



Colorado Spring Charter Academy

Middle School Addition and Existing Sports Center Mechanical Narrative

June 26, 2024

I. Mechanical and Plumbing Overview

1. The project consists of a new 2-story middle school addition of approximately 25,000 square feet (sf) and mechanical system replacement in the existing Sports Center, approximately 7,000 sf. Site location is 2560N Chelton Rd., Colorado Springs, CO 80909, the middle school addition is anticipated to be located on the southwest corner of the existing Sports Center. Spaces include:
 - i. Middle School
 - A. Maker's Space and Science Classrooms
 - B. General Classrooms
 - C. Toilet Core
 - D. Secure Entry
 - E. Administration Spaces
 - ii. Existing Sports Center
 - A. Gymnasium
 - B. Activities
 - C. Lockers
 - D. Storage Spaces

II. Mechanical Systems

1. HVAC

i. Design Criteria

A. Temperatures:

Summer Outdoor:	95°F db, 61°F wb
Summer Indoor:	75°F
Winter Outdoor:	-5°F db
Winter Indoor:	70°F

B. IECC Climate Zone: 5B

C. Humidity:

Humidity is not specifically controlled other than dehumidification that occurs naturally with the mechanical cooling process. Spaces will likely fluctuate between 20% to 60% relative humidity (RH).

D. Outside Air Ventilation:

Per local code requirements:

2021 International Mechanical Code

E. Lighting/Power:

Lighting:	1.0 watts/sf
Power:	0.5 watts/sf

F. Building Shell Construction

The following values are based on the 2021 International Energy Conservation Code for the above referenced climate zone.

Metal Framed Walls:	U=0.055
Mass Walls:	U=0.090
Roof (insulation above deck):	U=0.032
Fenestration (Fixed):	U=0.36 SHGC=0.38

G. Design Codes:

2021 International Building Code (IBC)
2021 International Mechanical Code (IMC)
2021 International Energy Conservation Code (IECC)
2021 International Plumbing Code (IPC)
2021 International Fire Code (IFC)

2. HVAC System

i. General:

- A. RTU-1 shall serve both levels of the Middle School Addition
- B. RTU-2 shall serve the existing gymnasium in the Sports Center utilizing new overhead ductwork distribution system, in tandem with replacement furnace FUR-1 utilizing existing underground air distribution system.
- C. FUR-2 shall serve the existing support spaces in the existing Sports Center. The existing ductwork distribution system will be re-used as possible.

- D. Provide a complete air distribution package including ductwork, hangers & supports, duct fittings, ductwork accessories, insulation and liner, and air terminal units.
- E. Provide a complete air device package including supply air outlet diffusers / grillers, return air inlet grilles, and exhaust grilles.
- F. Provide rectangular straight sound attenuators constructed of galvanized steel with fiberglass fill in the supply and return air ducts served by RTU-1.
- G. Provide a full hydronic piping and specialty package between the new heating water plant to the various terminal devices.

3. Primary Heating

i. Addition Heating Water Plant

The heating water plant shall serve RTU-1 heating coil, terminal unit reheat coils in the Addition, and miscellaneous heaters in the Addition.

- A. Provide and install (2) 999 MBH sea level input Lochinvar “CREST” boilers. Construct primary/secondary type heating water plant in the mechanical room. Each boiler shall be sized for 65% of the total building heating load to provide some redundancy.
- B. Provide each boiler with variable speed primary pump that will be controlled by its associated boiler.
- C. Boiler staging and capacity control shall be provided by the master boiler factory controller. This panel will energize/de-energize the boiler burner and modulates the boiler firing rates as required to meet the secondary piping system’s leaving water temperature setpoint. Provide BMS gateway with BACnet IP.
- D. The heating water plant shall be provided with code required heat, ventilation and emergency power off (EPO) switches at each boiler room exit. No combustion air openings are anticipated since all proposed heating equipment will be direct vented with sealed combustion air ducts to the outdoors.
- E. Provide (2) variable flow secondary heating water pumps with remote mounted variable frequency drives, air/dirt separator, expansion tank, glycol feed station, chemical pot feeder, and specialties as required for a complete heating water system.
- F. The heating water plant shall produce 30% propylene glycol heating water at a supply water temperature between 100°F and 150°F based on the system demand and/or outside air temperature reset.
- G. The hydronic piping distribution system, air handling unit heating coils, air terminal unit reheat coils, cabinet unit heaters and unit heaters shall be sized and selected for an entering water temperature of 150°F.
- H. Air handling unit heating coils shall be sized for a target water temperature drop of 40°F. Air terminal unit reheat coils shall be sized for a target water temperature drop of 25°F.

I. The (2) secondary heating water pumps shall be sized for 65% of the total building load for some redundancy, pumps shall operate in lead/standby and both shall operate in tandem as load requires.

J. The heating water system shall utilize a 30% propylene glycol solution for freeze protection.

K. P-1 & P-2 (secondary heating water pumps)

100 GPM at 80' Head

L. BP-1 & BP-2 (primary heating water pumps – boiler circulation)

40 GPM at 15' Head

M. Acceptable Manufacturers:

Heating water pumps: Bell & Gossett, Taco

Air Separator: Spirotherm VDN

Pump VFDs: ABB ACH-580, Danfoss

ii. Sports Center Heat Generation

A. The rooftop unit serving the existing gymnasium in the existing Sports Center, RTU-2, shall have gas fired heat exchanger, 81% combustion efficiency.

B. The replacement furnaces shall have gas fired heat exchangers, high efficiency condensing type, 92%+ combustion efficiency.

4. Primary Cooling

i. Air handling systems for the Addition and existing Sports Center shall have direct expansion (DX) cooling systems.

ii. DX cooling systems shall utilize code compliant A2L refrigerants (R454B or R32).

5. Air Handling Equipment

i. RTU-1 – Middle School Addition

A. One (1) packaged rooftop unit installed on the Addition roof shall be provided to serve the Addition spaces. Unit shall feature double wall construction and foam injected panel insulation. Provide unit with hydronic heating coil, packaged DX cooling with variable speed inverter duty compressors, 2" MERV-8 & 4" MERV-13 air filters, variable speed supply fan, variable speed return fan, and 100% economizer.

B. Provide hydronic heating coil with (1) coil circulation pump. Wet Rotor type with EC motor.

- C. This unit will provide heating, cooling, and ventilation air to the Middle School Addition.
- D. Variable air volume terminal units are to be provided with heating water reheat coils for zone control. Each terminal unit serving sound sensitive spaces shall be provided with an integral sound attenuator.
- E. All piping, wiring, etc. to the units shall be chased from below the roof and then up through the roof curb or mechanical equipment enclosure. Services shall not be run across the roof.
- F. RTU-1:
 - 32,000 CFM
 - 80 Ton Nominal DX Cooling
- G. Acceptable Manufacturers: Daikin, AAON

- ii. RTU-2 – Existing Gymnasium
 - A. One (1) packaged rooftop unit installed on the Addition roof shall be provided to serve the existing gymnasium, located in the existing Sports Center. Unit shall feature double wall construction and foam injected panel insulation. Provide unit with gas fired heat exchanger, packaged DX cooling with variable speed inverter duty compressors, 2" MERV-8 & 4" MERV-13 air filters, variable speed supply fan, variable speed power exhaust fan, and 100% economizer.
 - B. This unit will provide heating, cooling, and ventilation air to the existing gymnasium located in the existing Sports Center.
 - C. Unit shall be configured as single zone variable air volume.
 - D. RTU-2:
 - 7,000 CFM
 - 20 Ton Nominal DX Cooling
 - 500 MBH Sea Level input gas fired furnace
 - E. Acceptable Manufacturers: Daikin, AAON
- iii. FUR-1 & FUR-2 – Existing Gymnasium and Existing Support Spaces
 - A. Two (2) gas fired furnaces shall be provided to replace existing units. Units shall be provided with heat pump condensing units, cased cooling coil, MERV-8 air filters, high efficiency condensing type gas heat exchanger and modulating gas valve.
 - B. FUR-1 will serve the existing gymnasium in tandem with new RTU-2. FUR-1 shall re-use existing underground air distribution system.

C. FUR-2 will serve the existing locker rooms and support spaces, existing air distribution system will be re-used as possible.

D. FUR-1 & FUR-2:

1,800 CFM (each)

4.0 Ton nominal DX Cooling / Heat pump heating (each)

80.0 MBH Sea Level input gas fired furnace (each)

E. Acceptable Manufacturers: Carrier, Daikin

6. Fan Systems

- i. Exhaust fans shall be provided for the Addition.
- ii. A dedicated exhaust fan shall be provided for the Addition mechanical room, along with associated outside air intake to provide free cooling.
- iii. Dedicated general exhaust fans shall be provided in the Addition for the Maker Space and Science Classroom.
- iv. A dedicated exhaust fan shall be provided for a fume hood located in the Science Classroom. Fan shall be belt driven, with motor out of the corrosive air stream, and shall be provided with spark resistant construction and explosion proof disconnect.
- v. The existing locker room exhaust fan located in the existing Sports Center shall be replaced, with new fan having similar capacity.
- vi. Provide the following exhaust fans all with direct drive EC motors for speed control. All fans are to be controlled by the building automation system (BAS).

FAN TAG	FAN TYPE	AREA SERVED	AIRFLOW (CFM)	ESP In W.C.
EF-1	Roof Centrifugal	Addition Toilets	3,600	0.75"
EF-2	Roof Centrifugal	Addition Mechanical Room	1,500	1.0"
EF-3	Roof Centrifugal	Maker Space	1,500	0.5"
EF-4	Roof Centrifugal	Science Classroom	1,500	0.5"
EF-5	Roof Inline	Fume Hood	600	0.5"
(E)F-1	Indoor Utility Set	Existing Locker Rooms	1,230	0.375"

vii. Acceptable manufacturers: Loren Cook, Greenheck

7. Miscellaneous Heating

- i. Terminal Heating Devices

A. Hydronic cabinet unit heaters (CUH) serving vestibules.

- B. Hydronic unit heaters (UH) serving storage rooms and mechanical rooms.
- C. Variable air volume (VAV) terminal units will be provided with hydronic reheat coils for zones served by RTU-1.

- D. Acceptable Manufacturers:

CUHs & UHs: Vulcan, Daikin

VAVs: Titus, Krueger

8. Miscellaneous Cooling

- i. Electrical Room and IDF Room

- A. Provide Ductless Split System air conditioning/heat pump systems with indoor fan coil with a remote condensing unit capable of -20°F ambient cooling start and operation. Units shall be controlled through stand-alone controls provided by the equipment manufacturers. BAS shall monitor and alarm the space temperature.

- B. Provide with code compliant A2L refrigerants (R454B or R32).

DFC-1/DCU-1

Area Served: Addition Electrical Room

Nominal Capacity: 3.0 Tons

DFC-2/DCU-2

Area Served: Addition IDF Room

Nominal Capacity: 3.0 Tons

- C. Acceptable manufacturers: Trane/Mitsubishi, Daikin, Carrier

9. Air and Hydronic Distribution

- i. Ductwork:

- A. Materials:

G90 galvanized steel sheetmetal ductwork shall be used for supply, return and exhaust.

Ductwork serving the fume hood located in the Science Classroom shall be constructed of stainless steel with all welded seams and joints.

Grilles, registers, and diffusers shall be of steel or aluminum construction. Diffusers located in excess of 15'-0" above finished floor (A.F.F.) shall be of high capacity, long throw, drum louver type.

All ductwork shall be constructed in accordance with the latest edition of SMACNA Duct Construction Standards – Metal and Flexible.

B. Sizing:

All low velocity supply, return, and exhaust ducts shall be sized at 0.08"/100'.

Medium pressure ductwork upstream of VAV terminal units shall be sized at 0.15"/100' with a maximum velocity of 1,800 FPM.

C. Duct Penetrations:

Provide combination fire/smoke dampers at all duct penetrations of rated shafts, rated corridors, or building separations.

Provide fire dampers at all penetrations of fire rated walls. Fire dampers shall be Type "B" only.

ii. Existing Ductwork (existing Sports Center Only)

- A. All existing ductwork that is re-used shall be professionally cleaned, have any damage repaired to like-new condition, sealed air tight to SMACNA seal class "A", and have any existing insulation patched and repaired.

iii. Piping Distribution:

- A. The heating system fluid will consist of 30% propylene glycol with corrosion inhibitors for water treatment and freeze protection.
- B. Hydronic piping NPS 2 and smaller shall be of Type "L" copper, solder joints. NPS 2-1/2 and larger shall be of schedule 40 steel, ASTM A-53 Grade B, Type E, with black finish, and buttweld joints, schedule 40 buttweld fittings.
- C. Accessories: Provide all valves, specialties, and accessories for a complete piping system including 55 gallon glycol feed unit and bladder type expansion tank.

iv. Insulation:

- A. All supply and return air ductwork not provided with acoustic liner shall be wrapped with 2" fiberglass duct wrap.
- B. All outdoor ductwork insulation thickness shall be increased to obtain an R-12.0 assembly or better.
- C. All ductwork insulation shall be provided with continuous vapor barrier.
- D. All Exposed round (or flat oval) ductwork shall be lined with 1" thick acoustic liner. Johns Manville Spiracoustic Plus or equal.
- E. All heating water piping shall be insulated with 1-1/2" or 2" thick fiberglass pipe insulation as required to meet the 2021 IECC.

- F. All piping insulation shall be provided with a continuous vapor barrier.
- G. Removable insulation jackets shall be provided for all temperature control valves, expansion joints, pump volutes, unions, and check valves.
- v. Provide direct-vent flues and combustion air ducts of materials as required for the following pieces of equipment:

A. Heating Water Boilers:

AL29-4C double wall stainless steel flue and galvanized sheet metal combustion air with 1" duct wrap.

B. Gas fired domestic water heaters:

Schedule 40 solid core CPVC flue and schedule 40 solid core CPVC combustion air with 1" duct wrap.

10. System Test and Balance

- i. All mechanical systems shall be tested and balanced by a NEBB or TABB certified Contractor. Test and Balance contractor shall include time to assist with commissioning activities.
- ii. Acceptable Test and Balance Firms: JPG Engineering, Griffith Engineering Services, Lawrence H. Finn and Associates.

11. Temperature Controls

- i. A direct digital control (DDC) system shall provide the basis of the temperature control system. The system will be computer based and will allow for the mechanical systems to be controlled and monitored from a remote location or from within the building itself. Provide a full graphics package. All mechanical equipment shall interface with and be controlled through the BAS system with the following exceptions:
 - A. Miscellaneous Electric Heaters
 - B. Exhaust fans for individual/remote toilet rooms and janitor closets.

III. Plumbing System

1. Domestic Water

- i. Site Utilities:
 - A. It is anticipated that the new 2" water service will be utilized for new proposed addition and will back feed the existing Sports Center. The existing 1" water service shall be removed, and water tap fees credited back against the new water service.
 - (a) A new reduced pressure backflow preventer and pressure reducing station shall be installed at the new water entry room. Assume this room will also contain the new fire entry.

- B. A new 2" cold water line shall extend from the new water service and back feed the existing water service in the Sports Center, through the new addition.
- ii. Piping:
 - A. The domestic cold water, hot water and hot water recirculation and condensate piping above ground in the building shall be Type "L" hard copper with no-lead solder and fittings.
- iii. Water Heater:
 - A. A gas-fired tank type domestic hot water heater will be provided and will be sized and controlled to store 140°F hot water with a building thermostatic mixing valve to provide 120°F hot water to the building.
 - B. A new 1" hot water and $\frac{3}{4}$ " hot water circ lines shall extend from the new water heater and back feed the existing hot water needs in the Sports Center, through the new addition. The existing water heater in Sports Center can then be removed.
 - C. Basis of design is Bradford White EF-100T300E.
- iv. Domestic Water Recirculation Pump:
 - A. The domestic hot water will be circulated to provide instantaneous hot water at all fixtures and will operate continuously during the occupied periods. Provide one pump, 5 gpm at 15' head. Pump to be controlled on occupancy period through the BAS.

2. Waste and Vent Piping:

- i. Utilities:
 - A. A new 4" building drain will be provided to $\pm 5'-0"$ outside of the new building addition. Continuation will be by the civil engineer to the street.
 - B. Existing 4" building drain from the Sports Center shall remain active for those existing fixtures.
- ii. Piping:
 - A. Construct below ground waste piping solid core PVC to $\pm 5'-0"$ outside the building footprint.
 - B. Waste and vent piping above grade in building shall be service weight cast iron with no-hub fittings, assumed ceiling space is a return air plenum. All plumbing VTR's shall be located 20' minimum from any outside air intakes.

3. Storm Piping:

- i. Roof drains and overflow roof drain systems shall run totally independent of each other, and the roof drainage system will terminate below grade. The overflow roof drainage system will discharge above grade with a downspout nozzle to a splash block. The limit of responsibility shall stop at $\pm 5'-0"$ outside of building footprint. Material shall be the same as the waste and vent system. It is anticipated that overflow scuppers will be used when roof drains are located near the exterior wall of the building.

4. Gas Piping:

- i. New underground gas piping shall run from the existing gas meter, across the parking lot to the new addition. Gastite polyethylene piping system shall be used for underground installation.

Existing gas meter will likely need to be upsized by the gas provider for the new gas load of the addition.

- ii. Above ground natural gas piping shall be Schedule 40 black steel. Piping sizes 2" and smaller shall be screwed joints. Piping sizes 2-1/2" and larger shall have welded joints.
- iii. Gas piping will be routed to the new rooftop units and new water heater.

5. Plumbing Fixtures: Refer to architecture plans for quantities and locations.

- i. Water Closets: Wall hung, vitreous china, siphon jet type (1.6 GPF) with a battery operated electronic flush valve. Water saving option (LEED/CHPS); provide manual or electronically operated dual flush (1.6/1.1 GPF) flush valve.
- ii. Urinals: Vitreous china, siphon jet type (0.125 GPF) with a battery operated electronic flush valve (LEED/CHPS).
- iii. Lavatories: Vitreous china, self-rimming counter-top or wall hung type. Faucet shall have an electronically operated faucet with a 0.5 GPM flow restrictor for water saving feature.
- iv. Sinks: 18-gauge stainless steel self-rimming type. Faucet shall be manually operated with a 1.5 GPM flow restrictor for water saving feature (LEED/CHPS).
- v. Science Sinks: Sinks to be provided by others as integral to the acidproof counter tops. Provide deck mount faucet for hot and cold water, Delta Model 25C3947.
- vi. Mop Service Basins: Floor type, molded stone, 24"x24"x10" size.
- vii. Electric Water Cooler with Bottle Fill Station: Stainless steel, ADA, high/low with bottle fill station, 120/60/1 power.

6. Insulation:

- i. Domestic cold water will have 1" thick fiberglass type insulation with all service jacket with self seal lap.
- ii. Domestic hot and hot water recirculation will have 1" of fiberglass insulation for up to 1" piping, 1-1/2" fiberglass for piping above 1". Provide with all service jacket with self seal lap.
- iii. Roof drain and overflow roof drainage will be ½" fiberglass insulation for up to 6" piping, 1" fiberglass for 6" and larger. Provide insulation on all horizontal piping including drain bodies. Indoor condensate piping from air conditioning units and similar equipment shall have ½" of fiberglass insulation.
- iv. Provide PVC fitting covers all of the above mentioned systems.

7. Miscellaneous Plumbing:

- i. Provide hose bibbs, stainless steel box type with door in each toilet group for floor wash down.
- ii. Provide wall hydrant spaced on the exterior of the new building addition at maximum 150'.
- iii. Provide one yard hydrant on the roof for cleaning HVAC units.
- iv. Provide floor drains/sinks with trap seals as shown on architectural plans and/or as follows:
 - A. Toilet rooms where there are more than (2) water closet/urinals in the toilet room. All single toilet rooms will not have a floor drain.
 - B. Mechanical equipment rooms.
 - C. Janitor's rooms.

- v. Provide a simplex sump pump with oil sensing system for the elevator pit.
- vi. Provide emergency shower with eyewash and mixing valve in science room and science prep room.
- vii. Provide neutralization tanks below all science room sinks.
- viii. Provide gas control panel with solenoid valve and two (2) emergency gas push button off switches. Isimet Model LSP-GO-F-KP2

IV. Fire Protection

1. Fire Sprinklers

- i. Provide a complete sprinkler system for the entire building in conformance with NFPA 13. All heads shall be fully recessed, concealed type in finished areas, brass pendant in all exposed ceiling and unfinished areas.

2. Utilities

- i. Provide a new 6" fire service with double check valve assembly. Limit of responsibility shall be 10' outside the building.

3. Miscellaneous

- i. Smoke detectors at the rooftop units shall interface with the fire alarm system.

END OF MECHANICAL NARRATIVE