ITEM OPPORTUNITY SYNOPSIS

Scouting Number:	2024-081
Name of the item to be scouted:	Energy Recovery Mechanical System
State item to be used in:	Colorado
Describe the Item:	
Please describe the item application/the end use of the item.	For the construction of the new Energy and Minerals Research Facility (EMRF) for the U. S. Geological Survey (USGS) at the Colorado School of Mines (Mines), 1000 18th Street, Golden, Colorado 80401, provide a packaged ultra high performance energy recovery mechanical system (ERS) delivered to the EMRF construction site. This project is federally funded by the President Joe Biden's Bipartisan Infrastructure Law (BIL). Therefore, the material used for construction is required to be compliant with the Build America, Buy America Act (BABAA). This NIST MEP Supplier Report seeks a BABAA compliant ERS that meets or exceeds the basis of design. The basis of design is a Konvekta Energy Recovery Mechanical System (ERS) described herein (including additional information). The basis of design ERS system meets or exceeds the design requirements including the strict technical requirements, maximum size requirements, maximum delivery schedule, and the maximum cost parameters enclosed. See also the requirements stated in the enclosed specifications, drawings, dimension and performance requirements, and other documents including warranty requirements. Packaged ERS system and associated components and accessories include the following: 1. Coils 2. Pumps 3. Automatic Control Valves 4. Ball and Butterfly Valves 5. Air and Dirt Separator 6. Diaphragm-Type Expansion Tanks 7. Brazed Plate Heat Exchangers 8. Non-Slam Check Valves 9. Combination Pressure and Temperature Relief Valves 10. Electronic Flow Sensors 11. Electronic Temperature Sensors 12. Electronic Pressure Sensors and Transmitters 13. Programmable Logic Control Hardware and Software to operate and
Supplier Information:	
Type of Supplier Being Sought (select from the list below):	
Manufacturer	x
Contract Manufacturer	
Distributor	
Other (Please Specify)	
Reason for Scouting Submission (select from the list below)	
2nd Supplier	
Price	
Re-Shore	
Past supplier no longer available	
New Product Startup	
BABA	x
Other (Please Specify)	
Summary of Technical Specifications and Performance Requirements:	
Describe the manufacturing processes (elaborate to provide as much detail as possible)	Electronic and mechanical assembly.
Provide dimensions / size / tolerances / performance specifications of the item	See information provided.
List required materials needed to make the product, including materials of product components, if applicable	Various, see information provided.
Are there applicable certification requirements?	
Yes	x
No	
Please explain:	NEMA, National Electrical Code (NEC} Current Version, NFPA 70 Current Version
Are there any applicable regulations that apply to the production of this item?	
Yes	
No	x
Please explain:	

Are there any other standards / requirements?	
Yes	x
No	
Please explain:	See enclosed Energy Recovery System for Laboratory Ventilation System - Minimum General Requirements AND other requirements stated in other documents provided.
Additional Comments:	
Additional technical comments:	See enclosed specification section and Konvekta ERS information.
Volume and Pricing:	
Estimated Potential Business Volume (i.e. #units per day, month, year):	Limited to one set of equipment.
Estimated Target Price/Unit Cost Information:	Maximum total costs shall be $2,135,000 including shipping, start up services including commissioning and coordinating the ERS with Building Automation System, and required minimum manufacturer's warranty (see specifications). Costs also include providing approved submittal paperwork required in the specifications.
Delivery Requirements:	
When is it needed by? (Immediate, 30 days, 6 months, etc.)	Delivery schedule shall be no later than 3:00 PM (local time) October 31, 2025 for the manufacturer, packaging, and transportation of the ERS. If the schedule is for the delivery of the ERS to be on any date prior to listed above, this placement date will need to be coordinated with the general contractor. No storage fees will be allowed for the time between the manufacturing date and the delivery date. Submittal approval due date shall be no later than 3:00 PM (local time), December 20, 2024.
Describe packaging requirements (i.e. individually/group packaging, etc.)	Crate and package ERS for secure and undamaged transportation and delivery.
Where will this item be shipped?	Shipping will be to Golden, Colorado 80401, at the construction site address listed above.
Additional Comments:	
Is there other information you would like to include?	

SECTION 23 57 19

ENERGY RECOVERY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Abbreviations:
1. AHU – Air Handling Unit
2. BMS – Building Management System
3. ERS – Energy Recovery System
4. HRU – Heat Recovery Unit
5. MC – Mechanical Contractor
6. VFD – Variable Frequency Drive

B. Extent of work required is indicated on drawings and schedules, and within this section.

C. Types of energy recovery specified in this section include the following:
1. High efficiency run around energy recovery system (ERS) with controller.
2. Air flow measuring stations.

D. Insulation: Mechanical insulation, jacketing, and covering systems for the energy recovery piping.

E. Valves: Control valves and general duty valves for the energy recovery piping.

F. Piping: Pipe materials, fitting materials, and joining methods for the energy recovery piping.

G. Refer to other Division 23 sections for installation of insulation, valves, and piping.

H. Refer to Division 23 for work related to concrete pads, piping, ductwork, insulation, specialties, building automation system, etc. necessary for a complete operational system.

I. Refer to Division 26 for the following work.
1. Power supply wiring from power source to power connection on skids. Including starters, disconnects, and required electrical devices except where specified as furnished or factory installed, by manufacturer.
2. Wiring between electrically operated skids and between skids and field installed control devices.

J. Provide the following electrical work, complying with requirements of Division 23 for Automatic Temperature Controls:
1. Control wiring between field-installed controls, indicating devices, and control panels.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturing Company shall have a minimum of fifteen (15) years of experience with application of the specified system for heat recovery, heating, and cooling applications.

B. Codes and Standards:
   1. NEMA Compliance: Provide electrical components in compliance with NEMA Standards.
   2. NEC Compliance: Comply with National Electrical Code (NFPA 70 Current Version) as applicable to installation and electrical connections of ancillary electrical components.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights, installation and start-up instructions, and furnished specialties and accessories.

B. Drawings: Submit manufacturer’s drawings including the piping and instrumentation diagram (PID), equipment dimensions and weights, required clearances, and methods of installation.

C. Wiring Diagrams: Submit manufacturer’s electrical requirements for power supply wiring to hydronic modules, Submit manufacturer’s ladder-type wiring diagrams for control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.

D. Record Drawings: At project closeout, submit record drawings of installed systems and products.

E. Maintenance Data: Submit maintenance data and parts lists for the entire system including pumps, sensors, valves, controls and accessories: including “troubleshooting” maintenance guide; product data, shop drawings, and wiring diagrams in maintenance manual.

1.4 WARRANTY

A. The warranty shall be one year, parts only, from date of startup, not to exceed 18 months from shipment.

B. The coils shall be warranted against mechanical defects for a period of 2 years from the date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by the following:
   1. High Efficiency Energy Recovery System (ERS):
      a. Konvekta USA

b. Alternate manufacturers shall submit a substitute request form and shall guarantee equivalent annual energy savings based on hourly bin analysis.

2. Coils (Provided by Konvekta):
   a. Konvekta
3. Pumps with VFD (Provided by Konvekta):
   a. Grundfos
4. Mechanical Insulation (Provided by MC):
   a. Johns Manville Corporation
   b. Owens Corning Corporation
   c. CertainTeed
   d. Pittsburgh Corning Corporation
5. Jacketing & Covering Products (Provided by MC):
   a. Childers
   b. Ceel-Co
   c. Zeston
6. Automatic Control Valves (Furnished by Konvekta, Installed by Konvekta & by MC):
   a. Belimo
7. Ball Valves (Provided by Konvekta and by MC):
   a. Apollo
   b. Kitz Corporation
   c. Milwaukee Valve Company
   d. Nibco
   e. Watts
8. Butterfly Valves (Provided by Konvekta and by MC):
   a. ABZ Valve and Controls
   b. Bray Controls
   c. DeZurik
   d. Keystone
   e. Kitz Corporation
   f. Milwaukee Valve Company
   g. Nibco Inc
   h. Watts Regulator Company
9. Air & Dirt Separator (Provided by Konvekta):
   a. Spirotherm, Inc
10. Diaphragm-Type Expansion Tanks (Provided by Konvekta):
    a. Amtrol, Inc
    b. Armstrong Pumps, Inc
    c. Bell & Gossett
    d. Taco, Inc
    e. The John Wood Company
    f. Wessles
11. Brazed Plate Heat Exchangers (Provided by Konvekta):
    a. SWEP International
12. Glycol Feeder (Provided MC):
    a. Bell & Gossett
    b. J.L. Wingert Company
    c. Wessels Company
13. Strainers (Provided MC):
    a. Armstrong International

b. Hoffman Specialty
c. Metraflex Company
d. RP&C Valve
e. Spirax Sarco
f. Watts Regulator Company
g. Keckley

14. Non-Slam Check Valves (Provided by Konvekta):
    a. American Wheatley
    b. Keystone
    c. Kitz Corporation
    d. Metraflex
    e. Milwaukee Valve Company
    f. Nibco Inc
15. Air Vents (Provided MC):
    a. Amtrol, Inc
    b. Armstrong International
    c. Bell & Gossett
    d. Hoffman Specialty
    e. Spirax Sarco
16. Combination Pressure and Temperature Relief Valves (Provided by Konvekta):
    a. Amtrol Inc
    b. Bell & Gossett
    c. Spirax Sarco
    d. Watts Regulator Company
17. Electronic Flow Sensors (Furnished by Konvekta, Installed by MC):
    a. Belimo
18. Electronic Humidity/Dew Point Sensors and Transmitters (Provided MC):
    a. Vaisala
19. Electronic Temperature Sensors (Provided by Konvekta):
    a. IFM Electronic
20. Electronic Pressure Sensors and Transmitters (Provided by Konvekta):
    a. IFM Electronic
21. Averaging Temperature Sensors (Provided MC):
    a. Automation Components Inc

2.2 MATERIALS AND COMPONENTS

A. GENERAL:
1. Provide a high efficiency run around energy recovery system, consisting of heat exchangers for supply and exhaust air handling units and a factory packaged hydronic module. The system shall be a multi-functional system, providing combined heat recovery, heating, and cooling using one coil in each air handling unit. Performance shall be as listed in the coil schedules for “summer”, “transition”, and “winter” design conditions.

B. PIPING INSULATION MATERIALS:
1. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated. Jacket with tensile strength of 35 lbs/in, mullen burst 70 psi, Beach Units puncture 50 oz. in/in, permeability 0.02 perm factory applied vapor barrier jacket and adhesive self-sealing lap joint. “K” factor shall be

maximum 0.23 at 75°F MRT, 0.24 at 100°F MRT, 0.29 at 200°F MRT and 0.36 at 300°F MRT.

C. JACKETS FOR FIELD APPLICATION
   1. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
   2. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 30-mil thick, flame spread 25, smoke developed 50; roll stock ready for shop or field cutting and forming.
      a. Adhesive: As recommended by jacket material manufacturer.
      b. Color: White
      c. Factory- fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      d. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
   3. Metal Jacket:
      a. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
      b. Sheet and roll stock ready for shop or field sizing.
      c. Thickness shall be 0.016” minimum.
      d. what.
      e. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      f. Provide factory-fabricated fitting covers:
         a) Same material, finish, and thickness as jacket.
         b) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         c) Tee covers.
         d) Flange and union covers.
         e) End caps.
         f) Beveled collars.
         g) Valve covers.
         h) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated and additional finishes as specified.

F. STEEL PIPES AND PIPE FITTINGS:
   1. Black Steel Pipe: ASTM A 53, Grade B, type E, electric resistance welded.
   2. Malleable-Iron Threaded Fittings: ANSI/ASME B16.3; plain or galvanized as indicated (Class 150)
   3. Malleable-Iron Threaded Unions: ANSI B16.39, Class 250 or 300; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal- to-metal seats (iron, bronze or brass); plain or galvanized as indicated (Class 300).
   4. Steel Flanges/Fittings: ANSI/ASME B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.

a. Material Group: Group 1.1
b. End Connections: Buttwelding
c. Facings: Raised-face

5. Application:
a. 2 Inches and Smaller:
b. Schedule 40, black steel with 150 lb. malleable iron threaded fittings.
c. 2-1/2 Inches and Larger:
d. Schedule 40, seamless or ERW (std. weight 12 inches and over) black steel with flanged or welded joints.
e. Fittings: Standard weight / Extra strong, seamless steel, buttweld type.
f. Flanges: 300 lb. forged steel slip-on or welding neck type.
g. Bolting: Regular square head machine bolts with heavy hexagonal nuts.
h. Gaskets: Thickness, material, and type suitable for fluid to be handled, and design temperature and pressures.

G. COPPER TUBE AND FITTINGS:
1. Copper Tube: ASTM B 88; Type K; hard-drawn temper, except as otherwise indicated.
2. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

H. MISCELLANEOUS PIPING MATERIALS/PRODUCTS:
1. Welding Materials: Except as otherwise indicated, provide welding materials as determined by the Installer to comply with installation requirements.
a. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
2. Soldering Materials: All soldering materials shall be lead free.
a. 95-5 Tin-Antimony: ASTM B 32, Grade 95TA. Melting Range 450-470 degrees F.
b. Silver-Tin Alloy: Fed. Spec. QQ-S-571E, NSFC2. Melting Range 430 to 530 degrees F.
c. Flux: All flux shall be lead free, water soluble, and compatible with the solder and the materials being joined. ASTM B813-93.
3. Brazing Materials: Except as otherwise indicated, provide brazing materials to comply with installation requirements.
a. Comply with AWSA 5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
b. Copper phosphorus -Bcup-5, 15 percent solver content, melting range 1190 to 1480 degrees F.
c. Silver - BAg-36, 45 percent silver, cadmium-free. Melting range 1195 to 1265 degrees F.
4. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.

I. AUTOMATIC CONTROL VALVES:
1. Control valves shall have equal percentage equal percentage flow characteristics.
2. Control Valve Construction:
a. Butterfly Valves 2" and above (2-way and 3-way modulating):

b. Use with ASME Class 125/150 flanges conforming to ANSI B16.5 standards.
c. Materials:
    a) Body – ductile iron ASTM A536
    b) Disc – 304 stainless steel
    c) Seat - EPDM
    d) Shaft – 416 stainless steel
    e) Bearing - RPTFE
    f) Stem seal – EPDM (lubricated)
d. Fluid Temperature Range: -22 deg F to 250 deg F
e. Body Pressure Rating: ANSI Class 150
f. Close-off pressure: 285 psi
g. Leakage: bubble tight
h. Ball Valves 1" and above (2-way modulating):
i. NPT female ends.
j. Materials:
    a) Body – forged brass, nickel plated
    b) Ball – 316 stainless steel
    c) Stem – 316 stainless steel
    d) Seat - PTFE
    e) Packing – 2 EPDM O-rings, lubricated.
k. Fluid Temperature Range: -22 deg F to 250 deg F
l. Close off pressure (1/2”-2”): 200 psi
m. Close-off pressure (3”): 100 psi
n. Leakage: 0%
o. For motorized butterfly and ball valves, the operator shall be provided with the valve by the valve manufacturer.

3. Control Valve Operators/Actuators:
    a. All automatic control valves shall be provided with actuators of sufficient power for the duty intended.
    b. Valve body and actuator selection shall be sufficient to handle system pressure which will be encountered on the project.
    c. Electronic fail-safe reversible with switch.
    d. Push button manual override.
    e. Actuator housings shall be NEMA 2.
4. Manufacturer shall size control valves for proper control characteristics for each application.
5. Water control valves shall be sized for a pressure drop between 4 to 6 psig at full flow condition.
6. Select valves to fail in normally open or closed position as follows:
    a. Heat Recovery Loop Service:
    b. Research labs, animal holding rooms, etc.
        a) N.O.
        b) Or as dictated by life safety, freeze protection, humidity, fire or temperature protection.

J. BRONZE BALL VALVES:
1. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
    a. Description:
    b. Standard: MSS SP-110.
    c. WSP Rating: 150 psig.

d. CWP Rating: 600 psig.
e. Fluid Temperature Range: -22 deg F to 280 deg F.
f. Body Design: Two piece.
g. Body Material: Bronze.
h. Ends: Threaded or Soldered.
i. Seats: PTFE or TFE.
j. Stem: Bronze.
k. Ball: Chrome-plated brass.
l. Port: Full for 2” and smaller, regular port for 2-1/2” and larger.

K. IRON, SINGLE-FLANGE BUTTERFLY VALVES:
1. Single-Flange Butterfly Valves:
a. Description:
b. Standard: MSS SP-67, Type I.
c. CWP Rating: 250 psig.
d. Fluid Temperature Range: -20 deg F to 250 deg F.
e. Body Design: Lug type; suitable for bidirectional and dead-end service at rated pressure without use of downstream flange.
f. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
g. Molded in liner: EPDM.
h. Stem: One- or two-piece stainless steel.
i. Disc: Aluminum bronze or stainless steel.

L. DIAPHRAGM EXPANSION TANKS:
1. Tank: Forged steel, rated for 250-psig working pressure and 240 deg F maximum operating temperature. Factory tested with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Replaceable heavy duty butyl rubber securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

M. AIR AND DIRT SEPARATORS (KONVEKTA SKID):
1. Full flow coalescing type combination air eliminator and dirt separator.
2. Shell shall be fabricated steel; ASME constructed and labeled for 150-psig minimum working pressure and 270 deg F maximum operating temperature.
3. Factory tested with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1
4. Include an internal bundle filling the entire vessel to suppress turbulence and provide high efficiency. The bundle shall consist of a copper core tube with continuous wound copper medium permanently affixed to the internal element.
5. Each eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.
6. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.

7. Air separators shall be capable of removing 100% of the free air, 100% of the entrained air and up to 99.6% of the dissolved air in the system fluid.
8. Dirt separation shall be at least 80% of all particles 30 micron and larger within 100 passes.

N. BRAZED PLATE HEAT EXCHANGERS:
1. Constructed of 316/316L stainless steel plates with copper brazing.
2. Provide connections type as coordinated with the project requirements.
3. Units shall be ASME rated for 250 psig operating pressure, -40 deg F (-40 deg C) minimum temperature, 300 deg. F. (149 deg. C) maximum temperature, have a heat transfer area to be produce the conditions scheduled on the drawing.

O. GLYCOL FEEDERS:
1. Tank: 50-gallon (**-gallon) polyethylene tank with a removable polyethylene cover. Provide with a 2-inch vent opening on top for ventilation and filling. A ½ inch suction and under drain with hose bib for draining the tank and a pump shut off valve shall be provided.
2. The tank shall be supported by a sturdy steel frame with foot pads as an integral part of the tank.
3. Pump: All bronze, rotary gear pump with a 3/4 HP-1725 RPM motor mounted integrally with the pump. The pump shall be designed to produce 5.0 GPM at the required system pressure.
4. Piping: Type L copper pump discharge, including expansion tank, a ¾-inch check valve, balance valve, y-pattern strainer, ¾-inch threaded female "T" for connecting the Glycol Feeder to the system piping, and a pressure relief valve set at 50 (**) psi, which will dump any system over pressure back to the glycol feed tank.
5. Controls: The control cabinet shall be a NEMA I enclosure with a large LEXAN viewing window mounted in the cabinet door. The following components shall be mounted on the inside panel: Low level liquid alarm light, low level alarm silencer switch, pump test switch and indicating light, and a 0-60 (**) psi system pressure gauge. The low-level switch shall be mounted 3-inches above the bottom of the tank. A low-level audible alarm shall be mounted on the side of the panel. In addition, two extra, normally open contacts shall be provided for remote low level warning light or alarm. A 3-35 (**) psi adjustable pressure switch shall control the system pressure.

P. STRAINERS:
1. Y-Pattern Strainers:
   a. Body (NPS 2 and smaller): ASTM A-351 Grade CF8M 316 stainless steel, with tapped retainer cap and bottom drain connection.
   b. Body (NPS 2-1/2 and larger): Ductile Iron conforming to ASME standards with tapped retainer cap and bottom drain connection
   c. End Connections: Threaded ends for NPS 2 and smaller; flanged ends, Class 250 for NPS 2-1/2 and larger.
   d. Strainer Screen: 304 Stainless steel perforated screen strainer with 50 percent free area.
   e. Temperature Range: -20 deg F to 406 deg F.
   f. Pressure Rating: 250 psi minimum at 400 deg F.

Q. NON-SLAM CHECK VALVES:

1. Wafer Style
    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 300 psig.
    c. Body Design: Horizontal flow.
    d. Body Material: Cast Iron.
    e. Ends: Flanged.
    f. Trim: Stainless Steel.
2. Globe Style
    a. Standard: MSS SP-71, Type I.
    b. CWP Rating: 300 psig.
    c. Body Design: Clear or full waterway.
    d. Body Material: Cast Iron.
    e. Ends: Flanged.
    f. Trim: Stainless steel.
    g. Gasket: Asbestos free.

R. AIR VENTS:
    a. Body: Cast iron.
    b. Internal Parts: Nonferrous.
    c. Operator: Stainless steel seat and pin.
    d. Capable of 25 scfm elimination at 250 psig
    e. Inlet Connection: NPS 3/4" FNPT.
    f. Discharge Connection: NPS 1/2” FNPT.
    g. CWP Rating: 250 psig.
    h. Maximum Operating Temperature: 300 deg F.

S. COMBINATION PRESSURE & TEMPERATURE RELIEF VALVES:
1. Hydronic System Safety Relief Valves: Diaphragm operated, cast-iron or bronze body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem.
2. Safety relief valve shall be designed, manufactured, tested and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code.
3. 250 psig working pressure and 250 degrees F maximum operating temperature.
4. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure to suit system and have the capability for field adjustment. Set valve to relieve at 10 psi above operating pressure.

T. ELECTRONIC FLOW SENSORS:
1. Calibrated ultrasonic flow sensor, temperature and glycol compensated.
    a. Cast Iron Body.
    b. Flange ANSI 250
    c. Fluid Temperature: -5 F – 250 F
    d. Enclosure: UL Enclosure Type 2, NEMA 2

U. ELECTRONIC TEMPERATURE SENSORS:
1. Temperature sensor for connection to a control monitor with a maximum operating voltage of 32 volts:
    a. Stainless steel 316L.
    b. Installation length of 100mm.

c. Gold plated contacts.
d. Measuring range of -40 to 302 deg F.

V. ELECTRONIC HUMIDITY/DEWPOINT SENSORS & TRANSMITTERS:
1. Humidity and temperature transmitter with sensors for measuring in ductwork, air handling units, and rooms.
a. Full 0-100% RH measurement, temperature range up to 356 Degrees F.
b. Factory calibration at five humidity points.
c. Accuracy at -4 deg F to 104 deg F +/- 1% RH (0-90% RH).
d. Corrosion resistant housing.
e. Minimum 5-year battery life.

W. ELECTRONIC PRESSURE SENSORS & TRANSMITTERS:
1. Pressure Sensor:
a. Stainless steel wetted parts and 316L stainless steel housing.
b. Gold plated contacts.
c. Measuring range: 0-360 psi
d. Pressure rating: 2175 psi
2. Pressure Transmitter:
a. Stainless steel.
b. Measuring range: 0-300 psi
c. Pressure rating: 940 psi
d. Medium temperature: -40 – 190 degrees F.

X. Averaging Temperature Sensors:
1. Platinum RTD type, bendable copper averaging temperature sensor.
a. Sensing element includes a continuous sensing element covering the entire length of the copper tubes.
b. Hermetically sealed to ensure that moisture and other contaminants won’t affect the reliability of the sensing element.
c. Include a foam pad to seal the duct and dampen vibrations once installed.
d. Three-wire, etched Teflon colored lead wires.

Y. Coils:
1. Coils shall be made of steel headers, with steel or copper tubes, and 0.040” thick aluminum fins. Coils shall be coated with Konvekta K031 (Supply) and K032 (Exhaust), a 2-part epoxy resin base coat and a 2-part epoxy resin topcoat, to resist corrosion.
2. The frames shall be continuously welded to prevent corrosion in the crevices.
3. The top and bottom cover plates shall be stainless steel.
4. The coils shall be hydronically pressure tested at 500 psi for a period of not less than 5 contiguous days prior to shipment from the factory.
5. The coils shall be fully drainable.
6. Coils are cleanable with high pressure (up to 2,600 psi), hot or cold water and cleaning solution, or low-pressure steam. The cleaning solution shall have a neutral pH from 5 to 11. Do NOT use strong acid or strong base cleaners. An example of an acceptable cleaning solution is Simple Green All Purpose Cleaner.

Z. VERTICAL IN-LINE PUMPS:

1. Type: Vertical, multistage centrifugal pump with inline inlet and outlet ports. Maximum 232 psi working pressure, and 250 degrees F continuous water temperature.
2. Body: Cast iron, with flanged suction and discharge and gauge tappings.
3. Wetted parts: Stainless steel.
4. Motor: Fan-cooled asynchronous, 3-phase, with manufacturer paired VFD.
5. Coupling: Rigid split coupling.
6. Impeller: Stainless steel. .
7. Liquid temperature range -22 deg F to 250 deg F

AA. Hydronic Module:
1. The following elements shall be installed, piped, wired and factory tested:
   a. A Grundfos vertical inline pump with manufacturer paired variable frequency drive (VFD), a Grundfos redundant vertical inline pump with manufacturer paired VFD, including, shut-off valves, and manufacturer's recommended vibration isolation. Pump VFDs shall meet the Pump/VFD pairing requirements of Konvekta and the pump manufacturer. Motors shall meet IE3 efficiency standards.
   b. Membrane type expansion tank, check valves, pressure gauges, and pressure safety valves.
   c. Dirt/Air separator.
   d. Automatic bypass valve with drive for anti-freeze protection loop (field installed, piped, and wired).
   e. Belimo Automatic control valve for exhaust by-pass ((field installed, piped, and wired) if required).
   f. Automatic zone control valves (either skid mounted or shipped loose for field install).
   g. Balancing valves (either skid mounted or shipped loose for field install)
   h. Manual shut-off valves.
   i. Sight glass flow indicator.
   j. Fluid pressure transmitters.
   k. Safety relief valve.
   l. Fluid flow meter.
   m. Immersion pockets with PT100 temperature sensors built in.
   n. 100% redundant heat exchanger for heating, refer to schedules for quantities.
   o. One additional redundant heat exchanger for cooling, refer to schedules for quantities.
   p. Free Cooling/Waste Heat recovery system that includes Plate Heat Exchanger to introduce cooling into the chilled water circuit. The system includes circulation pump, mixing control valve, and balancing valve on the glycol loop side and strainer per exchanger on the building loop side.
   q. Brazed Plate Heat Exchangers (BPHE) to introduce heating and cooling into the glycol/water circuit including above mentioned automatic control valve and strainer per exchanger.
   r. NEMA 12 electrical cabinet with system controller.
   s. The hydronic module is delivered without piping insulation.
2. The following elements are required to be provided by others:

a. Strainers on supply line for all plate frame heat exchangers and control valves.
b. Filling nozzle.
c. Drain valve(s).
d. Glycol feeder.
e. Insulation of the piping on the hydronic module in accordance with the piping insulation specification section after the Konvekta system has been fully started up.

BB. System Controller:
1. Demand-dependent regulation of the entire energy recovery system (circulation pumps, valves, heat exchangers, etc.), including controller hardware & software, display unit for energy efficiency, temperatures, volumetric flows.
2. The controller shall be a Programmable Logic Controller (PLC).
3. The controller shall be located in the electrical cabinet, mounted on Hydronic Module.
4. The control software shall be based on a simulation/optimization algorithm with:
   a. Supply air set temperatures as set points or command signals.
   b. Glycol/Water temperatures and volumes in the supply air heat exchangers as the actuating variables.
   c. Air volumes in the air handlers, outside air temperature, exhaust air temperatures and humidity as disturbance variables.
5. During periods of low outside air ambient temperature, the energy recovery system shall initiate a frost/defrost sequence for the exhaust zones on a rotating basis to maximize latent energy recovery.
6. The simulation algorithm continuously calculates the theoretical system performance (energy recovery efficiency) based on all control variables, the pump and heat exchanger performance curves, and different Glycol/Water volumes pumped through the system. The optimization algorithm then sets the actuating variables based on the simulated optimal system performance.
7. Controller functions:
   a. Primary function: heat (winter operation) or cool (summer operation) supply air to supply air set temperature.
   b. Continuous measurement and recording of system operating parameters.
   c. Starting/shutting down pumps and regulating flow rate (pump speed) for optimal energy recovery.
   d. Minimizing pump power demand (flow rate increase only if additional pump power demand is smaller than marginal energy recovery).
   e. When reaching/exceeding the supply air temperature (set-point provided by Building Management System), the energy recovery system shall be gradually turned down in operating capacity.
   f. Freeze protection at exhaust air heat exchangers.
   g. Complete regulation and minimization of heating water and chilled water through the plate heat exchangers in winter, transition, and summer operation.

8. The system controller needs the following Input Signals from system components provided by the Building Management System (BMS) contractor, not installed on the Hydronic Module:
   a. From BMS: via BACnet MSTP – Wired by the BMS Contractor
      1) Operating mode (heating, cooling or transition operation).
      2) Startup request for each air handling unit (AHU).
      3) Supply air set temperatures for each supply AHU.
      4) Air volumes in each supply and exhaust AHU. The airflow stations for both the supply and exhaust shall be from the same manufacturer for accuracy. The airflow stations shall use the principle of thermal dispersion and provide one self-heated bead in-glass thermistor and one zero power bead-in-glass thermistor at each sending node. Each station shall have a micro-processor-based transmitter and one or more sensor probes capable of independently processing up to 4 independently wired sensor nodes contained in one or more probe assemblies per measurement location.
      5) Air temperature before each supply coil bank and after the fans in the supply air duct (two data points in each supply air handler).
      6) Air temperature before and after each exhaust coil bank and before the evaporative cooling device (three data points in each exhaust air handler). The air temperature before the evaporative cooling device shall be in the exhaust duct, not in the Heat Recovery Unit (HRU).
      7) The exhaust dew point and relative humidity in the exhaust duct for each HRU before the evaporative cooling grid. The humidity and dew point measurement shall be at the same location as the above exhaust air temperature. The measurement location shall be in the exhaust duct, not the HRU so there is no immediate sensor reading error due to the fog.
      8) The accuracy of the reading shall be +/-1% RH of reading at 0-90% RH between 59 F-77 F humidity measurement and +/-0.5 F temperature measurement.
      9) The BMS contractor shall provide and wire a Vaisala HMT330 series sensor.
      10) Fan status from each supply and exhaust air fan in each AHU.
      11) Cooling water supply temperature
      12) Free Cooling Requested.
      13) Free cooling supply set-point temperature.
   b. Hard-wired into the Konvekta control cabinet by the BMS contractor:
      1) Air temperature after each supply coil bank (one data point in each supply air handler).
      2) Return water temperature at each AHU and HRU. (The remote return water temperature sensors will be provided by Konvekta.)
      3) The BMS contractor shall provide the above remote air temperature sensors. The averaging sensor probes shall be long enough to extend across the coil fins for an accurate reading of the coil air temperatures.

4) Temperature Sensors: Passive PT100 with 385 curve 1/3DIN class AA (100 ohm @ 0°C; +/-0.1°K) or class AA according to new IEC 60751 accuracy class Connection type: 3-wire RTD configuration. Wiring: 3x1.5mm2 (AWG 15 – 3 conductor) cables.

c. Hard-wired directly to the Konvekta control cabinet by the BMS contractor:
   1) The remote-control valves, fluid temperature sensors, and flow meters (provided by Konvekta). Wiring shall be 4x2.5mm2 (AWG13 – 4 conductor) cables.

d. Other requirements:
   1) The system control cabinet requires one power supply line 460V/3-phase. (230V/3-phase if 460V/3phase is not available.)
   2) Internet access, via static IP, to the ERS controller provided by the owner or as coordinated with the owner.
   3) The BMS shall take in two alarm points from the Konvekta system thru BACnet.
      a) An immediate alarm that there is a failure condition.
      b) A maintenance alarm for an upcoming maintenance issue.

e. Konvekta shall send the BMS, thru BACnet MSTP, the evaporative cooling stage needed for the Evaporative Cooling system for each HRU. The number of stages shall be shown on the equipment schedules. The BMS shall read this data point from Konvekta for each HRU and write the data point to each Evaporative Cooling valve panel. The Evaporative Cooling system shall take this stage input and control its system internally thru its PLC.

CC. Remote Monitoring, Automatic Reporting, Optimization:
1. Remote monitoring and optimization of system parameters and performance shall be done by the Manufacturer during the first two years of operation (via internet). Many system malfunctions or errors (such as installation or wiring errors, erroneous set values, etc.) can only be detected by monitoring the dynamic system operation. Target values are calculated by means of a system-specific simulation program (built in the system controller), taking into account the measured air temperatures and volumes and the performance curves/maps of heat exchangers, pumps and valves.
2. Dynamic operations data, static measurements and computed values are made available to the Customer via Internet access. Automatic reporting includes:
   a. Calculation and comparison of Target/Actual energy recovered.
   b. Monitoring of important functions and components of the system
   c. Display and cause-analysis of malfunctions or deviations from target values.
3. An ERS factory trained technician shall be available to the building owner or designated representative, 24 hours per day, 365 days per year, via an ERS manufacturer provided toll free phone number, for technical support requirements during the warranty period.

DD. System Guarantee & Verification (First Two Years of Operation)

1. Manufacturer shall assume responsibility for the optimal and malfunction-free operation of the energy recovery system during the first year of operation and shall guarantee the system efficiency and/or energy recovery rates at the specified nominal conditions.
2. Manufacturer shall verify, at the end of the first year of operation, that the guaranteed values have been achieved (or have not been met, respectively):
   a. Verification of guaranteed efficiency and/or heat recovery rate.
   b. Verification of optimal and malfunction-free operation of the entire energy recovery system.
   c. Verification of total energy saved/recovered, corresponding to calculated target values.
   d. If estimated energy savings is not met, manufacturer shall pay the price difference of the energy costs for the life of the system.
3. This verification is in lieu of a performance measurement at the time of start-up.

EE. Routine Maintenance:
1. The system controller shall alert the operating staff of pending routine maintenance (e.g., pump routine maintenance, etc.…).
   a. Check coils for contamination, corrosion and leaks.
   b. Check piping and hydronic unit for insulation damage and leaks.
   c. Check system pressure, expansion tank functionality and make-up system.
   d. Extract glycol sample for lab analysis.
   e. Check/calibrate fluid temperature probes.
   f. Check pump pressure alarm functionality.
   g. Check redundant pumps and lead/lag functionality.
   h. Check valves and actuators (manual/automatic functionality).
   i. Rotation of redundant plate or shell-and-tube heat exchangers.
   j. Replace controller flash card.
   k. Inspect/clean electrical cabinet.
   l. Check flat screen functionality and menus.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which the systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the installer.

3.2 INSTALLATION:

A. General: Installation shall be performed by the mechanical contractor with instructions from the manufacturer’s representative and installation documents.

B. If the hydronic module is constructed and shipped in multiple sections, the onsite contractor shall reassemble and reconnect the individual sections per the manufacturer's written instructions.

C. The system shall be installed in accordance with the system manufacturer's written instructions, and with recognized industry practices, to ensure that the systems comply with requirements and serve intended purposes.
   1. Access: Provide access space around the system components for service as indicated, but in no case less than that recommended by manufacturer.
   2. Support: Provide supports from substrate for the system components in accordance with manufacturer's installation instructions.
   3. Electrical Wiring: The electrical contractor shall install electrical devices furnished by the manufacturer, but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to the electrical contractor.
   4. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements in accordance with the Electrical Work for Mechanical Systems specification section. Do not proceed with equipment start-up until wiring installation is acceptable to the equipment installer.
   5. Grounding: Provide electrical equipment ground for electrical-operated the system components.

D. low temperature Piping insulation:
   1. Insulate each piping system specified above with the following types and thicknesses of insulation:
      a. Above Ground, Interior or Exterior, Cellular Glass:
      b. 1.5 inch thick insulation on pipe sizes 1 inch to 2 inch.
      c. 2 inch thick insulation on pipe sizes 3 inch and larger.

E. Piping insulation:
   1. Insulate each piping system specified above with the following types and thicknesses of insulation:
      a. Above Ground, Inside Building, Fiberglass:
         1) 1-inch-thick insulation on pipe sizes 1-1/4 inch and smaller.
         2) 1.5- inches thick insulation on pipe sizes 1-1/2 inch and larger.

F. HEAT RECOVERY LOOP PIPING:
   1. Heat Recovery Loop Piping:
      a. 2 Inches and Smaller:
      b. Schedule 40, black steel with 150 lb. malleable iron threaded fittings.
         OR
      c. Type K copper, hard drawn copper wrought copper or bronze fittings, silver - tin alloy solder joints.
      d. 2-1/2 Inches and Larger:
      e. Schedule 40, seamless or ERW (std. weight 12 inches and over) black steel with flanged or welded joints.
      f. Fittings: Standard weight / Extra strong, seamless steel, butt weld type.
      g. Flanges: 150 lb./250 lb forged steel welding neck type.
      h. Bolting: Regular square head machine bolts with heavy hexagonal nuts.
      i. Gaskets: Thickness, material and type suitable for fluid to be handled, and design temperature and pressures.

G. HEAT RECOVERY LOOP VALVE SCHEDULE:
   1. Pipe NPS 2 and Smaller:

a. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
b. Ball Valves: Two-piece, full port, bronze with bronze trim.

2. Pipe NPS 2-1/2 and Larger:
   a. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
   b. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.

H. Items not within the scope of work by the ERS manufacturer (Konvekta) These items shall be provided by the contractor:
1. Install heat exchangers (coils) and hydronic module in compliance with system manufacturer's installation guidelines.
2. The hydronic module shall ship to the mechanical contractor for field installation. The heat exchangers (coils) for the supply AHU and exhaust HRU shall ship directly to the successful AHU and ERS manufacturers. The successful AHU and HRU manufacturers shall be responsible for approving the coil dimensions in the submittal phase prior to production. The successful AHU and HRU manufacturers must provide the location of their factory so appropriate freight charges can be calculated for each AHU/HRU bidder.
3. The successful AHU and HRU manufacturer is responsible for receiving and installing the coils in their units. Any damage to the coils is the responsibility of the AHU and HRU manufacturer.
4. Piping between the hydronic module and the coils in the AHUs and HRUs.
5. Provide flexible stainless-steel hoses at the external pipe connection points at the ERS.
6. Provide strainers at plate and frame heat exchangers and at all control valves.
7. Contractor shall supply and install ½" NPT drain valves on all the ERS (Konvekta) coil drains. The valve shall be ½" FNPT for the ½" MNPT drainpipe. The drain valve shall be plumbed either straight out horizontally or down vertically. The drain valve shall not be plumbed up vertically.
8. A drain connection and valve must be provided at the lowest point in the system so that the system can be drained.
9. The contractor shall chemically flush the field system piping in accordance with the pipe flushing requirements of the piping specifications. The contractor shall provide the pump and any temporary piping required to flush the system. The Konvekta skid pumps and Konvekta coils MUST be isolated and not be flushed. The contractor is NOT allowed to flush thru the skid or coils. The skid piping and coils are pre-flushed and drained before arriving to the jobsite. After the flush, the entire system must be drained prior to filling with glycol.
10. Manual air vents shall be installed at EVERY high point in the field piping between the skid and all coils. Konvekta coils do not have air vents on the coils, thus the field piping shall come straight out from the top coil connection and have a manual air vent to be able to vent the air out of the coil.
11. An air vent must be installed at the highest point in the pipe system, upstream and downstream of every heat exchanger.

12. Contractor to install premixed ethylene or propylene glycol solution at the scheduled concentration so the concentration is accurate and filled thru the glycol feeder that is piped to the filling nozzle on the hydronic module.
13. Glycol feeder shall be contractor provided.
14. Provide supply airflow and exhaust airflow measuring stations mounted within the AHUs and HRUs.
15. Provide/install air temperature sensors in AHUs/HRUs and connect either to the energy recovery system's electrical/control cabinet or the BMS and interface control cabinet with BMS as described in the Products section. Install internet access to system controller.
16. IP network cabling to the ERS controller.
17. BACnet communication cable between the ERS control cabinet and the BMS.
18. Electrical contractor to install wiring from above referenced automatic control valves, fluid temperature sensors, and fluid flow meters to the ERS control cabinet.
19. Contractor to insulate the piping on the skid per the piping insulation section of the specifications after the Konvekta system has been fully started up.
20. External vibration isolation for the Hydronic Module is not required as the pumps are isolated.

3.3 SYSTEM START UP

A. Konvekta:
1. The contractor shall fill out the pre-startup form from Konvekta.
2. A four-week notice is required prior to startup.
3. Remote functional inspection of system controller via internet approximately two weeks before start-up.
4. The entire piping system, including all fittings, must be acceptable for the pressure rating of the highest-pressure relief valve as indicated on the system documents.
5. Perform a hydrostatic pressure test of the field piping and coils according to ASME B31.1 or ASME B31.3. The test pressure shall be a minimum of 225 psi maintained for 10 minimum or as noted in the system-specific documentation.
6. Piping of the ERS must be grounded to ensure potential equalization.
7. The entire Energy Recovery System piping loop shall be pressure tested by the mechanical installation contractor. This includes the entire field piping and all Energy Recovery Coils. The Konvekta hydraulic assembly shall NOT be subject to the hydrostatic pressure test because it contains equipment rated for a lower pressure than the rest of the system.
8. The Konvekta Hydronic Module is pressure and leak tested at the skid manufacturer's facility.
9. The contractor must provide a temporary pump for flushing and filling the system. The contractor must also provide temporary piping to bypass the skid piping and the coils during the flushing of the system.
10. On-site start-up by factory authorized & trained representative:
    a. Review/inspection of heat exchanger and piping installation.
    b. Review/inspection of sensors and valves installation.
    c. Inspection/programming of pump VFDs.

d. Functional testing of valves and VFDs.
e. Testing of interface with Building Automation System.
f. Instruction/training of owner's operating/maintenance staff for a period of 8 working hours at project work site or two 4-hour sessions on two separate days.

B. Mechanical, Test and Balance (TAB), Electrical, and BMS contractors and /or suppliers shall coordinate with and support the start-up process performed by the ERS manufacturer representatives.

3.4 FIELD QUALITY CONTROL:

A. Start Up: Upon Completion of installation of systems, provide start-up by factory authorized and trained operators and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance. Manufacturer's representative shall submit a letter to the Architect/Engineer certifying the equipment is operating properly and in accordance with this specification.

B. The manufacturer's representative shall provide remote monitoring for a period of 2 years from the date of manufacture.

3.5 ADJUSTING AND CLEANING:

A. Start-Up: Start-up system in accordance with manufacturer's instructions.

B. Refer to Division 23 section "Testing, Adjusting, and Balancing" for system balancing; not work of this section.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

CUSTOM AIR HANDLING UNIT SCHEDULE

DESIG.	SERVICE	MFR	MODEL	MIN. FLOOR O.A. CFM @ 5,800'	MAX. CEILING O.A. CFM @ 5,800'	FAN DATA										COIL DATA										EVAPORATIVE COOLER DATA					FILTER DATA			DIMENSIONS				
						SERVICE	CFM TOTAL @ 5,800'	TSP IN. W.C. AT S.L.	ESP IN. W.C. AT S.L.	NO. FAN WHEELS	ARRANG. & MOUNTING	FAN WHEEL DIA./TYPE	RPM	BHP/FAN (MAX. BHP TOTAL)	HP/FAN (MAX. HP TOTAL)	SERVICE	FACE AREA SQ. FT.	COIL CFM @ 5,800'	APD @ S.L. (IN W.C.)	MIN. # OF ROWS	EAT °F DB	EAT °F WB	LAT °F DB	LAT °F WB	MBH	GPM	FPD (FT W.C.)						TYPE	AREA SQ. FT.	EFF (MERV)	L (IN)	W (IN)	H (IN)	OPERATING WEIGHT LBS. W/ CURB	REMARKS (1)
AHU-603	LABORATORY	NORTEK AIR SOLUTIONS / TEMTROL	CUSTOM	52,000	52,000	SUPPLY	52,000	7.89	4.70	12	FAN ARRAY	AIRFOIL PLENUM	3,478	7.70 (92.44)	8 (96)	REFER TO ENERGY RECOVERY COIL SCHEDULE	--	--	--	--	--	--	--	--	--	--						PRE	117.0	MERV 8A	244	183	180	32,000	(3) (7) (15)
																																FINAL	117.0	MERV 13A					
AHU-604	LABORATORY	NORTEK AIR SOLUTIONS / TEMTROL	CUSTOM	52,000	52,000	SUPPLY	52,000	7.89	4.70	12	FAN ARRAY	AIRFOIL PLENUM	3,478	7.70 (92.44)	8 (96)	REFER TO ENERGY RECOVERY COIL SCHEDULE	--	--	--	--	--	--	--	--	--	--						PRE	117.0	MERV 8A	244	183	180	32,000	(3) (7) (15)
																																FINAL	117.0	MERV 13A					
AHU-605	LABORATORY	NORTEK AIR SOLUTIONS / TEMTROL	CUSTOM	52,000	52,000	SUPPLY	52,000	7.89	4.70	12	FAN ARRAY	AIRFOIL PLENUM	3,478	7.70 (92.44)	8 (96)	REFER TO ENERGY RECOVERY COIL SCHEDULE	--	--	--	--	--	--	--	--	--	--						PRE	117.0	MERV 8A	244	183	180	32,000	(4) (7) (16)
																																FINAL	117.0	MERV 13A					
AHU-606	LABORATORY	NORTEK AIR SOLUTIONS / TEMTROL	CUSTOM	52,000	52,000	SUPPLY	52,000	7.89	4.70	12	FAN ARRAY	AIRFOIL PLENUM	3,478	7.70 (92.44)	8 (96)	REFER TO ENERGY RECOVERY COIL SCHEDULE	--	--	--	--	--	--	--	--	--	--						PRE	117.0	MERV 8A	244	183	180	32,000	(4) (7) (16)
																																FINAL	117.0	MERV 13A					
EAP-601	LABORATORY	NORTEK AIR SOLUTIONS / HUNTAIR	CUSTOM	--	--	EXHAUST	96,500	REFER TO FAN SCHEDULE								REFER TO ENERGY RECOVERY COIL SCHEDULE											REFER TO LAB INDIRECT EVAPORATIVE COOLING SYSTEM SCHEDULE					--	--	--	308	270	213	57,000	(9) (19) (20)
																																--	--	--					
EAP-602	LABORATORY	NORTEK AIR SOLUTIONS / HUNTAIR	CUSTOM	--	--	EXHAUST	96,500	REFER TO FAN SCHEDULE								REFER TO ENERGY RECOVERY COIL SCHEDULE											REFER TO LAB INDIRECT EVAPORATIVE COOLING SYSTEM SCHEDULE					--	--	--	308	270	213	57,000	(9) (19) (20)
																																--	--	--					

Information hidden does not relate to Konvekta ERS submittal

Information hidden does not relate to Konvekta ERS submittal

1. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL CHARACTERISTICS.
2. AHU-601 & AHU-602 DESIGNED TO RUN IN PARALLEL FOR TOTAL DESIGN CAPACITY.
3. AHU-603 & AHU-604 DESIGNED TO RUN IN PARALLEL FOR TOTAL DESIGN CAPACITY.
4. AHU-605 & AHU-606 DESIGNED TO RUN IN PARALLEL FOR TOTAL DESIGN CAPACITY.
5. AHU-607A & AHU-607B DESIGNED FOR N + 1 CAPACITY.
6. PROVIDE (2) VFDS, SERVING 4 SUPPLY FAN MOTORS PER VFD; PROVIDE (2) VFDS SERVING 4 RETURN FAN MOTORS PER VFD.
7. PROVIDE (4) VFDS, SERVING 3 SUPPLY FAN MOTORS PER VFD.
8. PROVIDE (2) VFDS, SERVING 2 SUPPLY FAN MOTORS PER VFD.
9. UNIT WEIGHT IS FOR PLENUM & ROOF CURB ONLY. REFER TO FAN SCHEDULE FOR EXHAUST FAN WEIGHTS. EXHAUST FANS AND EAP WILL BE MOUNTED ON INDIVIDUAL CURBS, REFER TO DETAILS.
10. COOLING COIL CAPACITIES BASED ON EWT = 45°F; LWT = 61°F; 100% WATER SOLUTION.
11. HEATING COIL CAPACITIES BASED ON EWT = 140°F; LWT = 100°F; 30% PP GLYCOL SOLUTION.
12. DEHUMIDIFICATION COIL CAPACITIES BASED ON EWT = 32°F; LWT = 42.3°F; 30% PP GLYCOL SOLUTION.
13. COOLING COIL CAPACITIES BASED ON EWT = 45°F; LWT = 54.4°F; 100% WATER SOLUTION.
14. REHEAT COIL CAPACITIES BASED ON EWT = 180°F; LWT = 140°F; 30% PP GLYCOL SOLUTION.
15. AHU-603 & AHU-604 ARE ONE UNIT WITH TWO SEPARATE AIR TUNNELS BUT WILL BE REFERRED TO AND SCHEDULED AS TWO SEPARATE UNITS.
16. AHU-605 & AHU-606 ARE ONE UNIT WITH TWO SEPARATE AIR TUNNELS BUT WILL BE REFERRED TO AND SCHEDULED AS TWO SEPARATE UNITS.
17. AHU-607A & AHU-607B ARE ONE UNIT WITH TWO SEPARATE AIR TUNNELS BUT WILL BE REFERRED TO AND SCHEDULED AS TWO SEPARATE UNITS AND ARE N+1.
18. TOTAL STATIC PRESSURE (TSP) INCLUDES 0.85" W.C. DIRTY FILTER ALLOWANCE.
19. PROVIDE 4kW ELECTRIC UNIT HEATER IN TOP EAP VESTIBULE AND 3KW ELECTRIC UNIT HEATER IN BOTTOM EAP VESTIBULE.
20. PROVIDE AIR FLOW MEASURING FOR EACH AIR TUNNEL'S EXHAUST ENERGY RECOVERY COIL.

LAB INDIRECT EVAPORATIVE COOLING SYSTEM SCHEDULE

DESIG.	SERVICE	MFR.	PUMP STATION MODEL	EVAPORATIVE COOLING PERFORMANCE (10)							SPRAY SYSTEM DATA (10)				PUMP PERFORMANCE (11)				REMARKS (1) (2)
				CFM @ 5,800' ELEV.	EAT DB (°F)	EAT WB (°F)	EVAP. SAT. EFF. (%)	LAT (°F)	WATER EVAP. RATE		# OF NOZZLES	# OF ZONE VALVES	MEDIA AREA (SQ. FT.)	# OF MANIFOLDS	FLOWRATE (GPM)	MAX. TDH (PSIG)	MOTOR (HP) (3)	SPEED (RPM)	
									LB / HR	GPM									
IEVC-601	LAB EXHAUST AIR EAP-601	DRI-STEEM	HPS - 3500	96,500	73.0	51.8	49.5	55.5	1,349.0	2.7	480	6	268.66	20	7	1,250	7.5	700 - 2450	(4 - 9)
IEVC-602	LAB EXHAUST AIR EAP-602	DRI-STEEM	HPS - 3500	96,500	73.0	51.8	49.5	55.5	1,349.0	2.7	480	6	268.66	20	7	1,250	7.5	700 - 2450	(4 - 9)

1. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL CHARACTERISTICS.
2. REFER TO SPEC. FOR CONTROLS.
3. MINIMUM REQUIRED MOTOR HP.
4. EXHAUST AIR INDIRECT SPRAY WATER IS REVERSE OSMOSIS WATER.
5. SYSTEM TO BE PROVIDED WITH RESPECTIVE EXHAUST AIR PLENUM UNIT.
6. PROVIDE REDUNDANT STANDBY PUMP W/ AUTO-DUPLEX ALTERNATOR CONTROLLER.
7. MAXIMUM VAPOR-TRAIL DISTANCE = 48 IN @ 80% LEAVING RH, WATER TEMP. 72 °F, AND 359.2 FPM AIR VELOCITY.
8. PROVIDE A PULSATION DAMPENER AT THE PUMP DISCHARGE.
9. SPRAY NOZZLE PRESSURE = 1,000 PSIG.
10. DATA SHOWN IS FOR TWO EQUALLY SIZED EVAPORATION GRIDS (UPPER AND LOWER).
11. DATA SHOWN IS FOR ONE PUMP STATION THAT SERVES TWO EVAPORATION GRIDS (UPPER AND LOWER).

Mechanical Equipment Schedules
Sheet 1 of 2

EXHAUST AIR PLENUM W/ KONVEKTA COIL (EAP-601, 602)

SUPPLY AIR HANDLING UNIT W/ KONVEKTA COIL (AHU-603, 604, 605, 606)

ENERGY RECOVERY HEAT EXCHANGER AND PUMP

ACCESS PATHWAY IN PENTHOUSE

BUILDING ELEVATOR/SHAFT/ELECTRICAL ROOM SPACE

ENERGY RECOVERY COIL SCHEDULE

DESIG.	MFR.	# OF COILS	FIN LENGTH EA. (IN)	FIN HEIGHT EA. (IN)	MIN. # OF ROWS	FINS / INCH	SERVICE	TOTAL COIL CFM @ 5,800'	TOTAL CAP. (MBH)	MIN. TOTAL FACE AREA (SQ FT)	MAX AIR VELOCITY (FPM)	AIR SIDE					FLUID SIDE				APPROX. OPER. WEIGHT (LBS)	REMARKS (1)
												EAT DB (°F)	EA RH (%)	LAT DB (°F)	LA RH (%)	APD @ S.L. (IN W.C.)	FLOW (GPM)	EWT (°F)	LWT (°F)	FPD (FT W.C.)		
AHU-603	KONVEKTA	4	84.0	52.4	5	8	SUMMER	52,000	2,227.7	122.3	430	100.7	6.0	55.0	28.0	0.71	156.8	47.6	78.4	111.3	6,000	
							SUMMER (2)	52,000	1,931.8	122.3	430	86.1	35.0	55.0	86.0	0.71	166.5	47.6	72.7	127.0		
							WINTER	52,000	3,154.0	122.3	430	-10.0	80.0	55.0	5.0	0.71	144.8	76.9	29.4	123.0		
AHU-604	KONVEKTA	4	84.0	52.4	5	8	SUMMER	52,000	2,227.7	122.3	430	100.7	6.0	55.0	28.0	0.71	156.8	47.6	78.4	111.3	6,000	
							SUMMER (2)	52,000	1,931.8	122.3	430	86.1	35.0	55.0	86.0	0.71	166.5	47.6	72.7	127.0		
							WINTER	52,000	3,154.0	122.3	430	-10.0	80.0	55.0	5.0	0.71	144.8	76.9	29.4	123.0		
AHU-605	KONVEKTA	4	84.0	52.4	5	8	SUMMER	52,000	2,227.7	122.3	430	100.7	6.0	55.0	28.0	0.71	156.8	47.6	78.4	111.3	6,000	
							SUMMER (2)	52,000	1,931.8	122.3	430	86.1	35.0	55.0	86.0	0.71	166.5	47.6	72.7	127.0		
							WINTER	52,000	3,154.0	122.3	430	-10.0	80.0	55.0	5.0	0.71	144.8	76.9	29.4	123.0		
AHU-606	KONVEKTA	4	84.0	52.4	5	8	SUMMER	52,000	2,227.7	122.3	430	100.7	6.0	55.0	28.0	0.71	156.8	47.6	78.4	111.3	6,000	
							SUMMER (2)	52,000	1,931.8	122.3	430	86.1	35.0	55.0	86.0	0.71	166.5	47.6	72.7	127.0		
							WINTER	52,000	3,154.0	122.3	430	-10.0	80.0	55.0	5.0	0.71	144.8	76.9	29.4	123.0		
EAP-601	KONVEKTA	8	96.0	38.6	5	8	SUMMER	96,500	1,236.6	205.9	470	62.3	93.0	75.7	58.0	0.79	297.9	78.4	69.4	95.7	10,000	
							WINTER	96,500	2,952.4	205.9	470	72.0	30.0	41.7	82.0	0.79	289.5	29.4	51.6	117.1		
EAP-602	KONVEKTA	8	96.0	38.6	5	8	SUMMER	96,500	1,236.6	205.9	470	62.3	93.0	75.7	58.0	0.79	297.9	78.4	69.4	95.7	10,000	
							WINTER	96,500	2,952.4	205.9	470	72.0	30.0	41.7	82.0	0.79	289.5	29.4	51.6	117.1		

1. COIL SELECTIONS BASED ON 40% PP GLYCOL.
2. SUMMER CONDITION DURING OUTDOOR ENTALPHY BASIS OF DESIGN CONDITION.

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DESIGNED BY:	CEJ
CHECK BY:	CEJ
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KEYPLAN

PR-05 - CONFORMED BUIDING PACK - JANUARY 16, 2024

ISSUE CHART

MARK	ISSUE	DATE
2	PR-05 - CONFORMED BUILDING PACK	2024.01.16
1	DP-3: INTERIOR PACKAGE	2023.11.09

Job Number	221904
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TITLE

MECHANICAL SCHEDULES

SHEET NUMBER

M00-03

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EXHAUST AIR PLENUM W/ KONVEKTA COIL (EAP-601, 602)

SUPPLY AIR HANDLING UNIT W/ KONVEKTA COIL (AHU-603, 604, 605, 606)

ENERGY RECOVERY HEAT EXCHANGER AND PUMP

ACCESS PATHWAY IN PENTHOUSE

BUILDING ELEVATOR/SHAFT/ELECTRICAL ROOM SPACE

ENERGY RECOVERY SYSTEM SCHEDULE

DESIG.	MFR.	SERVICE	PUMP MFR. / MODEL	# OF PUMPS OPER.	MOTOR SIZE (4) (HP)	# OF HX'S OPER.	TOTAL MBH	BUILDING SERVICE SIDE						ENERGY RECOVERY COIL SIDE						APPROX. O.D. SKID DIM. (IN)			APPROX. OPER. WEIGHT (LBS.)	REMARKS (1) (2) (3) (5)
								FLUID TYPE	EWT (°F)	LWT (°F)	FLOW / HX (GPM)	TOTAL FLOW (GPM)	FPD (FT W.C.)	FLUID TYPE	EWT (°F)	LWT (°F)	FLOW / HX (GPM)	TOTAL FLOW (GPM)	FPD (FT W.C.)	LENGTH	WIDTH	HEIGHT		
ERS-601.1	KONVEKTA	HEATING	GRUNDFOS	1	75.0	1	6,712.0	30% PP GLYCOL	180.0	140.0	354	354	5.6	40% PP GLYCOL	51.6	76.7	580	580	17.5	240	96	106	16,000	(6) (7) (8) (9) (10)
ERS-601.2	KONVEKTA	COOLING	--	--	--	6	7,858.0	100% WATER	45.0	61.0	164	984	2.7	40% PP GLYCOL	73.5	48.4	114	683	2.2	188	97	116	14,000	(8) (9)
ERS-601.3	KONVEKTA	FREE-COOLING	GRUNDFOS	1	3.0	1	998.0	100% WATER	70.0	60.0	200	200	7.8	40% PP GLYCOL	45.8	65.0	112	112	4.0	102	75	106	4,800	(8) (9)

1. REFER TO ELECTRICAL DRAWINGS FOR ELECTRICAL CHARACTERISTICS.
2. ALL PERFORMANCE CAPACITIES BASED ON SITE SPECIFIC CONDITIONS.
3. REFER TO SPEC. FOR CONTROLS.
4. MINIMUM REQUIRED MOTOR HP.
5. ENERGY RECOVERY SYSTEM AT RATED CONDITIONS: ε (SENS.) = 58.1%; ε (ENTH.) = 53.3% ; RECOVERY EFFIECIENT RATIO (RER) = 9.8.
6. PROVIDE WITH +1 REDUNDANT PUMP AND VFD, PERFORMANCE LISTED IS FOR # OF OPERATING PUMPS, REFER TO SCHEMATIC AND DETAILS FOR ADDITIONAL INFORMATION.
7. PROVIDE WITH +1 REDUNDANT HEAT EXCHANGER, PERFORMANCE LISTED IS FOR # OF OPERATING HXs, REFER TO SCHEMATIC AND DETAILS FOR ADDITIONAL INFORMATION.
8. THE SKID AND PLC CONTROLLER SHALL PROVIDE ALL COOLING, HEATING AND ENERGY RECOVERY FOR THE AHUs AND EAPs COILS, REFER TO ENERGY RECOVERY COIL SCHEDULE.
9. THE SKID SHALL BE FACTORY ASSEMBLED AND PROVIDED WITH SHIPPING SPLITS FOR SHIPPING TO SITE IN MULTIPLE PIECES AND FIELD ASSEMBLY.
10. COORDINATE CONNECTION OF SKID WITH IT/DATA INTERNET CONTRACTOR (2 CONNECTIONS REQ).

Mechanical Equipment Schedules
Sheet 2 of 2

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KEYPLAN

PR-05 - CONFORMED BUIDING PACK - JANUARY 16, 2024

ISSUE CHART

MARK	ISSUE	DATE
2	PR-05 - CONFORMED BUILDING PACK	2024.01.16
1	DP-3- INTERIOR PACKAGE	2023.11.09

Job Number	221904
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Approved	GS

TITLE

MECHANICAL SCHEDULES

SHEET NUMBER

M00-06

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GENERAL NOTES

1. (REFER TO SHEET M00-02)

KEYNOTE LEGEND

(NOTES BELOW ARE DESIGNATED IN PLAN BY: ⬡)

1 1" HIGH PRESSURE INDIRECT EVAPORATIVE SUPPLY WATER (HIES). RISE UP INSIDE EAP SERVICE VESTIBULE. CONNECT 1" HIES TO BOTH UPPER AND LOWER AIR TUNNEL EVAPORATIVE GRIDS. INSTALL MFR. PROVIDED STAGING AND DEPRESSURIZING VALVES IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS. (RE: DETAIL).

2 1/2" CW DOWN TO DBANS COOLER. RE: PLWG FOR CONT.

3 EXTEND 3/4" CN TO NEAREST FLOOR SINK RE: PLUMBING.

4 4" SGS AND S FOR INTO EXP SGY SERVICE VESTIBULE.

5 OFFSET UP AND OVER PRIOR TO ENTERING PENTHOUSE. ALL FOUR PIPES ENTER PENTHOUSE AT ONE ELEVATION ABOVE THE 84/74 EA DUCT.

6 4" SGS/SGR BRANCHES SHALL RISE UP OFF THE TOP OF SGS/SGR MAINS AND THEN DROP AND WRAP AROUND BELOW THE PIPE RACK AND EXTEND TO THE AHU COILS.

7 1" ROUTED FROM GLYCOL FEEDER GF-601 TO 1-1/2" FAST FILL/FLUSH CONNECTION TO ERS-601.1 SKID. FINAL ROUTING AND COORDINATION BY MC. REFER TO PLUMBING PLANS FOR NPCW CONNECTION.

8 1" ROUTED FROM GLYCOL FEEDER GF-602 TO CH-601A SKID. FINAL ROUTING AND COORDINATION BY MC.

9 5/8" REFRIGERANT RELIEF VENT PIPE DOWN TO CHILLER SAFETY RELIEF VALVE AND UP THROUGH ROOF. TERMINATE 3 FT. ABOVE ROOF WITH DOWNTURNED SCREENED OUTLET.

EXHAUST AIR PLENUM W/ KONVEKTA COIL (EAP-601, 602)

SUPPLY AIR HANDLING UNIT W/ KONVEKTA COIL (AHU-603, 604, 605, 606)

ENERGY RECOVERY HEAT EXCHANGER AND PUMP SKIDS

ACCESS PATHWAY IN PENTHOUSE

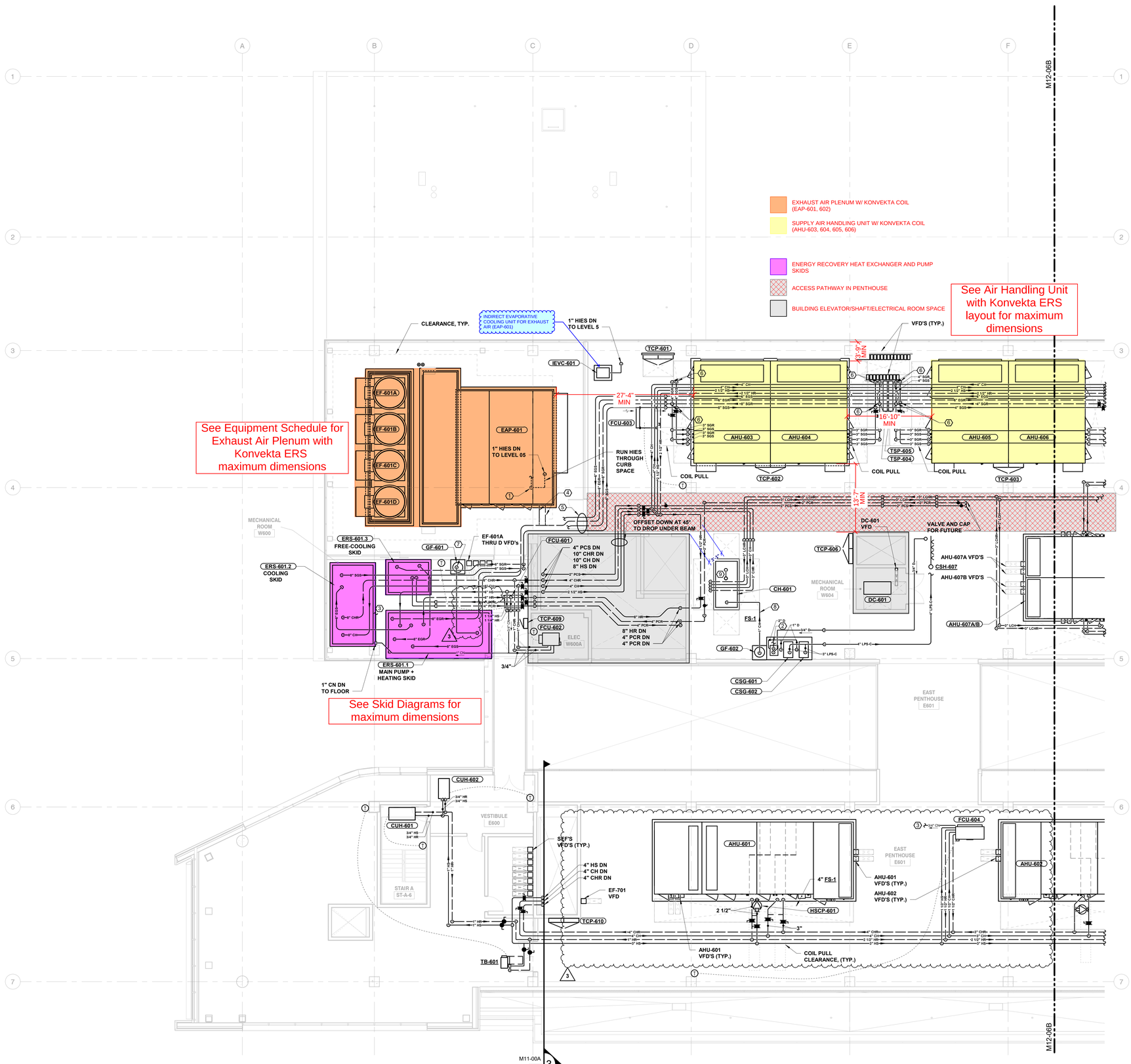
BUILDING ELEVATOR/SHAFT/ELECTRICAL ROOM SPACE

See Air Handling Unit with Konvekta ERS layout for maximum dimensions

See Equipment Schedule for Exhaust Air Plenum with Konvekta ERS maximum dimensions

See Skid Diagrams for maximum dimensions

Penthouse Mechanical System Layout & Dimensions With Konvekta ERS Sheet 1 of 2



1 MECHANICAL PIPING PLAN - LEVEL 06 - AREA A
SCALE: 1/8" = 1'-0"

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PR-05 - CONFORMED BUIDING PACK - JANUARY 16, 2024

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
3	PR-06 - BUILDING PACK	2024.03.08
2	PR-05 - CONFORMED BUILDING PACK	2024.01.16
1	DP-3: INTERIOR PACKAGE	2023.11.09

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MECHANICAL PIPING PLAN - LEVEL 06 - AREA A

SHEET NUMBER

M12-06A

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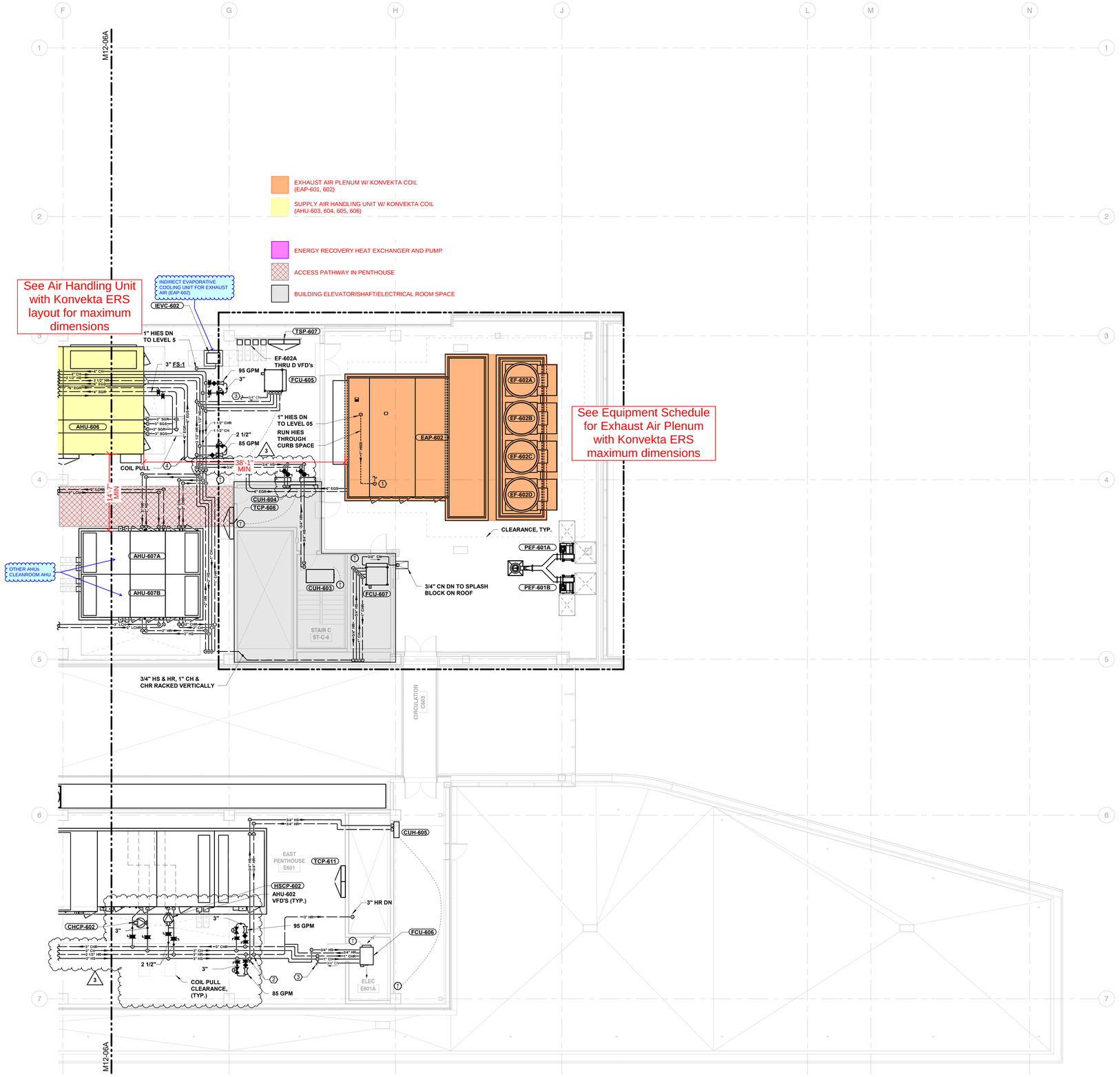

1 MECHANICAL PIPING PLAN - LEVEL 06 - AREA B
SCALE: 1/8" = 1'-0"

NORTH

GENERAL NOTES

1. (REFER TO SHEET M00-02)

KEYNOTE LEGEND

(NOTES BELOW ARE DESIGNATED IN PLAN BY: ◯)

1 1" HIGH PRESSURE INDIRECT EVAPORATIVE SUPPLY WATER (HIES). RISE UP INSIDE EAP SERVICE VESTIBULE. CONNECT 1" HIES TO BOTH UPPER AND LOWER AIR TUNNEL EVAPORATIVE GRIDS. INSTALL MFR. PROVIDED STAGING AND DEPRESSURIZING VALVES IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS. (RE: DETAIL).

2 RISE UP INTO BEAM POCKET AND RUN HS AND HR IN BEAM POCKET TO CROSS ABOVE LARGE DUCTS ABOVE AHU

3 EXTEND 3/4" CN TO NEAREST FLOOR SINK RE: PLUMBING.

4 RISE UP AT A 45 AND CROSS OVER ABOVE THE PIPE RACK

Penthouse Mechanical System Layout & Dimensions With Konvekta ERS Sheet 2 of 2

SBEC PROJECT #:	220022
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1	DP-3: INTERIOR PACKAGE	2023.11.09

Job Number	221904
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MECHANICAL PIPING PLAN - LEVEL 06 - AREA B

SHEET NUMBER

M12-06B

PR-05 - CONFORMED BUIDING PACK - JANUARY 16, 2024

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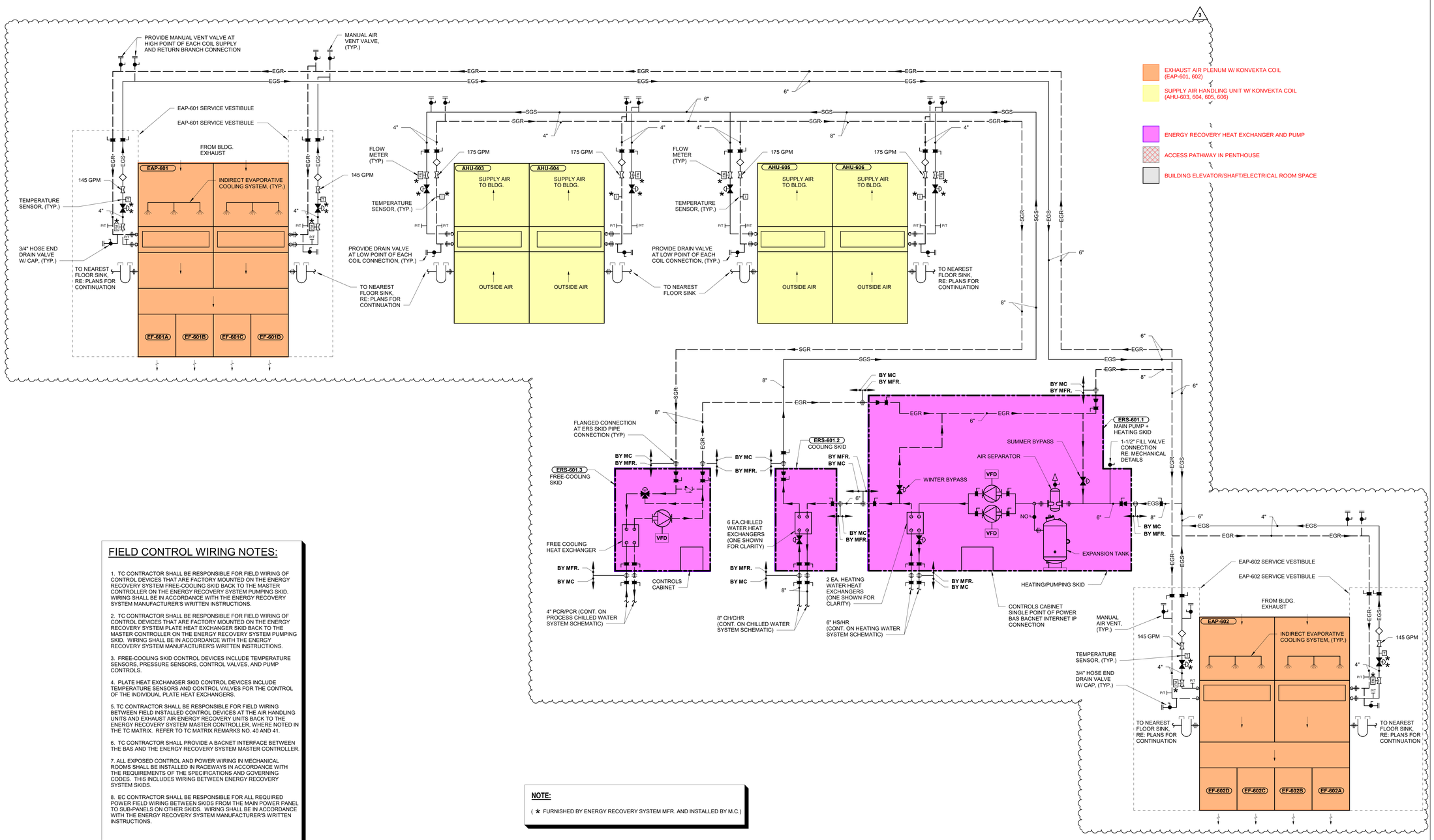
GENERAL NOTES

1. (REFER TO SHEET M00-02)
2. REFER TO DETAILS FOR ADDITIONAL INFORMATION INCLUDING COIL CONFIGURATIONS, EQUIPMENT CONNECTIONS, VALVES AND PIPING ACCESSORIES.
3. LOCATE FLOW METERS PER MANUFACTURER'S REQUIREMENTS AND AS REQUIRED BY T.C. CONTRACTOR TO ACHIEVE THE REQUIREMENTS OF THE SEQUENCE OF OPERATIONS.



EXHAUST AIR PLENUM W/ KONVEKTA COIL (EAP-601, 602)

SUPPLY AIR HANDLING UNIT W/ KONVEKTA COIL (AHU-603, 604, 605, 606)

ENERGY RECOVERY HEAT EXCHANGER AND PUMP

ACCESS PATHWAY IN PENTHOUSE

BUILDING ELEVATOR/SHAFT/ELECTRICAL ROOM SPACE

FIELD CONTROL WIRING NOTES:

1. TC CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD WIRING OF CONTROL DEVICES THAT ARE FACTORY MOUNTED ON THE ENERGY RECOVERY SYSTEM FREE-COOLING SKID BACK TO THE MASTER CONTROLLER ON THE ENERGY RECOVERY SYSTEM PUMPING SKID. WIRING SHALL BE IN ACCORDANCE WITH THE ENERGY RECOVERY SYSTEM MANUFACTURER'S WRITTEN INSTRUCTIONS.
2. TC CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD WIRING OF CONTROL DEVICES THAT ARE FACTORY MOUNTED ON THE ENERGY RECOVERY SYSTEM PLATE HEAT EXCHANGER SKID BACK TO THE MASTER CONTROLLER ON THE ENERGY RECOVERY SYSTEM PUMPING SKID. WIRING SHALL BE IN ACCORDANCE WITH THE ENERGY RECOVERY SYSTEM MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. FREE-COOLING SKID CONTROL DEVICES INCLUDE TEMPERATURE SENSORS, PRESSURE SENSORS, CONTROL VALVES, AND PUMP CONTROLS.
4. PLATE HEAT EXCHANGER SKID CONTROL DEVICES INCLUDE TEMPERATURE SENSORS AND CONTROL VALVES FOR THE CONTROL OF THE INDIVIDUAL PLATE HEAT EXCHANGERS.
5. TC CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD WIRING BETWEEN FIELD INSTALLED CONTROL DEVICES AT THE AIR HANDLING UNITS AND EXHAUST AIR ENERGY RECOVERY UNITS BACK TO THE ENERGY RECOVERY SYSTEM MASTER CONTROLLER, WHERE NOTED IN THE TC MATRIX. REFER TO TC MATRIX REMARKS NO. 40 AND 41.
6. TC CONTRACTOR SHALL PROVIDE A BACNET INTERFACE BETWEEN THE BAS AND THE ENERGY RECOVERY SYSTEM MASTER CONTROLLER.
7. ALL EXPOSED CONTROL AND POWER WIRING IN MECHANICAL ROOMS SHALL BE INSTALLED IN RACEWAYS IN ACCORDANCE WITH THE REQUIREMENTS OF THE SPECIFICATIONS AND GOVERNING CODES. THIS INCLUDES WIRING BETWEEN ENERGY RECOVERY SYSTEM SKIDS.
8. EC CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REQUIRED POWER FIELD WIRING BETWEEN SKIDS FROM THE MAIN POWER PANEL TO SUB-PANELS ON OTHER SKIDS. WIRING SHALL BE IN ACCORDANCE WITH THE ENERGY RECOVERY SYSTEM MANUFACTURER'S WRITTEN INSTRUCTIONS.

NOTE:

(✱ FURNISHED BY ENERGY RECOVERY SYSTEM MFR. AND INSTALLED BY M.C.)

1 / M50-05 ENERGY RECOVERY SYSTEM SCHEMATIC

SCALE: NONE

Energy Recovery System Schematic
Sheet 1 of 1

SBEC PROJECT #:	220022
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MECHANICAL - ENERGY RECOVERY SYSTEM SCHEMATIC

SHEET NUMBER

M50-05

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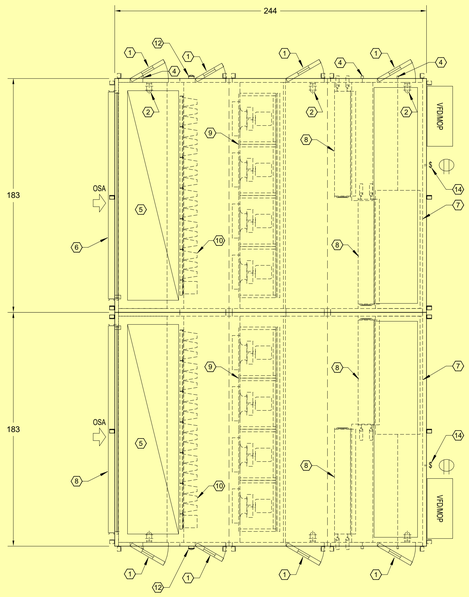
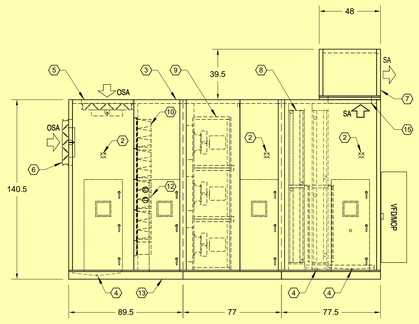


PLAN VIEW



ELEVATION VIEW

Maximum Dimensions for
Air Handling Unit
Sheet 1 of 1

KEY NOTES

1. AHU ACCESS DOOR WITH 10/10 VIEW WINDOW, (TYP). PROVIDE WITH A MINIMUM OF THREE (3) LATCHES.
2. INTERNAL AHU LED SERVICE LIGHT. PROVIDE LIGHTS IN ALL ACCESSIBLE SECTIONS OF UNIT.
3. PROVIDE 3" THICK DOUBLE WALL 16 GAUGE GALVANIZED STEEL CASING WITH 3 LB/FT3 DENSITY INSULATION (TYP).
4. 1-1/4" DRAIN CONNECTION FROM STAINLESS STEEL DRAIN PAN WITH WALK ON GRATING.
5. 150/40.5 OUTSIDE AIR OPENING AND DAMPER.
6. 150/38 OUTSIDE AIR OPENING AND DAMPER.
7. 144/33 SUPPLY AIR OPENING.
8. ENERGY RECOVERY COILS. REFER TO DETAIL FOR ADDITIONAL INFORMATION.
9. SUPPLY AIR FAN ARRAY ASSEMBLY. PROVIDE BACKDRAFT DAMPER FOR EACH FAN.
10. 2" THICK MERV 8A PRE-FILTERS WITH 12" THICK MERV 13A FINAL FILTERS.
11. MINIMUM 2-ROW HOT WATER HEATING COIL.
12. PROVIDE FILTER GAUGE ACROSS FILTER BANK.
13. 6" HIGH RAIL CURB.
14. AHU LIGHT SWITCH (TO CONTROL INTERNAL LIGHTS) AND CONVENIENCE OUTLET.
15. 34/169 SA OPENING WITH METAL GRATING (TYP EACH AIR TUNNEL.

AIR HANDLING UNIT (AHU-603, 604, 605 & 606) DETAIL

SCALE: NONE

EXHAUST AIR PLENUM W/ KONVEKTA COIL
(EAP-601, 602)

SUPPLY AIR HANDLING UNIT W/ KONVEKTA COIL
(AHU-603, 604, 605, 606)

ENERGY RECOVERY HEAT EXCHANGER AND PUMP

ACCESS PATHWAY IN PENTHOUSE

BUILDING ELEVATOR/SHAFT/ELECTRICAL ROOM SPACE

Perkins&Will

475 Lincoln Street, Suite100
Denver, CO 80203
t 303.308.0200
f 303.308.0222
www.perkinswill.com

CONSULTANTS

CIVIL
JVA
1319 Spruce Street
Boulder, Colorado 80302

LANDSCAPING
Confluence
3457 Ringsby Ct., Suite 223
Denver, Colorado 80216

STRUCTURAL
Martin/Martin
12499 West Colfax Avenue
Lakewood, Colorado 80215

MEP
Shaffer Baucom Engineering & Consulting
3900 S. Wadsworth Boulevard, Suite 600
Lakewood, Colorado 80235

TECHNOLOGY
DATACOM DESIGN GROUP
7600 Burnet Road, Suite 350
Austin, Texas

Facility Operator
Colorado School of Mines
1801 19th Street
Golden, Colorado 80401

OWNER
U.S. Geological Survey
Sunrise Valley Drive
Reston, Virginia 20192

FACILITY LOCATION
Energy & Mineral Research Facility
1000 18th Street
Golden, Colorado 80401

CONTRACTOR
Adolfson & Peterson Construction
797 Ventura Street
Aurora, Colorado 80011

PROJECT

U.S. GEOLOGICAL SURVEY
Sunrise Valley Drive
Reston, Virginia 20192

ENERGY & MINERALS RESEARCH FACILITY
1000 18TH STREET
GOLDEN, CO 80401

PR-05 - CONFORMED BUIDING PACK - JANUARY 16, 2024

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
2	PR-05 - CONFORMED BUILDING PACK	2024.01.16
1	DP-3: INTERIOR PACKAGE	2023.11.09

Job Number	221904
Drawn	DP / TMH / TW
Checked	CJ
Approved	GS

TITLE

MECHANICAL DETAILS

SBEC PROJECT #: 220022
DRAWN BY: DP/TH
DESIGNED BY: CEJ
CHECK BY: CEJ
APPROVED BY: GS

SHEET NUMBER

M60-08

2/23/2024 4:56:56 PM Autodesk Docs://Mines-SSF/MPF-EMRF-ALL.rvt

Project: CSM - Energy and Mineral Research Facility // -

Variant: 230615_XV_5/5_cu_dim

October 11., 2023 / V4.0.0 // Reference: 84190490-a1-v20 // state: 10% // Design Engineer: Joel Furrer

konvekta high performance energy recovery system
results of optimization calculations: HX w/ FC

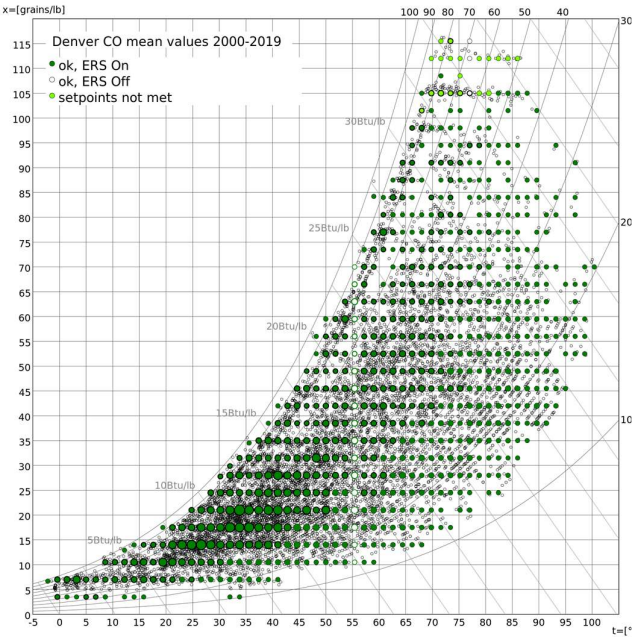
Minimum Energy Savings Criteria

basis for the energy calculations

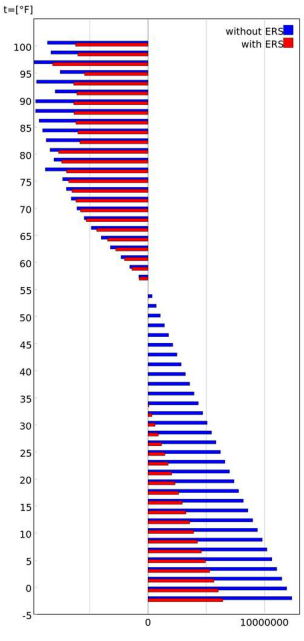
location (climate data)	Denver CO (mean values 2000-2019)
volume flows air	all systems equal: 01.01 - 31.12; Mon-Sun; 00:00-05:00 : 66.67% / 05:00-22:00 : 100% / 22:00-24:00
: 66.67%	
setpoints SA temperature	all systems equal, 55.0°F
temperature entering EA	all systems equal, winter 72.0°F // summer 76.0°F
humidity entering EA (latent heat load)	all systems equal, winter 42.1gn/lb // summer 72.7gn/lb

results energy calculations: reduction of heating energy: 86% reduction of cooling energy: 21%	**without ERS**	**with ERS**	**nr of hours**	**nr of hours with external heat/cold**
	(MMBtu)	(MMBtu)	(h)	(h)
heating requirement	15'316.4	2'078.0	4'832	1'612
cooling requirement	11'019.6	8'694.8	3'651	3'651
el. energy pump		547.6	8'483	
add. el. energy fans (HW-Coil + CW-Coil + ERS)	116.7 + 580.8	0.0 + 0.0 + 1'229.3	8'760	
		(cuft)	(h)	
water consumption evaporative cooling		131'474.6	3'651	

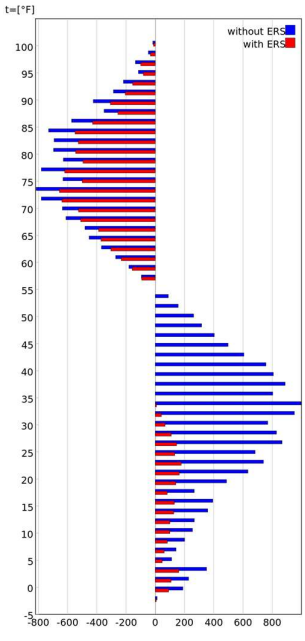
Operating points with weatherdata (hx diagram)



max. performance per temp. ambient (Btu/h)

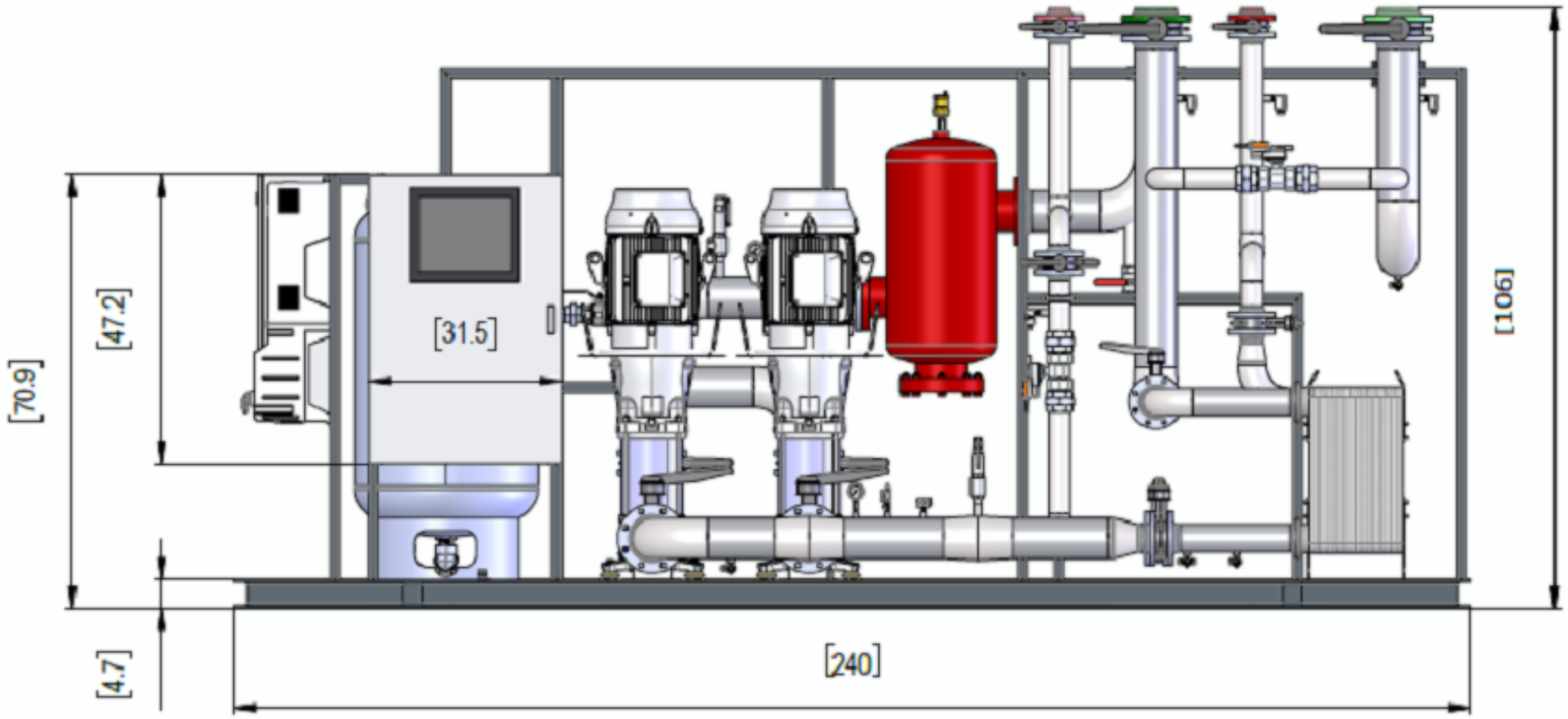


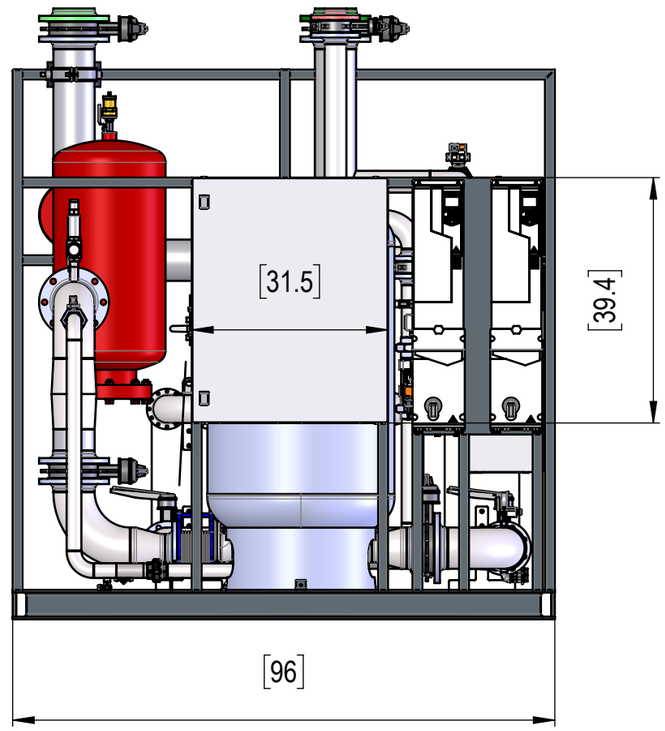
energies per temp. ambient (MMBtu)

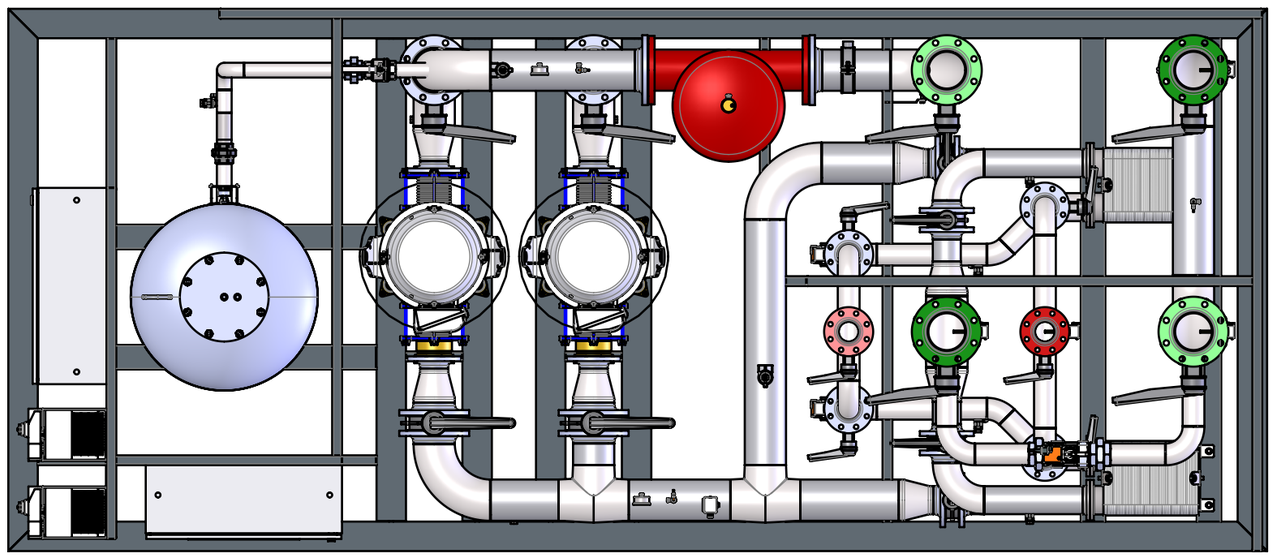


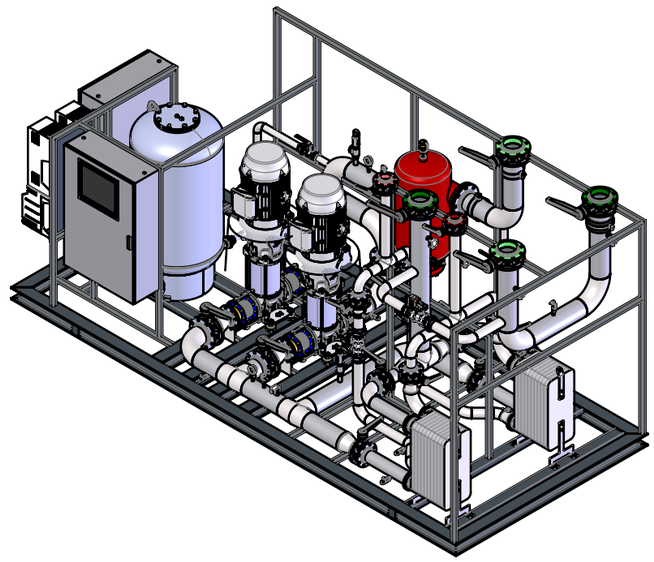
Remarks

- setpoints deviated in some operating points
- The diagrams on the right show the performances and energies without and with the high-performance ERS over the outside air temperatures.









Maximum Dimensions
Main Pumping and Heating Skid
Page 1 of 2

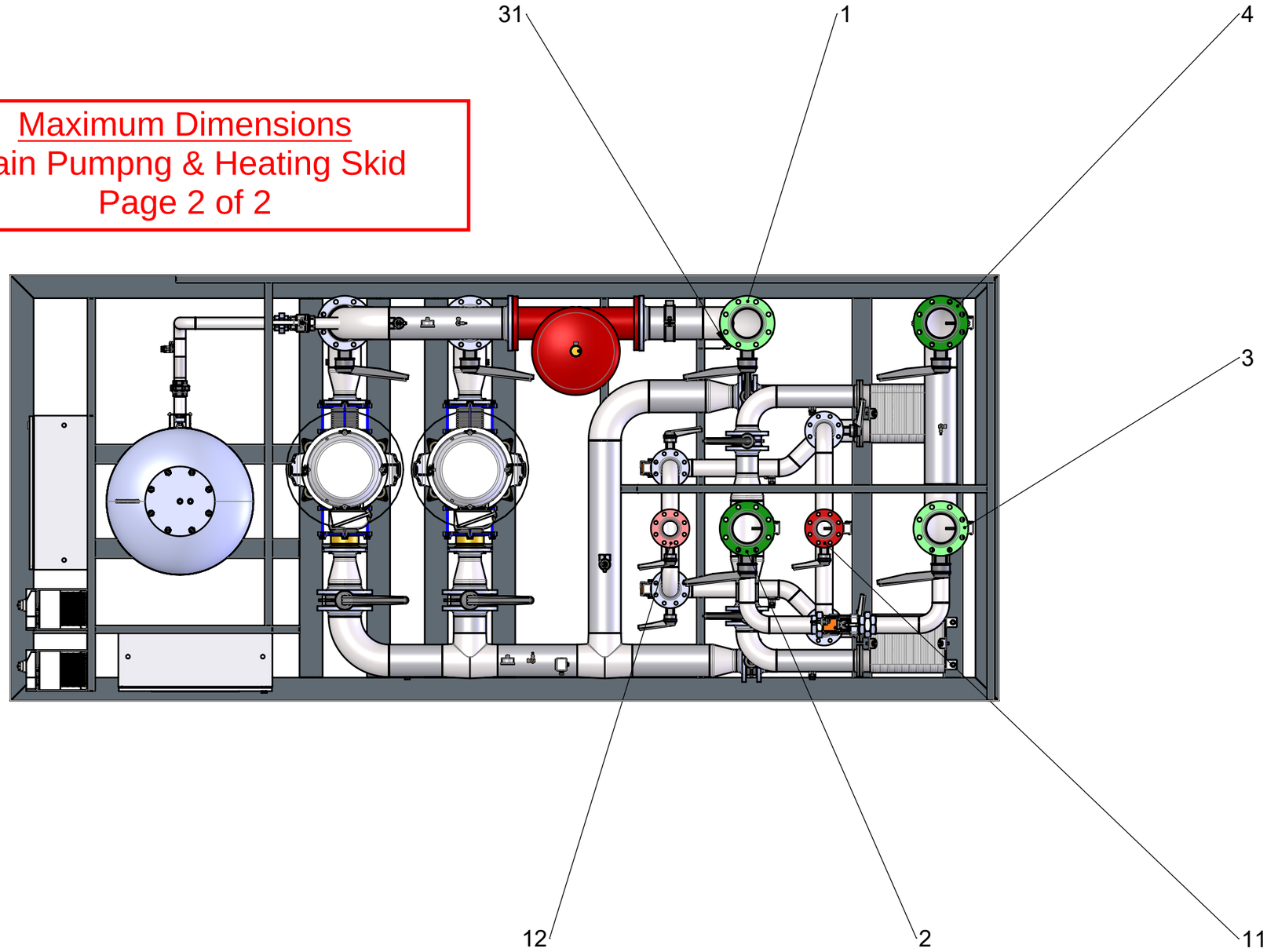
[inches] mm

Company	3021	revision	I 12.05.2023 A. Re	created	10.03.2023	A. Re	scale
	Konvekta USA Inc.		II -	approved		-	NTS
	Princeton NJ, 08540		III -	released		-	
			IV -	Scheme	1.1.2 NW150		
without separate BOM ☐	Notes			weight	12355 lb empty / 16000 lb full		
BOM with same Nr. ☐				Material		Format A3	Page 1 / 2
BOM with diffrent Nr. ☐	File Z_84190490-301_B1			Rev. / Index	1.0		
konvekta KONVEKTA AG CH-9015 St.Gallen	Project Hydronic Module CSM EMRF Pumping Skid [Preliminary]			Commission / Product-Nr. 84190490-301			

CAD-System: SolidWorks

Plotdate: 05.04.2023

Maximum Dimensions
Main Pumpng & Heating Skid
Page 2 of 2



1 return line from all EAHU, 6" flange to [8" field piping]

2 AHU supply line, 6" to CHW PHx skid

3 AHU return line, 6" from FC skid

4 supply line to all EAHU, 6" flange to [8" field piping]

11 supply line PHE-HW, 4" flange

12 return line PHE-HW, 4" flange

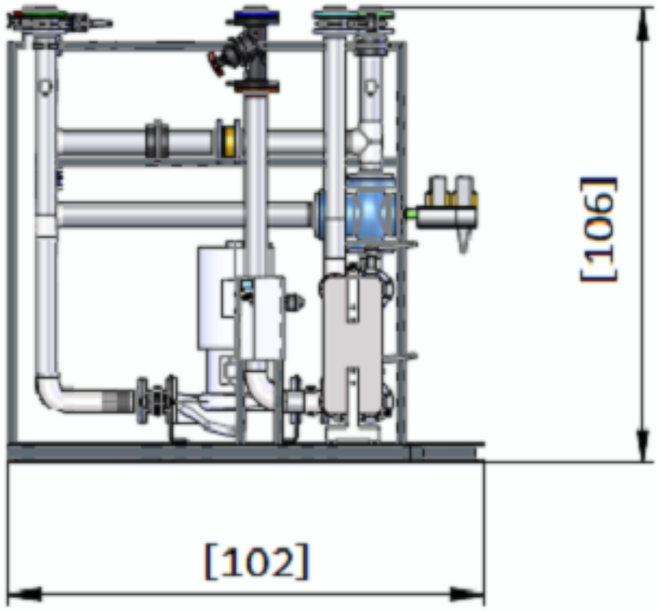
31 filling nozzle, 2"

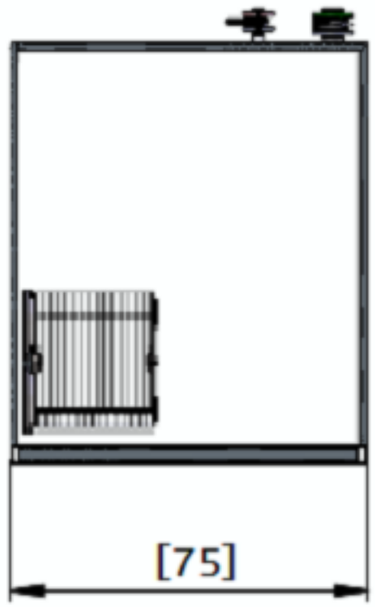
[inches] mm

Company	3021	revision	I	12.05.2023 A. Re	created	10.03.2023	A. Re	scale
	Konvekta USA Inc.		II	-	approved		-	NTS
	Princeton NJ, 08540		III	-	released		-	
			IV	-	Scheme	1.1.2 NW150		
without separate BOM ☐	Notes				weight	12355 lb empty / 16000 lb full		
BOM with same Nr. ☐					Material		Format A3	Page 2 / 2
BOM with diffrent Nr. ☐	File Z_84190490-301_B1				Rev. / Index	1.0		
konvekta KONVEKTA AG CH-9015 St.Gallen	Project Hydronic Module CSM EMRF Pumping Skid [Preliminary]						Commission / Product-Nr. 84190490-301	

CAD-System: SolidWorks

Plotdate: 05.04.2023





Maximum Dimensions
Free Cooling Skid
Page 1 of 1

5 return line from all AHU, 6" flange to [8" field piping]

3 return line, 6" to pumping skid

34 FC supply, 4"

35 FC return, 4"

[inches] mm

Company	3021	revision	I	12.05.2021 A. Re	created	08.12.2021	A. Re
	Konvekta USA Inc		II	-	approved		-
	Princeton NJ, 08540		III	-	released		-
			IV	-	Scheme	1.1.2 NW150	
without separate BOM ☐	Notes				weight	3,760 lb empty / 4,800 lb full	
BOM with same Nr. ☐					Material		Format A3 / Page 1 / 1
BOM with diffrent Nr. ☐	File Z_84170640-302_B3				Rev. / Index	3.0	

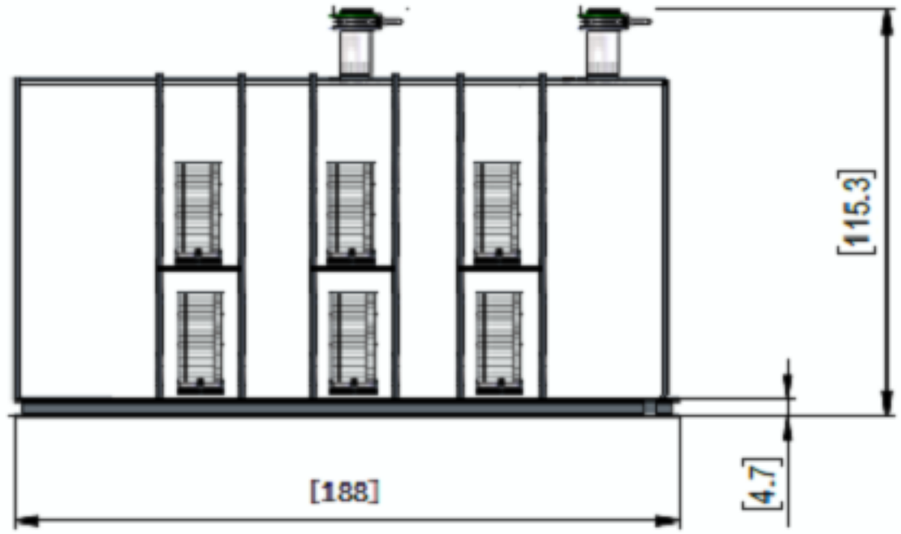
konvekta
KONVEKTA AG CH-9015 St.Gallen

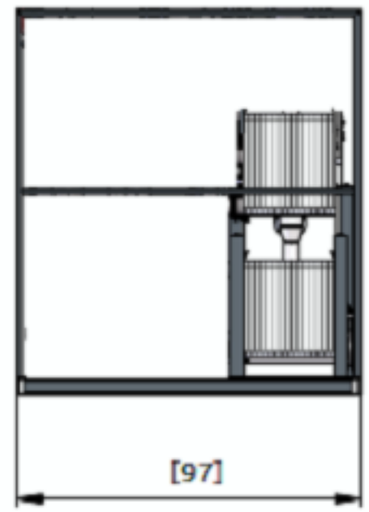
Project: Hydronic Module
CSM EMRF Free Cooling Skid [Preliminary]

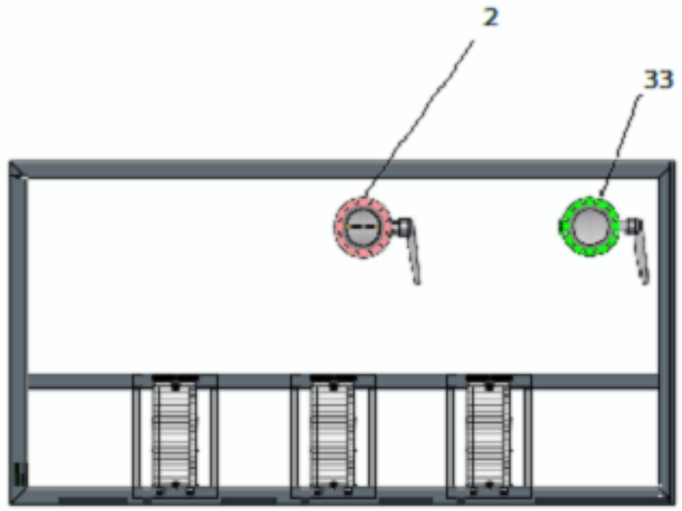
Commission / Product-Nr.: 84190490-303

Plotdate: 14.12.2021

CAD-System: SolidWorks







Maximum Dimensions
Chilled Water Skid
Page 1 of 1

2 supply line, 6" from pumping skid

33 supply line to all AHU, 6" flange to [8" field piping]

[inches] mm

Company	3021	revision	I 12.05.2021 A. Re	created	08.12.2021	A. Re	scale
	Konvekta USA Inc		II -	approved		-	NTS
	Princeton NJ, 08540		III -	released		-	
			IV -	Scheme	1.1.2 NW150		
without separate BOM ☐	Notes			weight	10,810 lb empty / 14,000 lb full		
BOM with same Nr. ☐				Material		Format A3	Page 1 / 1
BOM with diffrent Nr. ☐	File Z_84170640-302_B3			Rev. / Index	3.0		

konvekta
KONVEKTA AG CH-9015 St.Gallen

Project: Hydronic Module
CSM EMRF Chilled Water PHx [Preliminary]

Commission / Product-Nr.: 84190490-302

CAD-System: SolidWorks

Plotdate: 14.12.2021

Energy Recovery System for Laboratory Ventilation System
Minimum General Requirements

The system uses coils, pumps and controls to provide a single coil solution for heating, cooling, and energy recovery in laboratory air handlers. The system coils are epoxy coated to resist corrosion from hazardous lab exhaust. The single coil solution provides the small footprint that is required to fit into available mechanical room space, while achieving a high reduction in energy consumption.

Energy performance to be guaranteed by the manufacturer including a reduction in heating energy of 86% and cooling energy of 21% per attached details. Integral controls are to provide real time energy performance metrics utilizing sensors for flow and temperature.

The system must utilize existing campus infrastructure for steam and chilled water that is limited to 984 GPM of chilled water at an entering water temperature of 45F and a 16 degree delta T. Heating must be limited to 354 GPM with entering water temp of 180F and 40 degree delta T (equivalent to 6,578 lbs/hr at 50 psig.

Coils must use an epoxy coating suitable for corrosion resistance in hazardous laboratory exhaust systems. Coils must be constructed with fins spaced no closer than 8 fins per inch to allow pressure washing. Performance data per schedule.