates:

For the purpose of this Agreement, Substantial Completion shall be as defined in CRS §24-91-102(5) and shall include the issuance of a certificate of occupancy by the governing municipality, as applicable.

« »

- .4 Other milestone dates:

« »

§ 1.1.5 The Owner intends the following procurement and delivery method for the Project:

(Identify method such as competitive bid or negotiated contract, as well as any requirements for accelerated or fast-track design and construction, multiple bid packages, or phased construction.)

« Competitive Bid through pre-qualified General Contractors »

§ 1.1.6 The Owner's anticipated Sustainable Objective for the Project:

(Identify and describe the Owner's Sustainable Objective for the Project, if any.)

« As per the Owner's Sustainable Design Guidelines and Sustainability Management Plan as identified in Section 3.2.5.1 »

§ 1.1.7 The Owner identifies the following representative in accordance with Section 5.3:

(List name, address, and other contact information.)

« »

« »

« »

« »

« »

§ 1.1.8 The persons or entities, in addition to the Owner's representative, who are required to review the Architect's submittals to the Owner are as follows:

(List name, address, and other contact information.)

« N/A »

§ 1.1.9 The Owner shall retain the following consultants and contractors:

(List name, legal status, address, and other contact information.)

- .1 Geotechnical Engineer:

« »

« »

« »
« »

- 2** Other, if any:
(List any other consultants and contractors retained by the Owner.)

« »

§ 1.1.10 The Architect identifies the following representative in accordance with Section 2.3:
(List name, address, and other contact information.)

« »
« »
« »
« »
« »

§ 1.1.11 The Architect shall retain the consultants identified in Sections 1.1.11.1 and 1.1.11.2:
(List name, legal status, address, and other contact information.)

§ 1.1.11.1 Consultants retained under Basic Services:

- .1** Structural Engineer:

« »
« »
« »
« »

- .2** Mechanical Engineer:

« »
« »
« »
« »

- .3** Electrical Engineer:

« »
« »
« »
« »

- .4** Civil Engineer:

« Firm Name »
« Representatives Name »
« Street Address
City, State & Zip »
« Phone »

§ 1.1.11.2 Consultants retained under Supplemental Services:

« See Exhibit "B" »

§ 1.1.12 Other Initial Information on which the Agreement is based:

§ 1.2 The Owner and Architect may rely on the Initial Information. Both parties, however, recognize that the Initial Information may materially change and, in that event, the Owner and the Architect shall appropriately adjust the Architect's services, schedule for the Architect's services, and the Architect's compensation. The Owner shall adjust the Owner's budget for the Cost of the Work and the Owner's anticipated design and construction milestones, as necessary, to accommodate material changes in the Initial Information.

§ 1.3 The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form.

ARTICLE 2 ARCHITECT'S RESPONSIBILITIES

§ 2.1 The Architect shall provide professional services as set forth in this Agreement. The Architect represents that it is properly licensed in the jurisdiction where the Project is located to provide the services required by this Agreement, or shall cause such services to be performed by appropriately licensed design professionals.

§ 2.2 The Architect shall perform its services consistent with the professional skill and care ordinarily provided by architects practicing in the same or similar locality under the same or similar circumstances. The Architect shall perform its services as expeditiously as is consistent with such professional skill and care and the orderly progress of the Project.

§ 2.3 The Architect shall identify a representative authorized to act on behalf of the Architect with respect to the Project.

§ 2.4 Except with the Owner's knowledge and consent, the Architect shall not engage in any activity, or accept any employment, interest or contribution that would reasonably appear to compromise the Architect's professional judgment with respect to this Project. **Neither the Architect nor any of its employees or consultants shall have other interests which conflict with the interests of the Owner, including being connected with the sale or promotion of equipment or material which may be used on the Project, and the Architect shall make written inquiry of all of its consultants concerning the existence of or potential for such conflict. In unusual circumstances, and with full disclosure to the Owner of such conflict of interest, the Owner, in its sole discretion, may grant a written waiver for the Architect or particular consultant.**

§ 2.5 INSURANCE REQUIREMENTS

§ 2.5.1 The Architect and consultants shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this Agreement are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Architect, its agents, representative, employees or consultants. The insurance requirements herein are minimum requirements for this Agreement and in no way limit the indemnity covenants contained in this Agreement.

§ 2.5.2 The Owner in no way warrants that the minimum limits contained herein are sufficient to protect the Architect from liabilities that might arise out of the performance of the work under this Agreement by the Architect, its agents, representatives, employees, or consultants. The Architect shall assess its own risks and if it deems appropriate and/or prudent, maintain higher limits and/or broader coverages. The Architect is not relieved of any liability or other obligations assumed or pursuant to this Agreement by reason of its failure to obtain or maintain insurance in sufficient amounts, duration, or types.

§ 2.5.3 **Coverages and Limits of Insurance:** The Architect shall provide coverage with limits of liability not less than those stated below. An excess liability policy or umbrella liability policy may be used to meet the minimum liability requirements provided that the coverage is written on a "following form" basis.

1. Commercial General Liability – Occurrence Form – ISO CG 0001 or equivalent. Coverage to include:

- Premises and Operations
- Personal/Advertising Injury

- Products/Completed Operations
- Liability assumed under an Insured Contract (including defense costs assumed under contract)

General Aggregate	\$2,000,000
Products/Completed Operations Aggregate	\$2,000,000
Each Occurrence Limit	\$1,000,000
Personal/Advertising Injury	\$1,000,000
Fire Damage (Any One Fire)	\$50,000
Medical Payments (Any One Person)	\$5,000

- a. The policy shall be endorsed to include the following additional insured language: Poudre School District R-1, its elected officials, employees, agents, and volunteers are included as Additional Insureds (ISO Form CG 2010, or equivalent). Further, all policies of insurance shall:

1. Include a Waiver of Subrogation Clause.
2. Include a Separation of Insureds Clause (Cross Liability).

- b. Architect's consultants shall be subject to the same minimum requirements identified above.

2. Automobile Liability

Bodily injury and property damage for any owned, hired, and non-owned vehicles used in the performance of this Agreement.

Bodily Injury/Property Damage (Each Accident)	\$1,000,000
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Architect's consultants shall be subject to the same minimum requirements identified in this section.

3. Workers' Compensation and Employers' Liability

Coverage A (Workers' Compensation)	Statutory
Coverage B (Employers Liability)	
Each Accident	\$500,000
Disease – Policy Limit	\$500,000
Disease – Each Employee	\$500,000

- a. Architect's consultants shall be subject to the same minimum requirements identified in this section.
- b. This requirement shall not apply if the Architect or consultant is exempt under Colorado Workers' Compensation Act **AND** if the Architect or consultant has a current Workers' Compensation Coverage Rejection on file with the Colorado Department of Labor and Employment, Division of Worker's Compensation.

4. Professional Liability (Errors and Omissions Liability)

Each Claim	\$3,000,000
Annual Aggregate	\$3,000,000 (for each project under \$10,000,000) \$5,000,000 (for each project over \$10,000,000)

- a. In the event that any professional liability insurance required by this Agreement is written on a claims-made basis, Architect warrants that any retroactive date under the policy shall precede the effective date of this Agreement; and that either continuous coverage will be maintained, or an extended discovery period will be exercised for a period of three (3) years beginning at the time work under this Agreement is completed.

b. Policy shall include a waiver of subrogation clause.

5. Professional Liability (Errors and Omissions Liability) for Consultants

In addition to the insurance requirements for the Architect, the Architect's registered consultants (including structural, civil, mechanical, plumbing, electrical engineering, landscape architecture, survey, geotechnical and materials testing) are required to carry Professional Liability insurance as follows:

Major Consultants (structural, mechanical, plumbing, electrical engineers)

Each Claim	\$3,000,000
Annual Aggregate	\$3,000,000 (for each project under \$10,000,000) \$5,000,000 (for each project over \$10,000,000)

All other registered consultants not listed above will carry:

Each Claim	\$1,000,000
Annual Aggregate	\$1,000,000

a. In the event that any professional liability insurance required by this Agreement is written on a claims-made basis, Architect warrants that any retroactive date under the policy shall precede the effective date of this Agreement; and that either continuous coverage will be maintained, or an extended discovery period will be exercised for a period of three (3) years beginning at the time work under this Agreement is completed.

b. Policy shall include a waiver of subrogation clause.

§ 2.5.4 Additional Insured Requirements: The policies shall include, or be endorsed to include, the following provisions:

On insurance policies where the Owner is named as an additional insured, the Owner shall be an additional insured to the full limits of liability purchased by the Architect even if those limits of liability are in excess of those required by this Agreement.

§ 2.5.5 Notice of Cancellation: Each insurance policy required under this Agreement shall provide the required coverage and shall not be suspended, voided or canceled except after thirty (30) days prior written notice has been given to the Owner, except when cancellation is for non-payment of premium, then ten (10) days prior notice may be given. If the insurance carrier will not provide the required notice, the Architect and/or its insurance broker shall notify the Owner of any cancellation or non-renewal in coverage or limits of any insurance within seven (7) days of receipt of insurers' notification to that effect. Such notices shall be sent directly to the Owner's Director of Records & Risk Management.

§ 2.5.6 Verification of Coverage: Architect shall furnish the Owner with certificates of insurance (ACORD form or equivalent approved by the Owner's Director of Records & Risk Management) as required by this Agreement. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

1. All certificates and required endorsements are to be received and approved by the Owner's Director of Records & Risk Management before work commences. Each insurance policy required by this Agreement must be in effect at or prior to commencement of work under this Agreement and remain in effect for the duration of the project. Failure to maintain the insurance policies as required by this Agreement or to provide evidence of renewal is a material breach of contract.
2. All certificates required by this Agreement shall be sent directly to the Owner's Director of Records & Risk Management at risk@psdschools.org. The Owner's project/contract number and project

description shall be noted on the certificate of insurance. The Owner reserves the right to require complete, certified copies of all insurance policies required by this Agreement at any time.

§ 2.5.7 Consultants: All required consultants' certificates and endorsements are to be received and approved by the Owner's Director of Records & Risk Management before work commences.

§ 2.5.8 Approval: Any modification or variation from the insurance requirements in this Agreement shall be made by the Owner's Director of Records & Risk Management, whose decision shall be final. Such action will not require a formal amendment but may be made by administrative action.

ARTICLE 3 SCOPE OF ARCHITECT'S BASIC SERVICES

§ 3.1 The Architect, as part of its Basic Services, shall retain professional engineering consultants for the structural, mechanical and electrical design of the Project. At the Owner's request, a copy of the Architect/Engineer agreement (s), if any, shall be forwarded to the Owner for approval or, if the consultants are members of the Architect's staff, their qualifications shall be forwarded to the Owner for approval. The approval required hereunder shall be obtained prior to any obligations relative to the Project being incurred regarding that consultant.

§ 3.1.1 The Architect shall manage the Architect's services, research applicable design criteria, attend Project meetings, communicate with members of the Project team, and report progress to the Owner.

§ 3.1.2 The Architect shall coordinate its services with those services provided by the Owner and the Owner's consultants. The Architect shall be entitled to rely on, and shall not be responsible for, the accuracy, completeness, and timeliness of, services and information furnished by the Owner and the Owner's consultants. The Architect shall provide prompt written notice to the Owner if the Architect becomes aware of any error, omission, or inconsistency in such services or information.

§ 3.1.3 As soon as practicable after the date of this Agreement, the Architect shall submit for the Owner's approval a schedule for the performance of the Architect's services. The schedule initially shall include anticipated dates for the commencement of construction and for Substantial Completion of the Work as set forth in the Initial Information. The schedule shall include allowances for periods of time required for the Owner's review, for the performance of the Owner's consultants, and for approval of submissions by authorities having jurisdiction over the Project. Once approved by the Owner, time limits established by the schedule shall not, except for reasonable cause, be exceeded by the Architect or Owner **except by mutual agreement of the parties. Delays in the orderly progress of the Project caused by the Architect shall be the responsibility of the Architect. In the event of a delay caused by the Architect, the Architect shall accelerate to meet the time schedule without additional compensation. Time is of the essence of this Agreement.**

§ 3.1.3.1 See Exhibit "C" for Project Schedule

§ 3.1.4 The Architect shall not be responsible for an Owner's directive or substitution, or for the Owner's acceptance of non-conforming Work, made or given without the Architect's written approval.

§ 3.1.5 The Architect shall contact governmental authorities required to approve the Construction Documents and entities providing utility services to the Project. The Architect shall respond to applicable design requirements imposed by those authorities and entities.

§ 3.1.6 The Architect shall assist the Owner in connection with the Owner's responsibility for filing documents required for the approval of governmental authorities having jurisdiction over the Project. **The Architect shall meet with planning commissions, fire protection agencies, utility companies, affected street and traffic authorities, health departments, the State of Colorado, and any other government entities as often as reasonably necessary, and shall assist as reasonably necessary to obtain approvals before the start of construction, unless the Owner gives written instruction to proceed without such approval.**

§ 3.2 Schematic Design Phase Services

§ 3.2.1 The Architect shall review the program and other information furnished by the Owner, and shall review laws, codes, and regulations applicable to the Architect's services.

§ 3.2.2 The Architect shall prepare a preliminary evaluation of the Owner's program, schedule, budget for the Cost of the Work, Project site, the proposed procurement and delivery method, and other Initial Information, each in terms of the other, to ascertain the requirements of the Project. The Architect shall notify the Owner of (1) any inconsistencies discovered in the information, and (2) other information or consulting services that may be reasonably needed for the Project.

§ 3.2.3 The Architect shall present its preliminary evaluation to the Owner and shall discuss with the Owner alternative approaches to design and construction of the Project. The Architect shall reach an understanding with the Owner regarding the requirements of the Project.

§ 3.2.4 Based on the Project requirements agreed upon with the Owner, the Architect shall prepare and present, for the Owner's approval, a preliminary design illustrating the scale and relationship of the Project components.

§ 3.2.5 The Architect shall prepare Schematic Design Documents for approval by the Owner consisting of drawings and other documents illustrating the scale and relationship of Project components. The Schematic Design Documents shall at a minimum contain, but not be limited to, the following:

1. a recommended scope of site development;
2. functional areas outlined (single line plans) indicating schematic spaces to meet program criteria;
3. correlation of space with criteria;
4. gross square footage of additions and remodeled areas;
5. net square footage; and
6. initial building code analysis.

§ 3.2.5.1 The Owner's current version of the "Technical Specification v6" dated November 2014, "Sustainable Design Guideline" dated June 2005, and "Sustainability Management Plan" dated 2017 will be provided to the Architect as part of this Agreement. These documents are intended to provide uniform and consistent quality standards for The Owner's facilities and are intended to communicate to the Architect the minimum acceptable standards for energy performance, occupant comfort requirements, products, materials and systems used in the Owner's facilities. The Architect shall make every effort to abide by the requirements of these documents and shall notify the Owner of any deviations.

§ 3.2.5.2 The Architect shall consider the value of alternative materials, building systems and equipment, together with other considerations based on program and aesthetics, in developing a design for the Project that is consistent with the Owner's program, schedule, and budget for the Cost of the Work.

§ 3.2.6 The Architect shall submit to the Owner an estimate of the Cost of the Work prepared in accordance with Section 6.3.

§ 3.2.7 The Architect shall submit the Schematic Design Documents to the Owner, and request the Owner's approval.

§ 3.2.8 The Architect shall attend and facilitate, with the Owner, public meetings about the project design.

§ 3.3 Design Development Phase Services

§ 3.3.1 Based on the approved Schematic Design Documents, the Architect shall prepare Design Development Documents for approval by the Owner. The Design Development Documents shall consist of drawings and other documents to fix and describe the size and character of the entire Project as to architectural, structural, mechanical and electrical systems, materials, and such other elements as may be appropriate. Without limiting the generality of the foregoing, the Design Development Documents shall include the following:

1. outline of specifications;
2. architectural floor plans;
3. architectural elevations and building sections;
4. a proposed finish schedule;
5. tabulation of gross and net areas; and
6. major structural, mechanical and electrical system components overlaid on architectural floor plans.
7. major exterior improvements, including athletic fields and related seating areas.

8. code plan or study

§ 3.3.2 The Architect shall update the estimate of the Cost of the Work prepared in accordance with Section 6.3.

§ 3.3.3 The Architect shall submit the Design Development Documents to the Owner, advise the Owner of any adjustments to the estimate of the Cost of the Work, and request the Owner's approval.

§ 3.4 Construction Documents Phase Services

§ 3.4.1 Based on the Owner's approval of the Design Development Documents, and on the Owner's authorization of any adjustments in the Project requirements and the budget for the Cost of the Work, the Architect shall prepare Construction Documents for the Owner's approval. The Construction Documents shall illustrate and describe the further development of the approved Design Development Documents and shall consist of Drawings and Specifications setting forth in detail the quality levels and performance criteria of materials and systems and other requirements for the construction of the Work. The Owner and Architect acknowledge that, in order to perform the Work, the Contractor will provide additional information, including Shop Drawings, Product Data, Samples and other similar submittals, which the Architect shall review in accordance with Section 3.6.4.

§ 3.4.2 The Architect shall incorporate the design requirements of governmental authorities having jurisdiction over the Project into the Construction Documents.

§ 3.4.3 During the development of the Construction Documents, the Architect shall assist the Owner in the development and preparation of (1) procurement information that describes the time, place, and conditions of bidding, including bidding or proposal forms; (2) the form of agreement between the Owner and Contractor; and (3) the Conditions of the Contract for Construction (General, Supplementary and other Conditions). The Architect shall also compile a project manual that includes the Conditions of the Contract for Construction and Specifications, and may include bidding requirements and sample forms.

§ 3.4.4 The Architect shall update the estimate for the Cost of the Work prepared in accordance with Section 6.3.

§ 3.4.5 The Architect shall submit the Construction Documents to the Owner, advise the Owner of any adjustments to the estimate of the Cost of the Work, take any action required under Section 6.5, and request the Owner's approval.

§ 3.4.6 When the construction document phase is ninety percent (90%) complete and a minimum of ten (10) working days before construction documents are released for bid, the Architect shall submit to the Owner one (1) complete set of contract documents (drawings and specifications), and one (1) complete set of electronic documents in PDF format, for review and a current estimate of construction cost based on the ninety percent documents.

§ 3.5 Procurement Phase Services

§ 3.5.1 General

The Architect shall assist the Owner in establishing a list of prospective contractors. Following the Owner's approval of the Construction Documents, the Architect shall assist the Owner in (1) obtaining either competitive bids or negotiated proposals; (2) confirming responsiveness of bids or proposals; (3) determining the successful bid or proposal, if any; and, (4) awarding and preparing contracts for construction.

§ 3.5.2 Competitive Bidding

§ 3.5.2.1 Bidding Documents shall consist of bidding requirements and proposed Contract Documents.

§ 3.5.2.2 The Architect shall assist the Owner in bidding the Project by:

- .1 facilitating the distribution of Bidding Documents to prospective bidders;
- .2 organizing and conducting a pre-bid conference for prospective bidders;
- .3 preparing responses to questions from prospective bidders and providing clarifications and interpretations of the Bidding Documents to the prospective bidders in the form of addenda; and,
- .4 organizing and conducting the opening of the bids, and subsequently documenting and distributing the bidding results, as directed by the Owner.

§ 3.5.2.3 If the Bidding Documents permit substitutions, upon the Owner's written authorization, the Architect shall, as an Additional Service, consider requests for substitutions and prepare and distribute addenda identifying approved substitutions to all prospective bidders.

§ 3.5.3 Negotiated Proposals

§ 3.5.3.1 Proposal Documents shall consist of proposal requirements and proposed Contract Documents.

§ 3.5.3.2 The Architect shall assist the Owner in obtaining proposals by:

- .1 facilitating the distribution of Proposal Documents for distribution to prospective contractors and requesting their return upon completion of the negotiation process;
- .2 organizing and participating in selection interviews with prospective contractors;
- .3 preparing responses to questions from prospective contractors and providing clarifications and interpretations of the Proposal Documents to the prospective contractors in the form of addenda; and,
- .4 participating in negotiations with prospective contractors, and subsequently preparing a summary report of the negotiation results, as directed by the Owner.

§ 3.5.3.3 If the Proposal Documents permit substitutions, upon the Owner's written authorization, the Architect shall, as an Additional Service, consider requests for substitutions and prepare and distribute addenda identifying approved substitutions to all prospective contractors.

§ 3.6 Construction Phase Services

§ 3.6.1 General

§ 3.6.1.1 The Architect shall provide administration of the Contract between the Owner and the Contractor as set forth below and in AIA Document A201™-2017, General Conditions of the Contract for Construction, as amended by the Owner.

§ 3.6.1.2 The Architect shall advise and consult with the Owner during the Construction Phase Services. The Architect shall have authority to act on behalf of the Owner only to the extent provided in this Agreement and the Architect shall not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, nor shall the Architect be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Notwithstanding the preceding sentence, the Architect shall promptly report to the Owner known deviations from the Contract Documents and from the most recent approved construction schedule. If the Architect finds that the progress of the Project is not in compliance with the approved construction schedule then, in addition to reporting to the Owner as required above, the Architect shall request the Contractor to submit a recovery plan for approval. In addition to the foregoing obligations to notify Owner, the Architect shall notify Owner promptly if Architect becomes aware of any other failures to perform, acts or omissions of the Contractor that in the Architect's professional judgement will or may result in a detriment to the Owner. The Architect shall be responsible for the Architect's negligent acts or omissions and failure to comply with this Agreement, but shall not have control over or charge of, and shall not be responsible for, acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work not employed by or retained by Architect.

§ 3.6.1.3 The Architect shall administer, and maintain record copies showing dates and signatures, of all construction phase documents, using standard AIA forms where applicable. This obligation includes but is not limited to the following, all of which shall be done in a prompt and timely manner:

1. providing a standard Request for Information (RFI) form and responding to all RFIs;
2. issuing Architect's Supplemental Instructions (ASI) and Proposal Requests (PR) as needed;
3. providing a standard Change Order Request (COR) form and responding to all CORs;
4. issuing all Change Order (CO) drafts for the Owner's and Contractor's approval and signature;
5. issuing all Construction Change Directives (CCD);
6. issuing all Notices of Nonconformance as required;
7. reviewing and responding to all Submittals; and
8. reviewing and either certifying or rejecting Applications for Payment.

§ 3.6.1.4 Subject to Section 4.2 and except as provided in Section 3.6.6.5, the Architect's responsibility to provide Construction Phase Services commences with the award of the Contract for Construction and terminates on the date the Architect issues the final Certificate for Payment.

§ 3.6.2 Evaluations of the Work

§ 3.6.2.1 The Architect shall meet with the principal Contractor at the site at least once a week, or as mutually agreed to in writing by the Owner, Architect, and Contractor during the course of construction, or such further visits as shall be necessary, relative to the performance of the Contractor and all subcontractors in accordance with the final approved plans, specifications, and construction schedule. The Architect shall assist the Owner in reviewing the construction schedule for acceptability as outlined in the contract documents. Before the Contractor's first Application for Payment is processed, the Architect and Owner must agree and accept the Contractor's baseline documents and schedule of values. The Architect shall promptly prepare and distribute written minutes of the weekly meetings and distribute within three days of the meeting. The Architect shall request that any objections by the Contractor or the Owner to the content of such minutes shall promptly be made to the Architect in writing. On the basis of the site visits or any other information the Architect may have, the Architect shall keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work.

Any and all other of the Architect's consultants shall visit the site a minimum of once per week, or as mutually agreed to in writing by the Owner, Architect, and Contractor during construction of their consultants' respective portion of the projects, or as otherwise agreed upon, or more as shall be necessary, and as relative to the performance of the Contractor and all subcontractors in accordance with the final approved plans and specifications. The Architect and his consultants shall review the findings of such on-site observations with the Contractor prior to leaving the site, and such on-site observations shall continue beyond the time of substantial completion until all items of work are documented in writing by the Architect as fully completed. The Architect and his consultants shall prepare written reports to document all on-site observations and site meetings and shall promptly submit such written reports to the Owner and Contractor. The Architect's on-site observations shall include, but not be limited to, the following services by the Architect, structural, mechanical and electrical engineers, and other consultants retained by the Architect:

1. observe that approved shop drawings, lab and testing reports, and updated as-built documents are being maintained at the site;
2. observe reinforcing steel after installation and before concrete is placed;
3. observe structural and architectural concrete before, during, and after pouring;
4. observe structural steel after erection and prior to the same being covered or enclosed;
5. observe mechanical work following its installation and prior to its being covered and /or enclosed;
6. observe electrical work following its installation and prior to its being covered and/or enclosed;
7. observe exposed surfaces for compliance with Construction Contract Documents;
8. representation of Owner at preliminary and final observations;
9. assist the Owner in determining that all systems are properly working as per the Contract Documents.

§ 3.6.2.2 The Architect has the authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect shall have the authority to require inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 3.6.2.3 The Architect shall interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests shall be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 3.6.2.4 Interpretations and decisions of the Architect shall be consistent with the intent of, and reasonably inferable from, the Contract Documents and shall be in writing or in the form of drawings. When making such interpretations and decisions, the Architect shall endeavor to secure faithful performance by both Owner and Contractor, shall not show partiality to either, and shall not be liable for results of interpretations or decisions rendered in good faith. The

Architect's decisions on matters relating to aesthetic effect shall be final if consistent with the intent expressed in the Contract Documents.

§ 3.6.2.5 Unless the Owner and Contractor designate another person to serve as an Initial Decision Maker, as that term is defined in AIA Document A201–2017, the Architect shall render initial decisions on Claims between the Owner and Contractor as provided in the Contract Documents.

§ 3.6.3 Certificates for Payment to Contractor

§ 3.6.3.1 The Architect shall review and certify the amounts due the Contractor and shall issue certificates in such amounts. The Architect's certification for payment shall constitute a representation to the Owner, based on the Architect's evaluation of the Work as provided in Section 3.6.2 and on the data comprising the Contractor's Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to (1) an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, (2) results of subsequent tests and inspections, (3) correction of minor deviations from the Contract Documents prior to completion, and (4) specific qualifications expressed by the Architect.

§ 3.6.3.2 The issuance of a Certificate for Payment shall not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) ascertained how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 3.6.3.3 The Architect shall maintain a record of the Applications and Certificates for Payment.

§ 3.6.3.4 The Architect shall not execute the Contractor's monthly applications and Certificates for Payment and return to the Owner for action until Architect has made an observation of the construction to determine, to the best of his ability, that the said materials or services have been provided as indicated on the Contractor's Schedule of Values. If the Architect is aware of any legitimate basis upon which to dispute any sums payable, the Architect shall not issue a Certificate for Payment of such sums without first obtaining the Owner's written authorization.

§ 3.6.4 Submittals

§ 3.6.4.1 The Architect shall review the Contractor's submittal schedule and shall not unreasonably delay or withhold approval of the schedule. The Architect's action in reviewing submittals shall be taken in accordance with the approved submittal schedule or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time, in the Architect's professional judgment, to permit adequate review.

§ 3.6.4.2 The Architect shall review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of such submittals is not for the purpose of determining the accuracy and completeness of other information such as dimensions, quantities, and installation or performance of equipment or systems, which are the Contractor's responsibility. The Architect's review shall not constitute approval of safety precautions or construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component, but the Architect shall take reasonable measures to verify that such assembly is consistent with the design concept expressed in the Contract Documents.

§ 3.6.4.3 If the Contract Documents specifically require the Contractor to provide professional design services or certifications by a design professional related to systems, materials, or equipment, the Architect shall specify the appropriate performance and design criteria that such services must satisfy. The Architect shall review and take appropriate action on Shop Drawings and other submittals related to the Work designed or certified by the Contractor's design professional, provided the submittals bear such professional's seal and signature when submitted to the Architect. The Architect's review shall be for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect shall be entitled to rely upon, and

shall not be responsible for, the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals **except that the Architect shall exercise reasonable professional judgement as to the apparent accuracy and/or completeness of such shop drawings and other submittals, and to notify the Owner if such accuracy and/or completeness is in question.**

§ 3.6.4.4 Subject to Section 4.2, the Architect shall review and respond to requests for information about the Contract Documents. The Architect shall set forth, in the Contract Documents, the requirements for requests for information. Requests for information shall include, at a minimum, a detailed written statement that indicates the specific Drawings or Specifications in need of clarification and the nature of the clarification requested. The Architect's response to such requests shall be made in writing within any time limits agreed upon, or otherwise with reasonable promptness. If appropriate, the Architect shall prepare and issue supplemental Drawings and Specifications in response to the requests for information.

§ 3.6.4.5 The Architect shall maintain a record of submittals and copies of submittals supplied by the Contractor in accordance with the requirements of the Contract Documents.

§ 3.6.5 Changes in the Work

§ 3.6.5.1 The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. Subject to Section 4.2, the Architect shall prepare Change Orders and Construction Change Directives for the Owner's approval and execution in accordance with the Contract Documents.

§ 3.6.5.2 The Architect shall maintain records relative to changes in the Work, **by Addenda, RFI, PR, CCD, CO's, and submittals, and will incorporate Contractor's as-built redlines and provide to the Owner as provided in Section 3.6.6.6.**

§ 3.6.6 Project Completion

§ 3.6.6.1 The Architect shall:

- .1 conduct **observations** to determine the date or dates of Substantial Completion and the date of final completion;
- .2 issue Certificates of Substantial Completion;
- .3 forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract Documents and received from the Contractor; and,
- .4 issue a final Certificate for Payment based upon a final **observation** indicating that, to the best of the Architect's knowledge, information, and belief, the Work complies with the requirements of the Contract Documents.

§ 3.6.6.2 The Architect's observations shall be conducted with the Owner to check conformance of the Work with the requirements of the Contract Documents and to verify the accuracy and completeness of the list submitted by the Contractor of Work to be completed or corrected. **The Architect shall require in the specifications that the Contractor shall provide complete and thorough start-up assistance, operating and maintaining instructions, manuals, and advice to the Owner. The Architect shall provide adequate engineering assistance to the Owner during this start-up period. The Architect shall coordinate and track the closeout of the Project including, but not limited to: systems demonstrations, spare parts inventory, equipment move-in, permanent key acceptance and verify that the Contractor has met all closeout requirements as outlined in the contract documents.**

§ 3.6.6.3 When Substantial Completion has been achieved, the Architect shall inform the Owner about the balance of the Contract Sum remaining to be paid the Contractor, including the amount to be retained from the Contract Sum, if any, for final completion or correction of the Work.

§ 3.6.6.4 The Architect shall forward to the Owner the following information received from the Contractor: (1) consent of surety or sureties, if any, to reduction in or partial release of retainage or the making of final payment; (2) affidavits, receipts, releases and waivers of liens, or bonds indemnifying the Owner against liens; and (3) any other documentation required of the Contractor under the Contract Documents.

§ 3.6.6.5 **The Architect and his consultants shall issue written notices to the Contractor to correct failed work, reported by the Owner, as warranty items during the warranty period following substantial completion.**

§ 3.6.6.6 Within ninety (90) days after final acceptance by Owner of the Contractor’s as-built documents, the Architect shall supply the Owner with copies of all final contract documents, plans, specifications, drawings, showing all significant changes incorporated in the Work as finally complete. The following items shall be transmitted to the Owner prior to Final Payment:

- .1 One compact disk containing all electronic AutoCAD and/or Revit files including any necessary fonts, reference files, etc. that were used in preparing the final record documents.
- .2 One compact disk containing all final record drawings and specifications printed in an Adobe .pdf file format.

§ 3.6.6.7 As part of the Architect’s basic services under this Agreement, and notwithstanding any other provision in this Agreement, approximately eleven (11) months after substantial completion and issuance of certificate of occupancy and prior to the expiration of any one-year contractor’s or manufacturers warranties, the Architect and its consultants shall re-examine the Project and report to the Owner the status of the contractor’s completion of the work, including but not limited to “punch list” items, and identifying any deficiencies or defects in workmanship or materials for which a claim can be made under the contractor’s warranty.

ARTICLE 4 SUPPLEMENTAL AND ADDITIONAL SERVICES

§ 4.1 Supplemental Services

§ 4.1.1 The services listed below are included in Basic Services and are required for the Project. The Architect shall provide the listed Supplemental Services only if specifically designated in the table below as the Architect’s responsibility, and the Owner shall compensate the Architect as provided in Section 11.2. Unless otherwise specifically addressed in this Agreement, if neither the Owner nor the Architect is designated, the parties agree that the listed Supplemental Service is not being provided for the Project.

(Designate the Architect’s Supplemental Services and the Owner’s Supplemental Services required for the Project by indicating whether the Architect or Owner shall be responsible for providing the identified Supplemental Service. Insert a description of the Supplemental Services in Section 4.1.2 below or attach the description of services as an exhibit to this Agreement.)

Supplemental Services	Responsibility <i>(Architect, Owner, or not provided)</i>
§ 4.1.1.1 Programming	Architect
§ 4.1.1.2 Multiple preliminary designs	Architect
§ 4.1.1.3 Measured drawings	Not Provided
§ 4.1.1.4 Existing facilities surveys	Not Provided
§ 4.1.1.5 Site evaluation and planning	Not Provided
§ 4.1.1.6 Building Information Model management responsibilities	Not Provided
§ 4.1.1.7 Development of Building Information Models for post construction use	Not Provided
§ 4.1.1.8 Civil engineering	Architect
§ 4.1.1.9 Landscape design	Architect
§ 4.1.1.10 Architectural interior design	Architect
§ 4.1.1.11 Value analysis	Not Provided
§ 4.1.1.12 Detailed cost estimating beyond that required in Section 6.3	Not Provided
§ 4.1.1.13 On-site project representation	Not Provided
§ 4.1.1.14 Conformed documents for construction	Architect
§ 4.1.1.15 As-designed record drawings	Not Provided
§ 4.1.1.16 As-constructed record drawings	Architect
§ 4.1.1.17 Post-occupancy evaluation	Not Provided

Supplemental Services	Responsibility <i>(Architect, Owner, or not provided)</i>
§ 4.1.1.18 Facility support services	Not Provided
§ 4.1.1.19 Tenant-related services	Not Provided
§ 4.1.1.20 Architect's coordination of the Owner's consultants	Architect
§ 4.1.1.21 Telecommunications/data design	Architect
§ 4.1.1.22 Security design	Architect
§ 4.1.1.23 Commissioning	Owner
§ 4.1.1.24 Sustainable Project Services	Not Provided
§ 4.1.1.25 Fast-track design services	Not Provided
§ 4.1.1.26 Multiple bid packages	Not Provided
§ 4.1.1.27 Historic preservation	Not Provided
§ 4.1.1.28 Furniture, furnishings, and equipment design	Not Provided
§ 4.1.1.29 Other services provided by specialty Consultants	Per Exhibit "B"
§ 4.1.1.30 Other Supplemental Services	N/A

§ 4.1.2 Description of Supplemental Services

§ 4.1.2.1 A description of each Supplemental Service identified in Section 4.1.1 as the Architect's responsibility is provided below.

(Describe in detail the Architect's Supplemental Services identified in Section 4.1.1 or, if set forth in an exhibit, identify the exhibit. The AIA publishes a number of Standard Form of Architect's Services documents that can be included as an exhibit to describe the Architect's Supplemental Services.)

« See Exhibit "B" »

§ 4.1.2.2 A description of each Supplemental Service identified in Section 4.1.1 as the Owner's responsibility is provided below.

(Describe in detail the Owner's Supplemental Services identified in Section 4.1.1 or, if set forth in an exhibit, identify the exhibit.)

« N/A »

§ 4.2 Architect's Additional Services

The Architect may provide Additional Services after execution of this Agreement without invalidating the Agreement. Except for services required due to the fault of the Architect, any Additional Services provided in accordance with this Section 4.2 shall entitle the Architect to compensation pursuant to Section 11.3 and an appropriate adjustment in the Architect's schedule.

§ 4.2.1 Upon recognizing the need to perform the following Additional Services, the Architect shall notify the Owner with reasonable promptness and explain the facts and circumstances giving rise to the need. The Architect shall not proceed to provide the following Additional Services until the Architect receives the Owner's written authorization:

- .1 Services necessitated by a change in the Initial Information, previous instructions or approvals given by the Owner, or a material change in the Project including size, quality, complexity, the Owner's schedule or budget for Cost of the Work, or procurement or delivery method;
- .2 Services necessitated by the enactment or revision of codes, laws, or regulations, including changing or editing previously prepared Instruments of Service;
- .3 Changing or editing previously prepared Instruments of Service necessitated by official interpretations of applicable codes, laws or regulations that are either (a) contrary to specific interpretations by the applicable authorities having jurisdiction made prior to the issuance of the building permit, or (b)

- contrary to requirements of the Instruments of Service when those Instruments of Service were prepared in accordance with the applicable standard of care;
- .4 Services necessitated by decisions of the Owner not rendered in a timely manner or any other failure of performance on the part of the Owner or the Owner's consultants or contractors (Architect shall give Owner timely notice of the due date of any such decision and reasonable reminders as the time approaches);
 - .5 Preparing digital models or other design documentation for transmission to the Owner's consultants and contractors, or to other Owner-authorized recipients;
 - .6 DELETED
 - .7 DELETED
 - .8 Preparation for, and attendance at, a dispute resolution proceeding or legal proceeding, except where the Architect is party thereto;
 - .9 Evaluation of the qualifications of entities providing bids or proposals;
 - .10 Consultation concerning replacement of Work resulting from fire or other cause during construction; or,
 - .11 Assistance to the Initial Decision Maker, if other than the Architect.

§ 4.2.2 To avoid delay in the Construction Phase, the Architect shall provide the following Additional Services, notify the Owner with reasonable promptness, and explain the facts and circumstances giving rise to the need. If, upon receipt of the Architect's notice, the Owner determines that all or parts of the services are not required, the Owner shall give prompt written notice to the Architect of the Owner's determination. The Owner shall compensate the Architect for the services provided prior to the Architect's receipt of the Owner's notice.

- .1 Reviewing a Contractor's submittal out of sequence from the submittal schedule approved by the Architect;
- .2 Responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation;
- .3 Preparing Change Orders and Construction Change Directives that require evaluation of Contractor's proposals and supporting data, or the preparation or revision of Instruments of Service;
- .4 Evaluating an extensive number of Claims as the Initial Decision Maker; or,
- .5 Evaluating substitutions proposed by the Owner or Contractor and making subsequent revisions to Instruments of Service resulting therefrom.

§ 4.2.3 The Architect shall provide Construction Phase Services exceeding the limits set forth below as Additional Services. When the limits below are reached, the Architect shall notify the Owner:

- .1 « Two » (« 2 ») reviews of each Shop Drawing, Product Data item, sample and similar submittals of the Contractor
- .2 « Ninety-Six » (« 96 ») visits to the site by the Architect during construction or as required in Section 3.6.2.1, whichever is greater
- .3 « Two » (« 2 ») observations for any portion of the Work to determine whether such portion of the Work is substantially complete in accordance with the requirements of the Contract Documents
- .4 « One » (« 1 ») observation for any portion of the Work to determine final completion.

§ 4.2.4 Except for services required under Section 3.6.6.5 and those services that do not exceed the limits set forth in Section 4.2.3, Construction Phase Services provided more than 60 days after (1) the date of Substantial Completion of the Work or (2) the initial date of Substantial Completion identified in the agreement between the Owner and Contractor, whichever is earlier, shall be compensated as Additional Services to the extent the Architect incurs additional cost in providing those Construction Phase Services.

§ 4.2.5 If the services covered by this Agreement have not been completed within « » (« ») months of the date of this Agreement, through no fault of the Architect, extension of the Architect's services beyond that time shall be compensated as Additional Services.

ARTICLE 5 OWNER'S RESPONSIBILITIES

§ 5.1 Unless otherwise provided for under this Agreement, the Owner shall provide information in a timely manner regarding requirements for and limitations on the Project, including a written program, which shall set forth the Owner's objectives; schedule; constraints and criteria, including space requirements and relationships; flexibility; expandability; special equipment; systems; and site requirements. **The Architect shall assist the Owner as requested with the obligations and responsibilities referenced in this Article 5.**

§ 5.2 The Owner shall establish the Owner's budget for the Project, including (1) the budget for the Cost of the Work as defined in Section 6.1; (2) the Owner's other costs; and, (3) reasonable contingencies related to all of these costs. The Owner shall update the Owner's budget for the Project as necessary throughout the duration of the Project until final completion. If the Owner significantly increases or decreases the Owner's budget for the Cost of the Work, the Owner shall notify the Architect. The Owner and the Architect shall thereafter agree to a corresponding change in the Project's scope and quality.

§ 5.3 The Owner shall identify a representative authorized to act on the Owner's behalf with respect to the Project. The Owner shall render decisions and approve the Architect's submittals in a timely manner in order to avoid unreasonable delay in the orderly and sequential progress of the Architect's services. **The Architect shall promptly notify the Owner in writing of any decision the Architect claims is not being done in a timely manner.**

§ 5.4 The Owner shall furnish surveys to describe physical characteristics, legal limitations and utility locations for the site of the Project, and a written legal description of the site. The surveys and legal information shall include, as applicable, grades and lines of streets, alleys, pavements and adjoining property and structures; designated wetlands; adjacent drainage; rights-of-way, restrictions, easements, encroachments, zoning, deed restrictions, boundaries and contours of the site; locations, dimensions, and other necessary data with respect to existing buildings, other improvements and trees; and information concerning available utility services and lines, both public and private, above and below grade, including inverts and depths. All the information on the survey shall be referenced to a Project benchmark.

§ 5.5 The Owner shall furnish services of geotechnical engineers, which may include test borings, test pits, determinations of soil bearing values, percolation tests, evaluations of hazardous materials, seismic evaluation, ground corrosion tests and resistivity tests, including necessary operations for anticipating subsoil conditions, with written reports and appropriate recommendations.

§ 5.6 The Owner shall provide the Supplemental Services designated as the Owner's responsibility in Section 4.1.1.

§ 5.7 **DELETED**

§ 5.8 The Owner shall coordinate the services of its own consultants with those services provided by the Architect. Upon the Architect's **written** request, the Owner shall furnish copies of the scope of services in the contracts between the Owner and the Owner's consultants. The Owner shall furnish the services of consultants other than those designated as the responsibility of the Architect in this Agreement, or authorize the Architect to furnish them as an Additional Service, when the Architect requests such services and demonstrates **to the Owner's satisfaction** that they are reasonably required by the scope of the Project. The Owner shall require that its consultants and contractors maintain insurance, including professional liability insurance, as **deemed by the Owner to be** appropriate to the services or work provided.

§ 5.8.1 The Owner reserves the right to contract for commissioning services, construction management and/or inspection services, or other consultants in connection with the Work. In such event, the Architect agrees to cooperate fully, and the time set forth in Section 1.1.4 may be extended in writing by the Owner as reasonably necessary to allow for appropriate participation in the Work. In the event that the Architect's cooperation would require additional services by the Architect, such additional services will require prior written approval by the Owner.

§ 5.9 The Owner shall furnish tests, inspections and reports required by law or the Contract Documents, such as structural, mechanical, and chemical tests, tests for air and water pollution, and tests for hazardous materials.

§ 5.10 The Owner shall furnish all legal, insurance and accounting services, including auditing services, that may be reasonably necessary at any time for the Project to meet the Owner's needs and interests.

§ 5.11 The Owner shall provide prompt written notice to the Architect if the Owner becomes aware of any fault or defect in the Project, including errors, omissions or inconsistencies in the Architect's Instruments of Service.

Subparagraph 5.11 shall not be construed to impose a duty upon the Owner to inspect or to observe the Project, or to become aware of any fault or defect in the Project or of any nonconformance with the Contract Documents, nor is the Owner required to give written notice if it is the Architect who is the source of the Owner's knowledge about any fault, defect or discrepancy. Moreover, failure to deliver notice required in this Section 5.11 shall not relieve the Architect of responsibility for the professional quality, technical accuracy, timely completion and the coordination of all designs, plans, reports, specifications drawings and other services rendered by the Architect and the Architect shall without additional compensation, promptly remedy and correct any errors, omissions, or other deficiencies in Architects work product that the Architect is responsible for, which may occur.

§ 5.12 The Owner shall include the Architect in all communications with the Contractor that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect.

§ 5.13 Before executing the Contract for Construction, the Owner shall coordinate the Architect's duties and responsibilities set forth in the Contract for Construction with the Architect's services set forth in this Agreement. The Owner shall provide the Architect a copy of the executed agreement between the Owner and Contractor, including the General Conditions of the Contract for Construction.

§ 5.14 The Owner shall provide the Architect access to the Project site prior to commencement of the Work and shall obligate the Contractor to provide the Architect access to the Work wherever it is in preparation or progress.

§ 5.15 Within 15 days after receipt of a written request from the Architect, the Owner shall furnish the requested information as necessary and relevant for the Architect to evaluate, give notice of, or enforce lien rights.

ARTICLE 6 COST OF THE WORK

§ 6.1 For purposes of this Agreement, the Cost of the Work shall be the total cost to the Owner to construct all elements of the Project designed or specified by the Architect and shall include contractors' general conditions costs, overhead and profit. The Cost of the Work also includes the reasonable value of labor, materials, and equipment, donated to, or otherwise furnished by, the Owner. The Cost of the Work does not include the compensation of the Architect; the costs of the land, rights-of-way, financing, or contingencies for changes in the Work; or other costs that are the responsibility of the Owner.

§ 6.2 The Owner's budget for the Cost of the Work is provided in Initial Information, and shall be adjusted throughout the Project as required under Sections 5.2, 6.4 and 6.5. Evaluations of the Owner's budget for the Cost of the Work, and the preliminary estimate of the Cost of the Work and updated estimates of the Cost of the Work, prepared by the Architect, represent the Architect's judgment as a design professional. It is recognized, however, that neither the Architect nor the Owner has control over the cost of labor, materials, or equipment; the Contractor's methods of determining bid prices; or competitive bidding, market, or negotiating conditions. Accordingly, the Architect cannot and does not warrant or represent that bids or negotiated prices will not vary from the Owner's budget for the Cost of the Work, or from any estimate of the Cost of the Work, or evaluation, prepared or agreed to by the Architect.

§ 6.3 In preparing estimates of the Cost of Work, the Architect shall be permitted to include contingencies for design, bidding, and price escalation; to determine what materials, equipment, component systems, and types of construction are to be included in the Contract Documents; to recommend reasonable adjustments in the program and scope of the Project; and to include design alternates as may be necessary to adjust the estimated Cost of the Work to meet the Owner's budget. The Architect's estimate of the Cost of the Work shall be based on current area, volume or similar conceptual estimating techniques. If the Owner requires a detailed estimate of the Cost of the Work, the Architect shall provide such an estimate, if identified as the Architect's responsibility in Section 4.1.1, as a Supplemental Service.

§ 6.4 If, through no fault of the Architect, the Procurement Phase has not commenced within 90 days after the Architect submits the Construction Documents to the Owner, the Owner's budget for the Cost of the Work shall be adjusted to reflect changes in the general level of prices in the applicable construction market.

§ 6.5 If at any time the Architect's estimate of the Cost of the Work exceeds the Owner's budget for the Cost of the Work, the Architect shall make appropriate recommendations to the Owner to adjust the Project's size, quality, or budget for the Cost of the Work, and the Owner shall cooperate with the Architect in making such adjustments.

§ 6.6 If the Owner's budget for the Cost of the Work at the conclusion of the Construction Documents Phase Services is exceeded by the lowest bona fide bid or negotiated proposal, the Owner shall

- .1 give written approval of an increase in the budget for the Cost of the Work;
- .2 authorize rebidding or renegotiating of the Project within a reasonable time;
- .3 terminate in accordance with Section 9.5;
- .4 in consultation with the Architect, revise the Project program, scope, or quality as required to reduce the Cost of the Work; or,
- .5 implement any other mutually acceptable alternative.

§ 6.7 Regardless of which alternative the Owner chooses under Section 6.6 the Architect, the Architect's consultants and other planning professionals, without additional charge, shall modify the Contract Documents as necessary to ensure that the Cost of Work does not exceed the lesser amount of the Owner's Project Budget or the fixed limit of Construction Costs. The Architect's and/or consultants' and/or other planning professionals' modification of the Construction Documents shall be the limit of the Architect's responsibility under this Article 6.

ARTICLE 7 COPYRIGHTS AND LICENSES

§ 7.1 The Architect and the Owner warrant that in transmitting Instruments of Service, or any other information, the transmitting party is the copyright owner of such information or has permission from the copyright owner to transmit such information for its use on the Project.

§ 7.2 The drawings, specifications, and other documents or data prepared by the Architect and the Architect's consultants for the Project, or any component of the Project, are Instruments of Service. Upon payment of all amounts due under this Agreement for that portion of drawings, specifications or other documents prepared or furnished, the Owner shall be deemed the owner of the Instruments of Service. The Architect and its consultants retain nonexclusive licenses to the Instruments of Service, provided that the completed Project represented by the Instrument of Service shall not be duplicated for any other client without the prior written consent of the Owner. The Architect and its consultants do not convey to the Owner their unique or proprietary design techniques or concepts as may be employed in the final Instruments of Service. To the extent that work, design, process, or product which is patented, copyrighted, or otherwise protected by an intellectual property right (whether common law, statutory, contractual or reserved), is incorporated into the Instruments of Service or the Work performed under this Agreement by the Architect, the Architect shall pay royalties and/or license fees for such patented or copyrighted designs, process or products. Architect shall at its sole cost and expense indemnify, defend, and hold harmless the Owner against any claims by third parties of infringement of any copyrights or other common law, statutory, contractual or reserved rights incorporated into the Instruments of Service or the Work.

§7.2.1 Electronic Media: The information contained on or in the Architect's electronic media, or retrieved/downloaded from the Architect's ftp site, is provided as a convenience to the users and is provided in "as is" condition. In the event of a conflict in their content, the Architect's printed hard copy shall take precedence over the electronic media.

§7.2.1.1 Use of the Architect's electronic media shall be without liability to the Architect, its insurers, employees and consultants. It is expressly understood and agreed the Architect retains ownership of the printed hard copy drawings and/or specifications until completion of the project in accordance with Section 7.2, subject to the provisions of Section 9.3.

§7.2.1.2 It is understood and agreed that the information contained on or in the Architect's electronic media or retrieved/downloaded from the Architect's ftp site may have been or be altered intentionally or unintentionally by user or others and the user agrees to indemnify and hold harmless the Architect, its insurers, employees and consultants

from any claims, liabilities, damages, loss and costs, including, but not limited to cost of legal defense for the use of such media.

§ 7.3 The Owner has the right to reproduce and/or use, and to create derivative works based upon, the Instruments of Service for other projects at its discretion; provided, however, that if the Owner reproduces or uses the Instruments of Service for another project, or creates (or causes others to create) a derivative work based upon the Instruments of Service, the Owner shall remove or completely obliterate the original professional seals, logos, and other indications of the identity of the Architect and the Architect's consultants on the Instruments of Service. The Owner shall not assign the Instruments of Service to any third party for use on projects unrelated to the Owner, unless the Owner first obtains written consent from the Architect. The use by the Owner or its successors in interest in title, or assigns, which incorporates the Instruments of Service or any derivatives thereof, shall be at the Owner's sole risk and without any liability or responsibility whatsoever by Architect or its consultants.

§ 7.4 Except for the licenses granted in this Article 7, no other license or right shall be deemed granted or implied under this Agreement. The Owner shall not assign, delegate, sublicense, pledge or otherwise transfer any license granted herein to another party without the prior written agreement of the Architect. Any unauthorized use of the Instruments of Service shall be at the Owner's sole risk and without liability to the Architect and the Architect's consultants.

§ 7.5 Except as otherwise stated in Section 7.3, the provisions of this Article 7 shall survive the termination of this Agreement.

ARTICLE 8 CLAIMS AND DISPUTES

§ 8.1 In the event of any dispute or claim arising under or related to this Agreement, the parties shall use their best efforts to settle such dispute or claim through good faith negotiations with each other. If such dispute or claim is not settled through negotiations within 30 days after the earliest date on which one party notifies the other party in writing of its desire to attempt to resolve such dispute or claim through negotiations, then the parties agree to attempt in good faith to settle such dispute or claim by mediation conducted under the auspices of a recognized established mediation service within the State of Colorado. Such mediation shall be conducted within 60 days following either party's written request therefore. If such dispute or claim is not settled through mediation, then either party may initiate a civil action in the state courts of Larimer County, Colorado. No such action shall be removed to any other court or jurisdiction. The prevailing party in such court action shall be entitled to collect, as part of any judgment entered, its reasonable expert witness and attorneys' fees and costs.

§ 8.1.1 The Architect and Owner waive consequential damages for claims, disputes or other matters in question arising out of or relating to this Agreement. This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination of this Agreement. The term "consequential damages" shall not include the cost of any structural repair, demolition, dismantling, replacement, or construction waste that is reasonably related to the Architect's negligence.

§ 8.2 To the fullest extent permitted by law, Architect shall indemnify, defend and hold the Owner harmless from and against all liability, claims, and demands, on account of injury, loss, or damage, including, without limitation, claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, or any other loss of any kind whatsoever, that arise out of or are in any manner connected with this Agreement, to the extent that such injury, loss, or damage is caused by:

1. the negligent, intentional, or willful wrongful act of Architect, or any officer, employee, representative, agent, consultant of Architect, or other person for whom Architect is responsible under this Agreement; or
2. Architect's breach of this Agreement.

except to the extent such liability, claim, or demand arises through the negligent, intentional, or willful wrongful act of the Owner, its officers, employees, or agents, or Owner's breach of this Agreement.

This indemnity provision is to be interpreted to require Architect to indemnify, defend, and hold the Owner harmless only to the extent of the proportionate share of negligence or fault attributable to Architect or a person for whom Architect is responsible under this Section. To the extent indemnification is required under this Agreement, Architect

shall investigate, handle, respond to, and to provide defense for and defend against (with counsel acceptable to Owner), any such liability, claims, or demands at its expense, and to bear all other costs and expenses related thereto, including court costs and attorney fees. This Section shall survive the completion or termination of this Agreement and shall be fully enforceable thereafter until all of the requirements of this Section are performed

§ 8.3 For Change Orders resulting in an increase in the Cost of the Work that are a result of negligent errors, omissions, or discrepancies in the plans, specifications, or other of the Contract Documents prepared by the Architect, its employees, agents, or consultants, the Architect agrees to reimburse the Owner for the cost premium associated with the increase in the Cost of the Work, the cost premium being the difference between the Cost of the Work in the Change Order had the negligence not occurred and the cost to remedy the negligence by Change Order. Reimbursement calculations shall be determined by the Architect and submitted to the Owner for negotiation and acceptance. Additionally, the Architect shall bear all costs associated with redesign efforts pertaining to such Change Orders, including third party cost estimating.

ARTICLE 9 TERMINATION OR SUSPENSION

§ 9.1 This Agreement may be terminated by either party upon five (5) days' written notice should either party fail to substantially perform in accordance with its terms through no fault of the other. In addition, the Owner may terminate this Agreement whenever it becomes reasonably apparent that the Architect is or will be unable or unwilling to substantially perform this Agreement in accordance with its terms or without resulting in interference with or disruption of the Project. In the event of termination of this Agreement, the Architect shall be paid the specified compensation for its services performed to the termination date, including reimbursable expenses then due.

§ 9.2 If the Owner suspends the Project, the Architect shall be compensated for services performed prior to notice of such suspension. When the Project is resumed, the Architect shall be compensated for expenses incurred in the interruption and resumption of the Architect's services. The Architect's fee for the remaining services and the time schedules shall be equitably adjusted.

§ 9.3 In the event of a termination, the Architect shall deliver to the Owner all copies of all drawings, plans, and similar materials relating to the Project and for which it has received compensation, and all other documents delivered to Architect by Owner with respect to this Project, subject to the provisions of Article 7.

§ 9.4 The party properly terminating this Agreement under this Article 9 shall be entitled, in addition to any other amounts due under this Agreement, or as set off against amounts otherwise owed under this Agreement, to the reasonable costs, expenses, and damages occasioned by the termination of this Agreement.

ARTICLE 10 MISCELLANEOUS PROVISIONS

§ 10.1 This Agreement shall be governed by and construed in accordance with the laws of Colorado. Exclusive venue for litigation over any issues pursuant to this Agreement shall be in the District Court of Larimer County, Colorado, and such litigation shall not be removed to any other court or jurisdiction.

§ 10.2 Unless otherwise defined in the Agreement, the Terms in this Agreement shall have the same meaning as those in AIA Document A201-2017, General Conditions of the Contract for Construction as amended by the Owner.

§ 10.3 The Owner and Architect, respectively, bind themselves, their agents, successors, assigns, and legal representatives to this Agreement. Neither the Owner nor the Architect shall assign this Agreement without the written consent of the other, except that the Owner may assign this Agreement to a lender providing financing for the Project if the lender agrees to assume the Owner's rights and obligations under this Agreement. Further, the Owner may assign its rights under this Agreement to satisfy any governmental or financing requirements without the consent of Architect.

§ 10.4 If the Owner requests the Architect to execute certificates, the proposed language of such certificates shall be submitted to the Architect for review at least 14 days prior to the requested dates of execution. If the Owner requests the Architect to execute consents reasonably required to facilitate assignment to a lender, the Architect shall execute all such consents that are consistent with this Agreement, provided the proposed consent is submitted to the Architect for review at least 14 days prior to execution. The Architect shall not be required to execute certificates or consents that would require knowledge, services, or responsibilities beyond the scope of this Agreement.

§ 10.5 Nothing contained in this Agreement shall create a contractual relationship with, or a cause of action in favor of, a third party against either the Owner or Architect, and no third party is entitled to rely on the terms of this Agreement. Notwithstanding the preceding sentence, the Architect is not prohibited from incorporating this Agreement into its agreements with its consultants, provided that the Architect shall not thereby create (i) a contractual relationship between any consultant and the Owner, or (ii) any cause of action in favor of any consultant against the Owner.

§ 10.6 Unless otherwise provided in this Agreement, the Architect shall have no responsibility for the presence, handling, removal, disposal or detection of hazardous materials in any form at the Project site including, but not limited to, asbestos, asbestos products, polychlorinated biphenyl (PCB) or other hazardous materials. If the Architect in the conduct of his duties and obligations as provided in this Agreement shall become aware or shall reasonably suspect the presence of hazardous materials at the Project site, the Architect shall provide written notice to the Owner of the presence, and the general location, amount and condition of the known or suspected hazardous materials at the Project site. Such notice shall be in writing and shall be submitted no more than 24 hours after the presence of such materials reasonably become known or suspected by the Architect.

§ 10.6.1 In the event hazardous materials become known or suspected by the Architect as described in Section 10.6 of this Agreement, the Architect shall take all steps reasonably necessary to assist the Owner to ensure that work on the Project does not proceed or continue until the Architect and the Contractor have received written authorization from the Owner to proceed.

§ 10.6.2 In the event hazardous materials are identified or encountered during the course of the Project the Owner, at its expense, shall take reasonable actions to properly and safely deal with such materials. With respect to new construction, the Owner accepts the above-mentioned responsibility for the real property which is involved in the Project and not with any hazardous substances or materials which may be brought onto the property by others, including subcontractors.

§ 10.6.3 The Architect acknowledges that it and its employees, Consultants and agents have the responsibility of being fully informed of the Owner's Management Plan as it relates to the buildings located at the Project site and shall consult with the Owner about how such Plan addresses suspected or active asbestos-containing material areas within such buildings.

§ 10.7 The Architect shall have the right to include photographic or artistic representations of the design of the Project among the Architect's promotional and professional materials. The Architect shall be given reasonable access to the completed Project to make such representations. However, the Architect's materials shall not include the Owner's confidential or proprietary information if the Owner has previously advised the Architect in writing of the specific information considered by the Owner to be confidential or proprietary. The Owner shall provide professional credit for the Architect in the Owner's promotional materials for the Project. This Section 10.7 shall survive the termination of this Agreement unless the Owner terminates this Agreement for cause pursuant to Section 9.4.

§ 10.8 If the Architect or Owner receives information specifically designated as "confidential" or "business proprietary," the receiving party shall keep such information strictly confidential and shall not disclose it to any other person except as set forth in Section 10.8.1, and except as required under the Colorado Open Records Act (C.R.S. § 24-72-201 et. seq.), as amended and applicable. This Section 10.8 shall survive the termination of this Agreement.

§ 10.8.1 The receiving party may disclose "confidential" or "business proprietary" information after 7 days' notice to the other party, when required by law, arbitrator's order, or court order, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or to the extent such information is reasonably necessary for the receiving party to defend itself in any dispute. The receiving party may also disclose such information to its employees, consultants, or contractors in order to perform services or work solely and exclusively for the Project, provided those employees, consultants and contractors are subject to the restrictions on the disclosure and use of such information as set forth in this Section 10.8.

§ 10.9 The invalidity of any provision of the Agreement shall not invalidate the Agreement or its remaining provisions. If it is determined that any provision of the Agreement violates any law, or is otherwise invalid or

unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Agreement shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Agreement.

§ 10.10 Notwithstanding any provisions herein, this Agreement shall be deemed to include and be subject to all applicable requirements and provisions of all governing federal, state and local laws.

§ 10.11 The parties hereto understand and agree that Owner is relying on, and does not waive or intend to waive by any provision of this Agreement, the monetary limitations (presently \$387,000 per person and \$1,093,000 per occurrence) or any other rights, immunities, and protections provided by the Colorado Governmental Immunity Act, Section 24-10-101 *et seq.*, C.R.S. as from time to time amended, or any other limitation, right, immunity or protection otherwise available to Owner its officers, or its employees.

§ 10.12 The Architect shall perform all work under this Agreement as an independent contractor and not as an agent or an employee of Owner. The Architect shall be free from the control and direction of the Owner in the performance of the services, both under the terms of this Agreement and in fact. The Owner and Architect further stipulate and agree that Architect is customarily engaged in an independent trade, occupation, profession or business related to the performance of the services required by this Agreement. Architect understands that: (i) Owner will not pay or withhold any sum for income tax, unemployment insurance, Social Security or any other withholding pursuant to any law or requirement of any governmental body; (ii) Architect is obligated to pay federal and state tax on any moneys earned pursuant to this Agreement; (iii) Architect's employees are not entitled to workers' compensation benefits from the Owner or the Owner's workers' compensation insurance carrier; and (iv) Architect's employees are not entitled to unemployment insurance benefits unless unemployment compensation coverage is provided by Architect or some other entity. Architect agrees to indemnify and hold Owner harmless from any liability resulting from Architect's failure to pay or withhold state or federal taxes on the compensation paid hereunder.

§ 10.13 In connection with work to be performed under this Agreement, and without limiting the generality of any provision of this Agreement, Architect hereby agrees that it: (i) will not discriminate against any employee or applicant for employment because of race, color, creed, sex, sexual orientation, religion, national origin, or disability; (ii) will insure that applicants are employed and that employees are treated during employment without regard to their race, color, creed, sex, sexual orientation, religion, national origin, or disability; and (iii) will in all solicitations or advertisements for employees to be engaged in the performance of work under this Agreement state that all qualified applicants will receive consideration for employment without regard to race, color, creed, sex, sexual orientation, religion, national origin, or disability. Architect shall further comply with all applicable federal, state, and local laws, rules and regulations. Without limiting the generality of the foregoing, Architect shall comply with all applicable provisions of the Americans With Disabilities Act, 42 U.S.C. §12101, *et seq.* (Public Law 101-336), and all applicable regulations and rules promulgated thereunder by any regulatory agency. The Architect shall indemnify the Owner from any and all liability arising from Architect's failure to comply with all applicable laws or regulations.

ARTICLE 11 COMPENSATION

§ 11.1 For the Architect's Basic Services described under Article 3, the Owner shall compensate the Architect as follows:

.1 Stipulated Sum
(Insert amount)

« »

.2 Percentage Basis
(Insert percentage value)

« » (« ») % of the Owner's budget for the Cost of the Work, as calculated in accordance with Section 11.6.

.3 Other
(Describe the method of compensation)

« »

§ 11.2 For the Architect’s Supplemental Services designated in Section 4.1.1.29 and 4.1.1.30, the Owner shall compensate the Architect as follows:
(Insert amount of, or basis for, compensation. If necessary, list specific services to which particular methods of compensation apply.)

« As negotiated in a future Fee Adjustment AIA Document G802 »

§ 11.3 For Additional Services that may arise during the course of the Project, including those under Section 4.2, the Owner shall compensate the Architect as follows:
(Insert amount of, or basis for, compensation.)

« As negotiated in a future Fee Adjustment AIA Document G802 »

§ 11.4 Compensation for Supplemental and Additional Services of the Architect’s consultants when not included in Section 11.2 or 11.3, shall be the amount invoiced to the Architect plus « Ten » percent (« 10 » %), or as follows:
(Insert amount of, or basis for computing, Architect’s consultants’ compensation for Supplemental or Additional Services.)

« N/A »

§ 11.5 When compensation for Basic Services is based on a stipulated sum or a percentage basis, the proportion of compensation for each phase of services shall be as follows:

Schematic Design Phase	« Twenty »	percent (« 20 »	%)
Design Development Phase	« Twenty »	percent (« 20 »	%)
Construction Documents Phase	« Twenty-Five »	percent (« 25 »	%)
Procurement Phase	« Five »	percent (« 5 »	%)
Construction Phase	« Twenty-Five »	percent (« 25 »	%)
Record Documents	Five	percent (5	%)
Total Basic Compensation	one hundred	percent (100	%)

§ 11.6 When compensation identified in Section 11.1 is on a percentage basis, progress payments for each phase of Basic Services shall be calculated by multiplying the percentages identified in this Article by the Owner’s most recent budget for the Cost of the Work. Compensation paid in previous progress payments shall not be adjusted based on subsequent updates to the Owner’s budget for the Cost of the Work.

§ 11.6.1 When compensation is on a percentage basis and any portions of the Project are deleted or otherwise not constructed, compensation for those portions of the Project shall be payable to the extent services are performed on those portions. The Architect shall be entitled to compensation in accordance with this Agreement for all services performed whether or not the Construction Phase is commenced.

§ 11.7 The hourly billing rates for services of the Architect and the Architect’s consultants are set forth below. The rates shall be adjusted in accordance with the Architect’s and Architect’s consultants’ normal review practices.
(If applicable, attach an exhibit of hourly billing rates or insert them below.)

« See Exhibit “B” »

Employee or Category	Rate (\$0.00)
See Exhibit “B”	

§ 11.8 Compensation for Reimbursable Expenses

§ 11.8.1 Reimbursable Expenses are in addition to compensation for Basic, Supplemental, and Additional Services and include expenses incurred by the Architect and the Architect's consultants directly related to the Project, as follows: (All reimbursable expenses in excess of those identified in Exhibit "B" must be authorized in advance and in writing by the Owner)

- .1 Transportation and authorized out-of-town travel and subsistence;
- .2 Long distance services, dedicated data and communication services, teleconferences, Project web sites, and extranets;
- .3 Permitting and other fees required by authorities having jurisdiction over the Project;
- .4 Printing, reproductions, plots, and standard form documents;
- .5 Postage, handling, and delivery;
- .6 Expense of overtime work requiring higher than regular rates, if authorized in advance by the Owner except that no overtime will be paid for Basic Services;
- .7 Renderings, physical models, mock-ups, professional photography, and presentation materials requested by the Owner or required for the Project;
- .8 DELETED;
- .9 All taxes levied on professional services and on reimbursable expenses;
- .10 Site office expenses;
- .11 Registration fees and any other fees charged by the Certifying Authority or by other entities as necessary to achieve the Sustainable Objective; and,
- .12 Other similar Project-related expenditures as approved by the Owner.

§ 11.8.2 For Reimbursable Expenses the compensation shall be the expenses incurred by the Architect and the Architect's consultants plus « Zero » percent (« 0 » %) of the expenses incurred.

§ 11.8.3 The Architect shall not incur reimbursable expenses pursuant to Article 11 in excess of those identified in Exhibit "B" for the entire Project, without prior written approval of the Owner. However, in no event shall any single reimbursable expense exceed Five Hundred Dollars (\$500.00) without the prior approval of the Owner.

§ 11.9 DELETED

§ 11.10 Payments to the Architect

§ 11.10.1 Initial Payments

§ 11.10.1.1 An initial payment of « Zero Dollars and Zero Cents » (\$ « 0.00 ») shall be made upon execution of this Agreement and is the minimum payment under this Agreement. It shall be credited to the Owner's account in the final invoice.

§ 11.10.2 Progress Payments

§ 11.10.2.1 Unless otherwise agreed, payments for services shall be made monthly in proportion to services performed. Payments are due and payable upon presentation of the Architect's invoice. Amounts unpaid « Forty-Five » (« 45 ») days after the invoice date shall bear interest at the rate entered below, or in the absence thereof at the legal rate prevailing from time to time at the principal place of business of the Architect.
(Insert rate of monthly or annual interest agreed upon.)

« 1.00 » % « Monthly »

§ 11.10.2.2 The Owner shall not withhold amounts from the Architect's compensation to impose a penalty or liquidated damages on the Architect, or to offset sums requested by or paid to contractors for the cost of changes in the Work, unless the Architect agrees or has been found liable for the amounts in a binding dispute resolution proceeding.

§ 11.10.2.3 Records of Reimbursable Expenses, expenses pertaining to Supplemental and Additional Services, and services performed on the basis of hourly rates shall be available to the Owner at mutually convenient times.

§ 11.11 BILLING THE OWNER

The Architect's billing shall be in such form as may be prescribed by the Owner.

§ 11.12 OTHER

The Architect agrees that his services performed under this Agreement are considered labor performed or materials furnished for public works and as such the Architect agrees for himself and his consultants to waive any rights to claim a mechanic's or materialman's lien on the Project. Architect further agrees that all funds disbursed to him for services performed by consultants under this Agreement shall be held in trust for those consultants, and Architect guarantees to pay those consultants in a timely manner using those funds. The Architect agrees to look solely to the Owner for payment for their services. Further, the Architect agrees to advise and obtain the consent of its consultants with respect to this arrangement.

ARTICLE 12 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Agreement are as follows:
(Include other terms and conditions applicable to this Agreement.)

« N/A »

§ 12.1 ILLEGAL ALIENS

§ 12.1.1 In accordance with the mandatory provisions of Colo. Rev. Stat. § 8-17.5-101 et. seq., Architect certifies that it has not knowingly employed or contracted with an illegal alien to perform work under this Contract, and that Architect will participate in the E-Verify Program or the Department Program [as defined in Colo. Rev. Stat. § 8-17.5-101(3.3)] in order to confirm the employment eligibility of all employees who are newly hired to perform work under this Contract. Architect further certifies that it will not enter into a contract with a consultant who fails to certify to Architect that the consultant shall not knowingly employ or contract with an illegal alien to perform work under this Contract.

§ 12.1.2 Architect has confirmed the employment eligibility of all employees who are newly hired to perform work under this Contract through participation in either the E-Verify Program or the Department Program. Architect shall not use the E-Verify Program or the Department Program to undertake pre-employment screening of job applicants while the Contract is being performed.

§ 12.1.3 If Architect obtains actual knowledge that a consultant performing work under this Contract knowingly employs or contracts with an illegal alien, Architect shall:

1. Notify the consultant and the Owner within three days that Architect has actual knowledge that the consultant is employing or contracting with an illegal alien; and
2. Terminate the contract if within three days of receiving actual notice the consultant does not stop employing or contracting with the illegal alien, except that Architect shall not terminate the consultant if during such three days the consultant provides information to establish that the consultant has not knowingly employed or contracted with an illegal alien.

§ 12.1.4 Architect shall comply with any reasonable request by the Department of Labor and Employment (hereinafter referred to as the "Department") made in the course of an investigation that the Department is undertaking pursuant to C.R.S. § 8-17.5-102(5).

§ 12.1.5 If Architect violates the provisions of this paragraph, the Owner may terminate this Agreement for breach and Architect shall be liable for actual and consequential damages.

§12.2 OTHER SPECIAL PROVISIONS

§12.2.1 It is anticipated that Architect will engage other professionals to perform portions of its services. Such professionals shall be employed at Architect's sole cost and expense, unless otherwise agreed in writing by the Owner. The Architect shall obtain from each such professional a written acknowledgment of understanding that the Architect is not a "contractor" as defined by Section 38-26-101, C.R.S., and a waiver of any claim to entitlement of benefits under a public works bond furnished to the Owner by the Contractor, or subcontractors. All contracts entered into by the Architect with such professionals shall contain a provision acknowledging the terms of this subsection 12.2.1. The Architect shall forward the Owner a signed copy of each such acknowledgment and waiver along with a copy of each such agreement entered into between the Architect and a professional engaged by the Architect to perform a portion of the services.

§12.2.2 The Owner and the Architect acknowledge and agree that nothing in this Agreement implies any undertaking by the Architect for the benefit of or which may be enforced by the Contractor, its subcontractors, or the surety of any of them; it being understood that the Architect's obligations are to the Owner. Conversely, in performing such obligations, the Architect may not and shall not increase the burdens and exposure of the Contractor, its subcontractors, or the surety of any of them.

§12.2.3 Architect will comply with the terms of Section 8-17-101, *et seq.*, C.R.S., which states:

Whenever any public works financed in whole or in part by funds of the state, counties, school districts, or municipalities of the state of Colorado are undertaken in this state, Colorado labor shall be employed to perform the work to the extent of not less than 80% of each type or class of labor in the several classifications of skilled and common labor employed on such project or public works.

'Colorado labor' as used in this Agreement means any person who is a resident of the state of Colorado, at the time of the employment, without discrimination as to race, color, creed, sex, sexual orientation, marital status, national origin, ancestry, age, or religion except when sex or age is a bona fide occupational qualification.

Architect shall, in all respects, comply with the requirements of the above statute.

§12.2.4 Fiscal Funding: In accordance with Article X, Section 20(4)(b) of the Colorado Constitution, this Agreement shall neither create nor be construed to create any multiple-fiscal year direct or indirect Owner debt or other financial obligation whatsoever. The parties recognize that this Agreement is dependent upon the continuing availability and appropriation of funds beyond the term of the Owner's current fiscal period ending upon the next succeeding June 30, and that financial obligations of the Owner payable after the current fiscal year are contingent upon funds for that purpose being appropriated, budgeted, and otherwise made available. Notwithstanding any other provision of this Agreement, the Owner and the Architect understand and agree that the Owner may terminate this Agreement at or before the end of any Owner's fiscal year upon thirty (30) days' prior written notice to Architect with or without cause and without any liability, penalty or other obligation, except that Architect shall be paid the specified compensation for its services performed to the termination date, including reimbursable expenses then due.

§12.2.5 Condition Precedent: The parties acknowledge and agree that the Owner is currently involved in litigation that bears upon its ability to proceed with Project within the time contemplated herein, and further agree that all of the Owner's obligations hereunder are subject to and conditioned upon the Owner's receipt of all final judicial judgments, decisions, and orders as are necessary, in the Owner's sole and absolute judgment and discretion, before proceeding with the Project. Notwithstanding the foregoing, the Owner may by separate addendum hereto authorize the Architect to proceed with preliminary work on the Project as specified in such addendum, with compensation to be based upon sources not subject to the aforementioned litigation.

ARTICLE 13 SCOPE OF THE AGREEMENT

§ 13.1 This Agreement represents the entire and integrated agreement between the Owner and the Architect and supersedes all prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both the Owner and Architect.

§ 13.2 This Agreement is comprised of the following documents identified below:

- .1 AIA Document B101™-2017, Standard Form Agreement Between Owner and Architect, ~~as amended~~ by the Owner
- .2 DELETED
- .3 Exhibits:
(Check the appropriate box for any exhibits incorporated into this Agreement.)

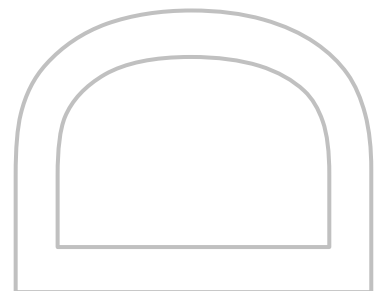
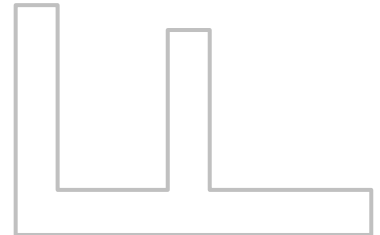
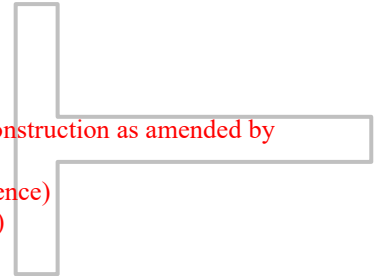
[] Other Exhibits incorporated into this Agreement:
(Clearly identify any other exhibits incorporated into this Agreement, including any exhibits and scopes of services identified as exhibits in Section 4.1.2.)



4 Other documents:

(List other documents, if any, forming part of the Agreement.)

1. Exhibit "A" - Scope of Work (? pages attached)
2. Exhibit "B" - Fee Schedule & Hourly Rates (? pages attached)
3. Exhibit "C" – Project Schedule (? pages attached)
4. AIA Document A201 - 2017, General Conditions of the Contract for Construction as amended by the Owner, dated December 5, 2017 (49 page draft attached)
5. Technical Specifications v6, dated November 2014 (584 pages by reference)
6. Sustainable Design Guidelines, dated June 2005 (90 pages by reference)
7. Sustainability Management Plan, dated 2017 (39 pages by reference)



This Agreement entered into as of the day and year first written above.

OWNER (Signature)

« »« »

(Printed name and title)

ARCHITECT (Signature)

« »« »

(Printed name, title, and license number, if required)

ALL CONTRACTS MUST BE APPROVED PER DISTRICT POLICY DJA

Poudre School District Policy DJA requires all contracts in excess of \$250,000 have Board of Education approval. Contracts up to \$250,000 must be approved by either the Superintendent, Executive Director of Finance, Purchasing and Materials Manager, or authorized delegate. This Contract is not valid until signed and dated below by an authorized person. Contractor is not authorized to begin performance until such time. If Contractor begins performing prior thereto, Poudre School District is not obligated to pay Contractor for such performance or for any goods and/or services provided hereunder.

APPROVED:

(Signature)

(Printed name, title, and date)

Approved at the Board of Education Meeting on _____

