

**ADDENDUM NO. 01**

October 15, 2021

This Addendum contains changes to the requirements of the Contract Documents and Specifications. Such changes are to be incorporated into the Construction Documents and shall apply to the work with the same meaning and force as if they had been included in the original document. Wherever this Addendum modifies a portion of a paragraph of the specifications or a portion of any Drawing, the remainder of the Paragraph or Drawing shall remain in force.

NOTE: Provisions of all Contract Documents apply.

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**INSTRUCTION TO BIDDERS**

Item 1. INS-1, 1. Bid Documents, (5)

**ADD**

- Pre-Bid Conference video and other materials will be available via Drop Box at:

<https://cornell.box.com/s/a5vx6db66a99v6r58mpr85uflo50r2nm>

**GENERAL REQUIREMENTS**

Item 2. **ADD** Section 01 35 13 CLEAN ROOM SPECIAL CONSTRUCTION AND CLEANING

**TECHNICAL SPECIFICATIONS**

Item 3. Section 23 08 10 Clean Room Certification

**DELETE** in its entirety.

**REPLACE** with Revised Clean Room Certification specification, attached.

**Item 4.** Section 23 09 23 Building Automation Control System Guidelines, 2.4, A.10

**DELETE** "Cambridge"

**REPLACE** with "Accutrol"

Item 5. Section 23 09 23 Building Automation Control System Guidelines, 2.4, B.8

**DELETE** "Cambridge"

**REPLACE** with "Accutrol"

DUFFIELD HALL CLEAN ROOM HVAC REHABILITATION

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Item 6. Section 23 09 23 Building Automation Control System Guidelines, 2.4, C.7

**ADD** "Accutrol"

Item 7. Section 23 09 23 Building Automation Control System Guidelines, 2.4, D.8

**DELETE** "Cambridge"

**REPLACE** with "Accutrol"

**DRAWINGS**

Item 8. Drawing M-001, Drawing Note 2

**DELETE** "... ELEVATOR IS 4'-5" x 8'-4" x 7'-11"..."

**REPLACE** with "... ELEVATOR IS 5'-5" x 8'-6" x 8'-11" TALL..."

Item 9. Drawing M-002, Drawing Note 2

**DELETE** "... ELEVATOR IS 4'-5" x 8'-4" x 7'-11"..."

**REPLACE** with "... ELEVATOR IS 5'-5" x 8'-6" x 8'-11" TALL."

Item 10. Drawing M-204

**DELETE** in its entirety.

**REPLACE** with revised Drawing M-204R, attached.

Item 11. Drawing M-500

**DELETE** in its entirety.

**REPLACE** with revised Drawing M-500R, attached.

Item 12. Drawing M-600

**DELETE** in its entirety.

**REPLACE** with revised Drawing M-600R, attached.

Item 13. RFI Questions and Clarifications

See attached RFI Log (Items 1-3)

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Attachments:   Section 01 35 13 Clean Room Special Construction and Cleaning Procedures  
                  Section 23 08 10 Clean Room Certification  
                  Drawing M-204R  
                  Drawing M-500R  
                  Drawing M-600R  
                  RFI Log (Items 1-3)

**\*\*\*\*END OF ADDENDUM\*\*\*\***

**SECTION 01 35 13 CLEAN ROOM SPECIAL CONSTRUCTION AND CLEANING**

**1.0 GENERAL**

**1.1 DESCRIPTION**

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:

1. This Section is intended to give the Subcontractor a general framework for cleanroom cleaning procedures. This Section does not relieve the General Contractor and/or Subcontractor from the responsibility to maintain a generally clean, orderly and safe worksite and to develop more stringent cleaning guidelines to ensure an effective cleanroom installation

C. Related Sections:

1. Division 01 42 00 Section "References"
2. Division 01 45 00 Section "Quality Control"
3. Technical Specifications 23 08 10 Section "Clean Room Certification"

**1.2 DEFINITIONS**

A. Stages of Construction Cleanliness: Defined as clean stages in construction schedule where cleaning requirements in building are more stringent and type and methods of work are more restrictive.

1. Normal Clean.
2. Very Clean.
3. Ultra Clean.
4. Final Clean.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Special Handling: All items being transported into the cleanroom are to be cleaned in such a way as to remove all obvious dirt, loose particles, and contaminants while located in the equipment Wipe Down Room. Quality Assurance Personnel must accept all the equipment designated to enter the cleanroom. All wafer transport boxes, test equipment, tool cases, etc., are to be blown off with a filtered air gun immediately prior to entering the cleanroom in the Wipe Down Room. Items known or suspected as particle generators such as, cardboard boxes, dry mops, etc., are not permitted in the cleanroom.

**1.4 PROJECT/SITE CONDITIONS OR SPECIAL CONDITIONS**

- A. Typical construction activities during the Normal Clean Stage include:
  - 1. HEPA filter ceiling grid support structure and removal
- B. Ultra Clean Stage:
  - 1. Install HEPA filters
  - 2. MAU-1 Testing and Certification
- C. Final Clean
  - 1. Particle Count Tracking and Compliance
  - 2. HEPA/ RECIRCULATING AHU System Testing and Certification

**1.5 SCHEDULING**

- A. Cleanroom Protocol Training: Coordinate, schedule and lead training classes for all site subcontractors at least one week before they are required on the job.
  - 1. TRAINING – General Contractor shall determine who will perform the Cleanroom training. Cleanroom training will be completed prior to construction.
  - 2. PRODUCTS – Adequate supplies of proper garments shall be ordered timely by the General Contractor or whoever the General Contractor designates responsible.

**1.6 PREPARATION**

- A. Provide Cleanroom Protocol classroom training for all workers employed by contractors and subcontractors entering work site. Provide identification for attendees completing training. Training class will contain but not be limited to following:
  - 1. Clean room protocol
  - 2. Hazardous Communication awareness
  - 3. Hazardous Materials awareness
- B. Upon completion of any portion of work, clean and wipe down affected areas.

- C. Restrict number of entrances to cleanroom. Location of entrances may change during construction due to construction schedule.
- D. Locate trash containers throughout building interior. Empty daily, or more often if required.
- E. Workers must display identification badge at all times clearly identifying themselves and their company.
- F. Provide two or more sets of cleanroom garments for all employees required to enter the cleanroom, subcontractors and Owner Project Team including shoes, smocks or jumpsuits, and head covers. Clean reusable garments every two days. Disposable garments are an alternate option. Also provide disposable facemasks, shoe covers and gloves which will be used for one time only.
- G. Provide shoe covers at beginning of very clean stage at all building entrances for all contractors and subcontractors.
- H. Ensure employees and subcontractors follow cleanroom protocol, including wearing cleanroom garments in designated areas and changing to cleanroom and building shoes, as construction progresses to ultra clean stage.

### **1.7 APPLICATION**

- A. Entrances to cleanroom to include:
  - 1. Shelves for storage of hard hats and shoes
  - 2. Space and bench for workers to change shoes
  - 3. Hanging bars for smocks and method to control use of smocks
  - 4. Sticky/tacky mats to remove dust from shoes
  - 5. Seal entrances airtight to maintain positive pressure in building
  - 6. Mirror so people can see if their gowning is adequate
  - 7. Waste containers for disposable cleanroom garments
  - 8. Adequate supplies of required cleanroom garments
- B. Entrances may be temporary freestanding units attached to building if space within building cannot be made available.
- C. Post signs in English and other applicable local languages at cleanroom entrances explaining cleanliness procedures, including but not be limited to:
  - 1. No eating or drinking
  - 2. No smoking
  - 3. No tobacco
  - 4. No sleeping
  - 5. No cosmetics

6. Gowning requirements (use photos)
7. Gowning procedures (use photos)

## **1.0 PRODUCTS**

### **1.1 MATERIALS**

- A. CREW 2 or equivalent cleanroom wipe
- B. De-ionized water
- C. 10 percent Isopropyl Alcohol 90 percent De-ionized water solution
- D. Disposable sticky roller – Clean Room Rated
- E. Cleanroom Detergent
- F. Other as noted in Technical Specification 23 08 10 Section, “Clean Room Certification”

## **2.0 EXECUTION**

### **2.1 CLEANING**

- A. General: The tasks of the specialty cleaning subcontractor are described as follows:
  1. Responsible for maintaining cleanliness in the cleanroom area at the beginning of the very clean stage.
  2. Responsible for maintaining and securing all entrances to the cleanroom at the beginning of the very clean stage.
  3. Provide all equipment, materials, and manpower required to maintain the building clean.
  4. Supply trash containers throughout the fab building and emptied regularly as required.
- B. Normal Clean Stage:
  1. Conduct cleaning and non-hazardous, non-toxic waste disposal operations in compliance with local laws and ordinances. Comply with federal and local environmental and anti-pollution regulations.
  2. Complete the following cleaning operations:
    - a. Remove tools, construction equipment, machinery and surplus material from the cleanroom area.
    - b. Remove waste material and rubbish from the cleanroom area.

- c. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - d. Remove debris and surface dust from limited access spaces, including roofs, plenums, trenches, and similar spaces.
  - e. Broom clean concrete floors in unoccupied spaces.
  - f. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
  - g. Remove labels that are not permanent.
  - h. Touchup and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.
  - j. Replace air disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - k. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
3. Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of construction period.



C. Very Clean Stage:

1. At the start of the very clean stage a thorough cleaning of the facility should be performed starting at the ceiling support level and working down to the floor level.

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Items	Job description
Steel structure	Vacuum and wipe clean
Hepa filter support	Vacuum and wipe clean
Floor	Vacuum and wipe clean
Other fixtures	Wipe clean
Support areas	Vacuum and wipe clean
Sprinkler mains	Vacuum and wipe clean

2. Daily Cleaning Routine
  - a. Vacuum floor with dry vacuum cleaner at least twice daily.
  - b. Removal of waste from waste containers at least twice daily.
  - c. Spot clean glass panels to remove finger marks and stains.
  - d. Spot clean wall to remove stains.
  - e. Spot mop floor with solution of mild and compatible cleaning agents. Follow with DI water rinse. This must be repeated after any spill.
3. Full time protocol workers will keep the entrances clean and inform the workers and visitors about the clean construction requirements.
4. Cleaning material will be available at the entrances for the workers to wipe down materials before transportation inside the building.
5. Shoe racks are provided at the entrances.
6. During the very clean stage materials will unpacked in designated areas. The materials are wiped down in the entrance area.
7. This entrance will also act as air-locks to keep the building with positive pressure, i.e. they are relatively sealed.
8. Special attention will be paid to the housekeeping, to keep the working area in the whole construction site safe, neat and clean.

D. Ultra Clean Stage:

1. At the start of the ultra clean stage again a thorough cleaning of the facility should be performed starting at the ceiling support level and working down to the floor level.

Items	Job Description
Repeat all items of first cleaning	
Filter ceiling grid	Vacuum and wipe clean
Make up air units and ductwork	Vacuum and wipe clean
Lighting fixtures	Wipe clean
Sprinkler piping	Wipe clean
Piping	Wipe clean
Exhaust ducts and piping	Vacuum and wipe clean
Walls	Wipe clean
Floors and trenches	Vacuum and wipe clean
Entrances	Vacuum and wipe clean

2. Daily Cleaning Routine

- a. Cleaners are to use the HEPA Vacuum cleaner to remove heavier than air particle matter, such particle matter is too heavy to be swept from the room by air treatment system (twice a day).
- b. All wet cleaning will be accompanied with the use of a 10 percent IPA/DI water solution within the cleanroom to reduce ionic contamination brought into the area by unfiltered water.
- c. Use sticky roller to remove particle matter. Such particles are solidly deposited on the floor and cannot be removed by vacuum cleaner (twice a day).
- d. Collect the waste material from the cleanroom area and dispose of it in the designated containers (three times daily).
- e. Vacuum cleaner brush and attachment will be inspected and cleaned outside the cleanroom to prevent contamination within the cleanroom area.
- f. Spot clean glass and wall panels with Crew 2 wiper and 10 percent IPA/DI water solution.
- g. All incoming material filter, blanks, must be cleaned again just before installation.

3. Weekly Cleaning Routine:
    - a. All glass panels, walls will be wiped with Crew 2 Wiper using cleanroom detergent and dilute with DI water (according to Manufacturing Specification).
    - b. All doors, partition walls, cabinet top and equipment top will be wiped with Crew 2 Wiper using cleanroom detergent diluted with DI water (according to cleaning procedures specification).
    - c. Thorough washing of waste containers. Such cleaning should be done outside the cleanroom area.
  4. Full time protocol workers keep the entrances clean and inform the workers and visitors about the clean construction requirements, which are valid for the ultra-clean stage.
  5. Prohibit entrance to the building of staff, which show repeatedly or serious irregular behavior.
  6. Materials for the interior of the building will arrive on-site individually packed.
  7. Before entering into the ultra clean area the following general procedure of cleaning the material will be used:
    - a. The materials will be unpacked outside the building in a designated entrance area. This entrance will also act as an air-lock to keep the building with positive pressure, i.e. they are relatively sealed. The outer box will be removed into trash containers. The material will be wiped down in the designated entrance area.
    - b. For filters and blanks, the polyethylene plastic bags will be removed in steps according to temporary storage and final clean/quality check just before installation.
    - c. Special attention will be paid to the housekeeping, to keep the working area in the whole fab safe, neat and clean.
    - d. Components, which arrive not in clean condition, are cleaned with humid cloths or vacuum cleaner before the assembly.
  8. The passenger and material traffic are only allowed via air locks. Sticky tacky mats are installed at the entries to the clean areas. Humid wiping is the preferred cleaning method using 10 percent IPA/DI water solution. Surfaces are treated either with an anti-static or blown off with ionized, very fine filtered compressed air.
  9. The cleaning operations shall be documented continuously during all stages of construction.
- E. Final Clean (Reference Technical Specification 23 08 10 Section, "Clean Room Certification")
1. Clean spaces, check particle counts for compliance with Cleanroom Classification
  2. If particle counts do not meet the criteria, re-clean.

3. If particle counts still do not meet the criteria, complete ambient air challenge on filters in space to check for any deficiencies. (Ambient Air challenge is part of Allowance #2)
4. Re-clean until criteria is met.

**\*\*\*END OF SECTION 01 35 13\*\*\***

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CLEAN ROOM CERTIFICATION

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SECTION 230810 - CLEAN ROOM CERTIFICATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete certification of Clean Room areas as designed in contract documents.

1.2 SUBMITTALS

- A. Provide information in report from listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.
- B. Report format shall consist of the following:
  - 1. Title sheet with job name, contractor, architect, engineer, date, contractor's name, address, telephone number and contact person's name, room identification name/number
  - 2. Individual test sheets to be provided for each area and test performed.
  - 3. Provide commentary of installed system with respect to deviations to Contract Documents not indicated, system performance and craftsmanship of the installation.

1.3 QUALIFICATIONS

- A. Follow procedures and methods published in accordance with recommended ISO standard 14644-1 and 14644-2.
- B. Testing contractor to maintain qualified personal at the project site throughout certification testing. Testing contractor to have been actively employed over past five year certifying Clean Rooms and is NEBB certified in clean room performance.

1.4 AREAS REQUIRING CERTIFICATION

- A. Class 1000 Areas: All spaces with HEPA filter replacements are considered class 1000.

PART 2 – PRODUCTS

2.1 AIRBORN PARTICLE COUNT

- A. This test to be performed to determine that the complete as-built facility can achieve the air cleanliness level listed in Article 1.4 "Areas requiring certification." Working plane for sampling in clean rooms to be 48" above finished floor.

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CLEAN ROOM CERTIFICATION

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- B. Apparatus:
1. Laser particles counter having a minimum sampling rate of 1.0 CFM and particle size discrimination capability of 0.5 microns and larger. Apparatus shall also measure temperature and humidity.
- C. Procedure:
1. Verify that HEPA filter replacement and all renovation work is complete.
  2. Establish a test point grid pattern at the working level.
  3. ISO 14644-1 & 14644-2 will determine the minimum number, location, and grid size of sampling points. Maximum area for a sample point will be 100 square foot grid for the class 100 and 1000 rooms. (ISO Class 5&6 respectively).
  4. Unless otherwise noted particle counts should be based on the number of particles 0.5 micrometer and larger per unit volume of air.
  5. The number of count measurements at each sample point and the volume of air sampled at each measurement should be based on 1 reading per sample point.
  6. Statistical analysis of all data is required.
- D. Reporting:
1. Record the particle count at each grid location.
  2. Record the temperature and humidity readings on the same grid pattern as the particle count testing above.
- E. Note all measurements exceeding the specified air cleanliness level. Acceptance:
1. To classify the complete Clean Room as meeting the specified air cleanliness level, particle counts shown on the sample point plan are not to exceed the specified level.

## 2.2 AIRFLOW VELOCITY AND UNIFORMITY TEST

- A. This test to be performed to determine record and document the average airflow velocity and uniformity of the filter face in the unidirectional airflow. Alternative velocity or uniformity testing is allowed, if approved by Owner/Engineer.
- B. Apparatus:
1. A digital anemometer having a range of 50 to 2500 fpm, accuracy of 5% of a reading 100 FPM or greater, accuracy of 10% of a reading 100 FPM or less, and resolution of 1.0 fpm.

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CLEAN ROOM CERTIFICATION

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C. Procedure:

1. Verify that HEPA filter replacement and all renovation work is complete.
2. Establish a test point grid pattern at 6 in. from the filter face. Keep the sampled area unobstructed during the airflow measurements.
3. ISO 14644-1 & 14644-2 will determine the minimum number, location, and grid size of sampling points. Maximum area for a sample point will be 100 square foot grid for the class 100 and 1000 rooms. (ISO Class 5&6 respectively).
4. Measurement shall be a minimum of 5 seconds or the instrument manufacturer's minimum specified time.
5. Statistical analysis of all data is required.

D. Reporting:

1. Record the airflow measurements with corresponding grid locations.
2. Note all measurements exceeding the specified average air velocity.

E. Acceptance:

1. The average airflow velocity of the filter shall be within 10% of the specified velocity.

2.3 ROOM PRESSURIZATION TEST

A. This test to be performed to determine record and document the room pressurization.

B. Apparatus:

1. Manometer having a minimum range of 0 to 0.5 in.w.g and accuracy of 2%.

C. Procedure:

1. Verify that HEPA filter replacement and all renovation work is complete.
2. Measure the pressure differential (in.w.g.) between the inner most cleanroom and the adjacent spaces, rooms, or the exterior environment.
3. Measure the pressure differential (in.w.g.) between the next adjacent spaces and other spaces or exterior environment until all pressure differentials have been obtained and recorded.

D. Reporting:

1. Record all pressure differentials in each measured location.

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CLEAN ROOM CERTIFICATION

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2. Note all measurements exceeding the specified pressure differential levels.
- E. Acceptance:
1. Pressurization levels shall meet the existing pressurization levels.
- 2.4 AMBIENT AIR CHALLENGE - HEPA FILTER INSTALLATION LEAK TEST
- A. This test is performed to confirm that the HEPA filter system is properly installed by verifying the absence of bypass leakage in the installation and that the HEPA filters are free of defects and pinhole leaks. The test is made by introducing an aerosol challenge up-stream of the HEPA filters and scanning immediately down-stream of the filters and support frame.
- B. Ambient Particle Aerosol Challenge and Airborn Particle Counter-Down-stream Filter Scan Test Method.
- C. Apparatus:
1. Optical particle counter having a minimum sampling rate of 1.0 ft./min. and particle size discrimination capability of 0.1 micrometer or smaller.
- D. Procedure:
1. Establish the particle count in the plenum upstream of the HEPA filter installation under test. If the upstream concentration is less than  $1 \times 6$  particles  $0.5$  micrometer and larger/ $\text{ft}^3$ ), introduce additional ambient makeup air or other suitable aerosol upstream of the filter.
- E. Return the probe of the particle counter to a point immediately downstream of the filter face centerline. Allow the counter to clean down and stabilize until readings are below  $100$  particles/ $\text{ft}^3$ .
- F. For scanning, the probe inlet of the particle counter shall be of sufficient cross-sectional area to maintain the probe inlet velocity at or above the test air flow rate through the filter.
- G. The filter face and the perimeter of the filter pack should be scanned by passing the probe in slightly overlapping strokes so that the entire area of the filter is sampled. The probe should be held approximately  $1$  in. from the area to be tested during scanning. Separate passes should be made around the entire periphery of the filter, along the bond between the filter pack and the frame, and around the seal between the filter and the device, at a traverse rate of not more  $10$  ft./min. *Note:* Prolonged exposure of filters to DOP should be avoided.
- H. Reporting:
1. Report all leaks greater than  $10$ - $4$  times the upstream concentration and rejected HEPA Filters.



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CLEAN ROOM CERTIFICATION

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- I. Acceptance:
  - 1. HEPA filters may be repaired providing:
    - a. The size of the repair(s) is less than 3% of each filter face area, and one dimension of any repair is limited to 1.5 in maximum, or as otherwise agreed upon by Owner's Representative. Retest the HEPA. If the leak cannot be repaired, reject the HEPA. Sealant for HEPA repairs to be pre-approved by the Owner representative. Repairs to filter leaks may be made by only procedures acceptable to Owner's Representative. Non out-gassing silicone is acceptable sealant for repairing HEPA filter leaks.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Examine bid documents and notify Owner's Representative of any questions regarding certification, within thirty days after receipt of bid.

3.2 EXAMINATION

- A. Inspect substrates and conditions under which the work of this section will be performed. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

3.3 COORDINATION

- A. Coordinate all work with other contractors to ensure accessibility to filters, etc.

END OF SECTION



**ENGINEERING**  
Mechanical/Electrical Engineering Consultants  
Rochester / Buffalo / Syracuse / Schenectady  
300 TROLLEY BLVD. 585.288.5500  
ROCHESTER, NY 14606 www.meengineering.com

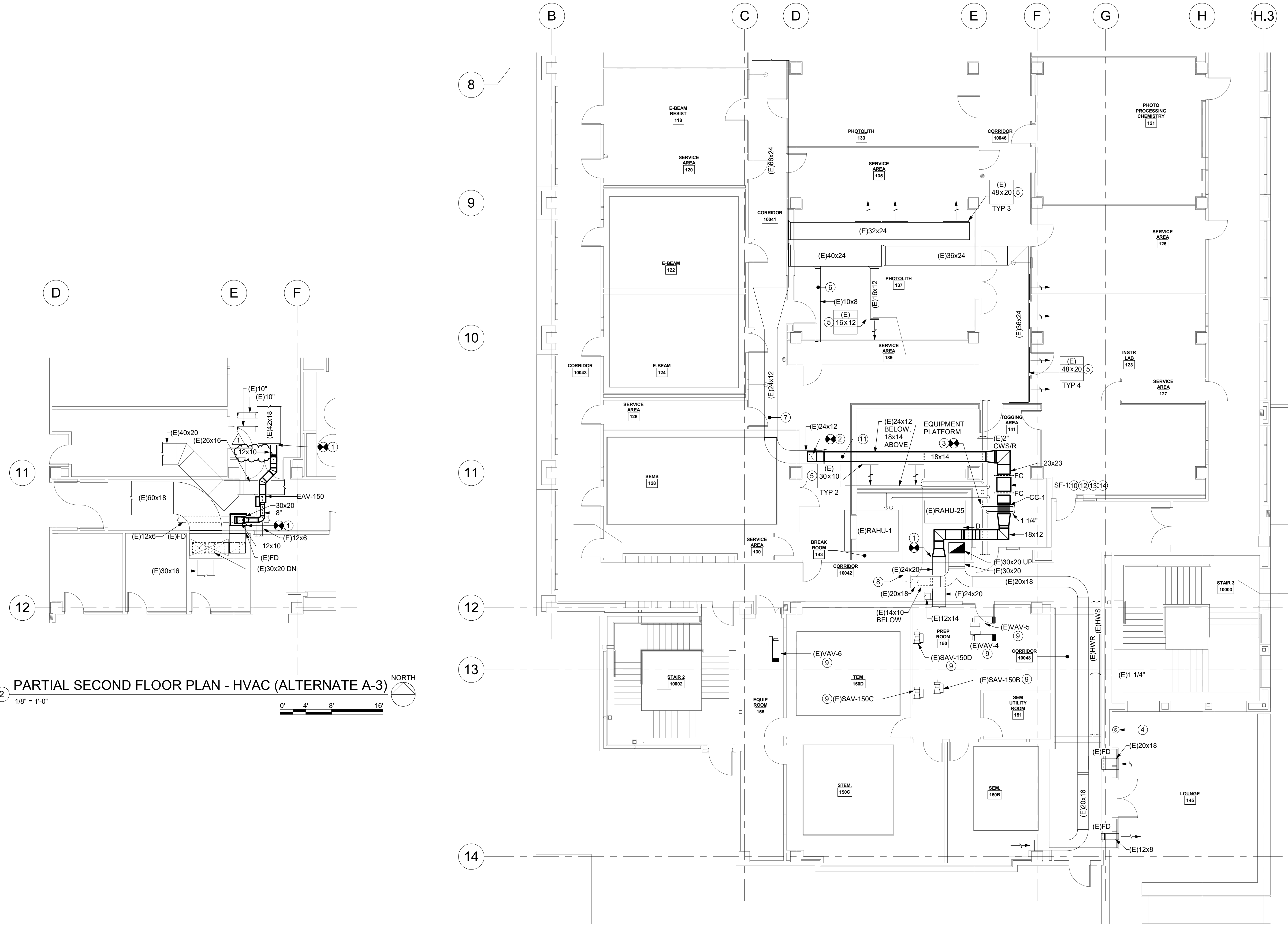
**CORNELL UNIVERSITY  
DUFFIELD HALL  
CLEAN ROOM HVAC REHABILITATION  
ITHACA, NY 14853**

**GENERAL NOTES:**

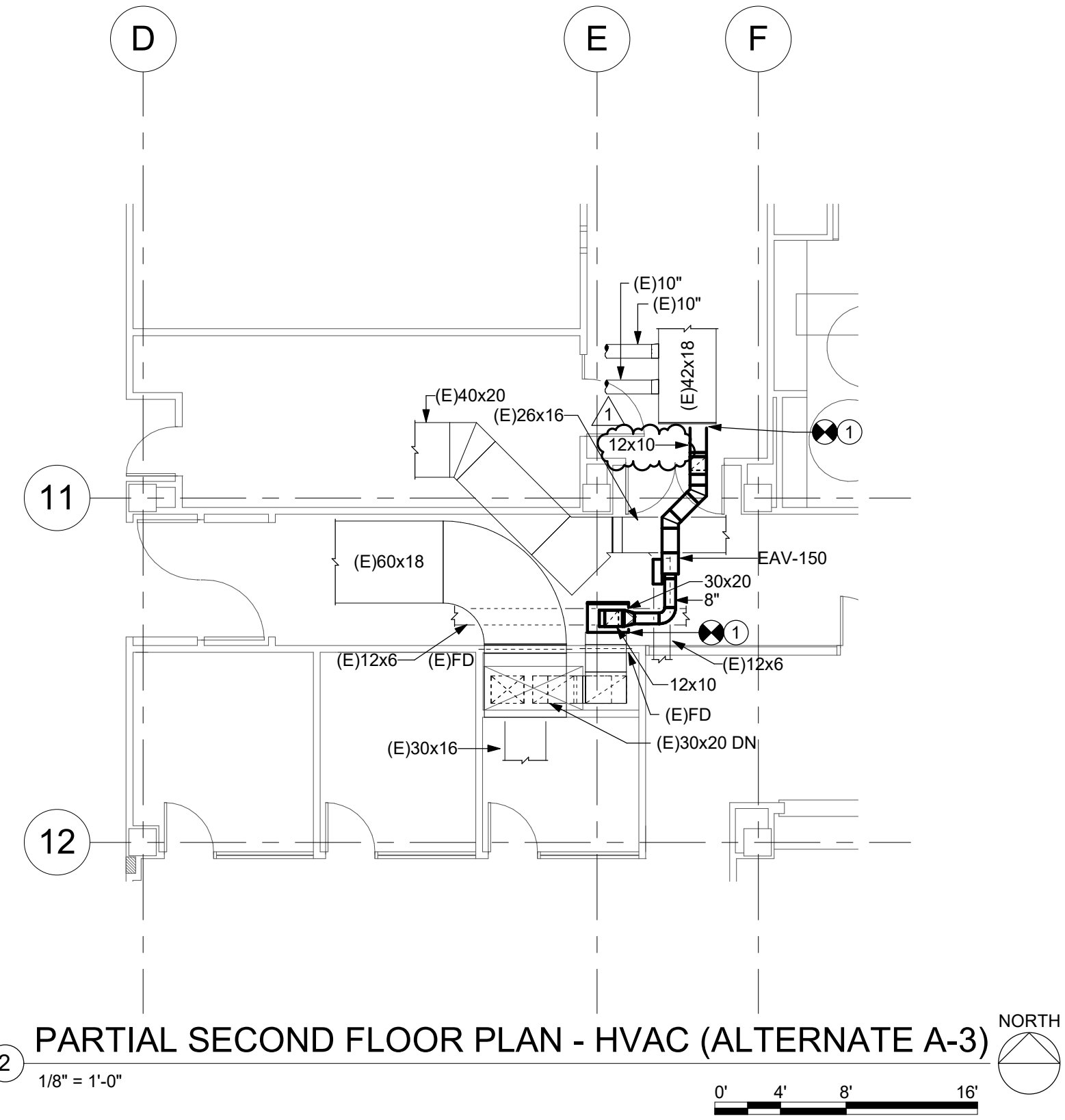
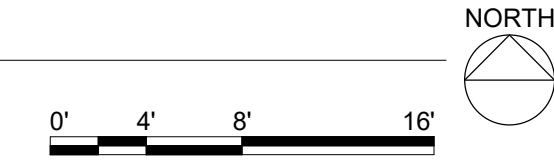
- A. REMOVE AND RE-INSTALL CEILING TILES AND GRID AS REQUIRED. REPLACE ANY DAMAGED CEILING TILES IN KIND.

**DRAWING NOTES**

- 1 TIE DUCTWORK INTO EXISTING. TRANSITION AS REQUIRED TO MAKE THE CONNECTION.
- 2 THE MICROSCOPY SUPPLY DUCTWORK INTO THE SUPPLY AIR DUCTWORK SYSTEM FROM MAKE-UP AIR HANDLING UNIT MAU-1.
- 3 THE PIPING INTO EXISTING. PROVIDE ALL PIPING MODIFICATIONS AS REQUIRED TO MAKE THE TIE IN.
- 4 SENSOR SHALL REMAIN AND CONTINUE TO TEND THE SPACE TEMPERATURE.
- 5 RE-BALANCE SUPPLY GRILLE UPON COMPLETION OF DUCTWORK MODIFICATION. AIRFLOW WILL BE PROVIDED DURING CONSTRUCTION AND WILL BE BASED ON PRE-BALANCE READINGS AND ORIGINAL DESIGN.
- 6 RE-BALANCE SUPPLY DUCTWORK UPON COMPLETION OF DUCTWORK MODIFICATION. AIRFLOW WILL BE PROVIDED DURING CONSTRUCTION AND WILL BE BASED ON PRE-BALANCE READINGS AND ORIGINAL DESIGN.
- 7 RE-BALANCE SUPPLY DUCTWORK UPON COMPLETION OF DUCTWORK MODIFICATION. AIRFLOW WILL BE PROVIDED DURING CONSTRUCTION AND WILL BE BASED ON PRE-BALANCE READINGS. ORIGINAL DESIGN AND SHALL BE INCREASED TO INCLUDE ADDITIONAL XXX CFM FOR THE MICROSCOPY SUITE.
- 8 ACCESS DOOR ABOVE THE CEILING GRID TO EQUIPMENT PLATFORM.
- 9 SEQUENCE OF OPERATION FOR EXISTING AIR TERMINAL UNIT / LAB AIR VALVE SHALL BE REVISED. REFER TO CONTROL SCHEMATIC AND SYSTEM SUMMARY FOR FURTHER REQUIREMENTS. UNIT SERVES SPACE WITH CRITICAL TEMPERATURE REQUIREMENTS. SYSTEM SHALL BE FULLY TESTED AND COMMISSIONED PRIOR TO RETURNING SPACE TO USERS.
- 10 SUPPLY FAN SHALL BE BALANCED TO PRE-BALANCE READINGS.
- 11 INSTALL STATIC PRESSURE SENSOR IN (E)24x12 DUCT. REFER TO CONTROL SCHEMATIC AND SYSTEM FOR FURTHER REQUIREMENTS.
- 12 THE MICROSCOPY SUITE HAS CRITICAL TEMPERATURE REQUIREMENTS. PRIOR TO TURN OVER TO USERS THE SYSTEM SHALL BE FULLY TESTED AND COMMISSIONED.
- 13 THE DUFFIELD HALL TOXIC GAS MONITORING SYSTEM (TGMS) REDUCES THE AIRFLOW OF MAU-1 AND CLEAN ROOM PRESSURIZATION SWITCHES FROM POSITIVE TO SLIGHTLY NEGATIVE IN THE EVENT OF A TOXIC GAS LEAK AS DETECTED BY THE TGMS. PRIOR TO TURN OVER, THE SYSTEM SHALL BE TESTED IN A TGMS ALARM EVENT. VERIFY THE STATIC PRESSURE SENSOR IN THE (E)24x12 DOES READ A NEGATIVE PRESSURIZATION AND THE
- 14 UPON COMPLETION ON INSTALLATION, MODIFY AHU-2 SEQUENCE OF OPERATION. REFER TO CONTROL SCHEMATICS AND SYSTEM SUMMARY FOR FURTHER INFORMATION.



**1 PARTIAL FIRST FLOOR PLAN - HVAC (ALTERNATE A-3)**  
1/8" = 1'-0"



**2 PARTIAL SECOND FLOOR PLAN - HVAC (ALTERNATE A-3)**  
1/8" = 1'-0"

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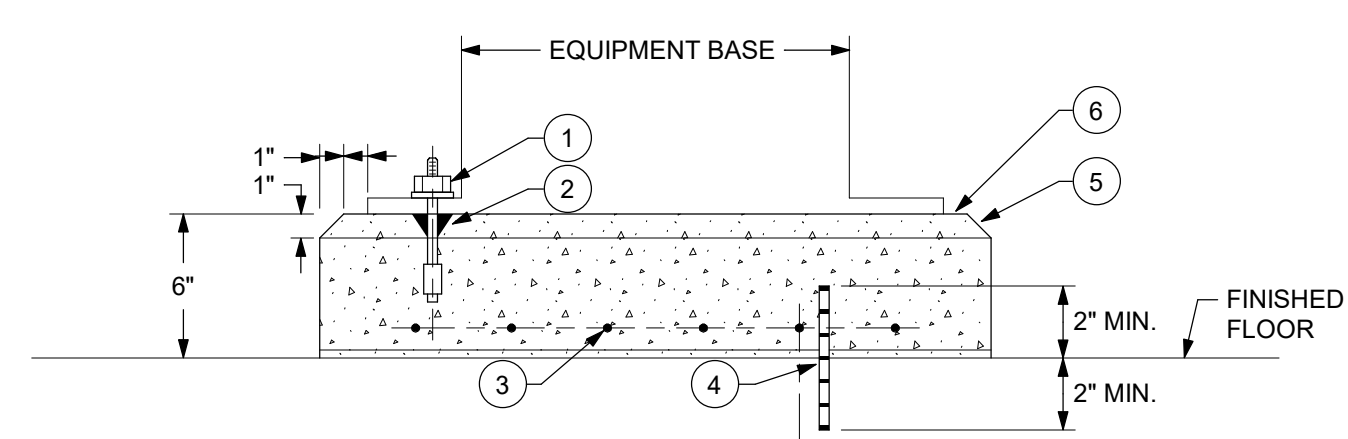
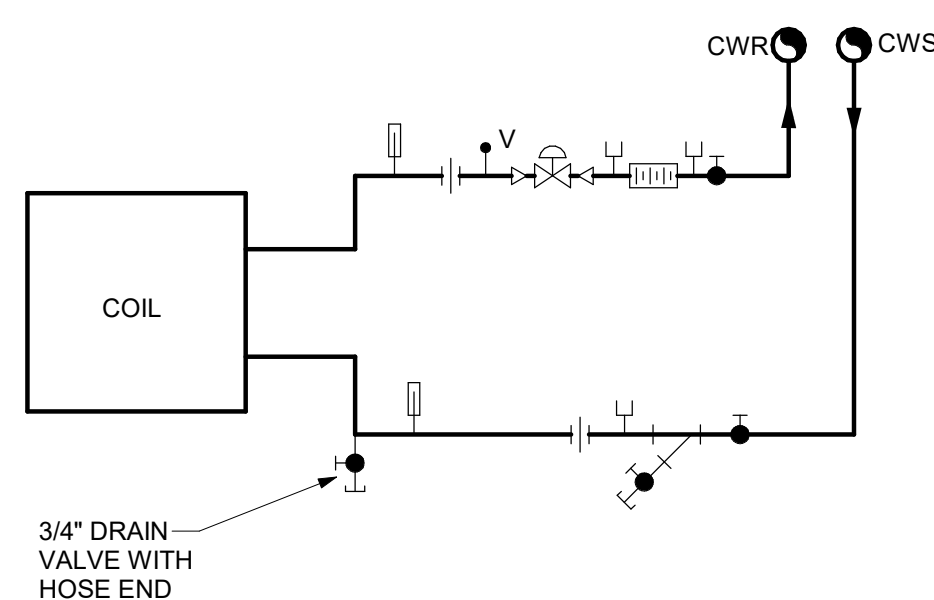
No.	Date	By	Description
1	10/13/21	ME	ADDENDUM 1

**DRAWING TITLE**  
**PARTIAL FIRST & SECOND FLOOR PLAN - SOUTH - HVAC**

**DRAWING NO.** M-204R  
Drawn By: NMJ  
Checked By: GDD  
Project Mgr: GDD  
Project No: 200213

**ISSUE DATE** 09/23/2021  
100% CONSTRUCTION DOCUMENTS

**CORNELL UNIVERSITY  
DUFFIELD HALL  
CLEAN ROOM HVAC REHABILITATION  
ITHACA, NY 14853**

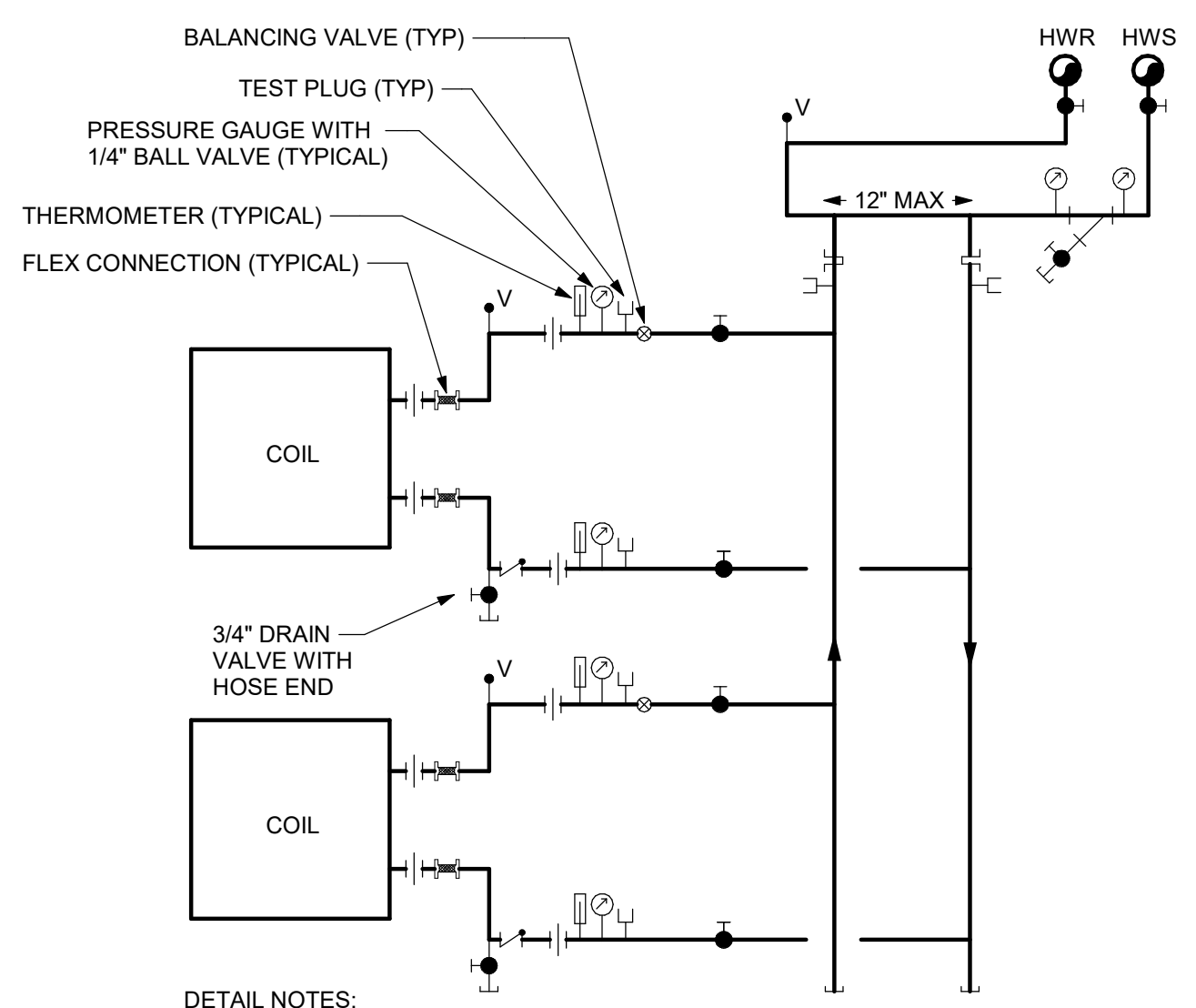


- DETAIL NOTES:**
- ANCHOR BOLT, SIZE & LOCATION AS REQUIRED TO MATCH EQUIPMENT BASE.
  - PLASTIC SLEEVE & ANCHOR.
  - #3 REINFORCING BARS, 12" O.C. EACH WAY.
  - #4 DOWEL, 12" O.C.
  - CHAMFER.
  - CONCRETE PAD 3,000 PSI CONCRETE, LENGTH & WIDTH, 6" GREATER THAN THE EQUIPMENT BASE PLATE.

- DETAIL NOTES:**
- ARRANGE PIPING TO ALLOW REMOVAL OF COIL WITHOUT REMOVAL OF PIPING AHEAD OF UNIONS AND TO ALLOW ACCESS TO FILTERS AND ACCESS PANELS.
  - WHERE THERE IS MORE THAN ONE COIL SECTION, PROVIDE ISOLATION VALVES, AIR VENTS, DRAIN CONNECTIONS, TEST PLUGS, UNIONS AND FLOW BALANCER FOR EACH SECTION. PIPE SIZE TO EACH COIL SECTION SHALL MATCH THE COIL CONNECTION SIZE. PIPE COILS IN A REVERSE RETURN CONFIGURATION.
  - PIPE COIL FOR COUNTERFLOW ARRANGEMENT. SUPPLY CONNECTION SHALL BE ON THE DISCHARGE AIR SIDE OF THE COIL.

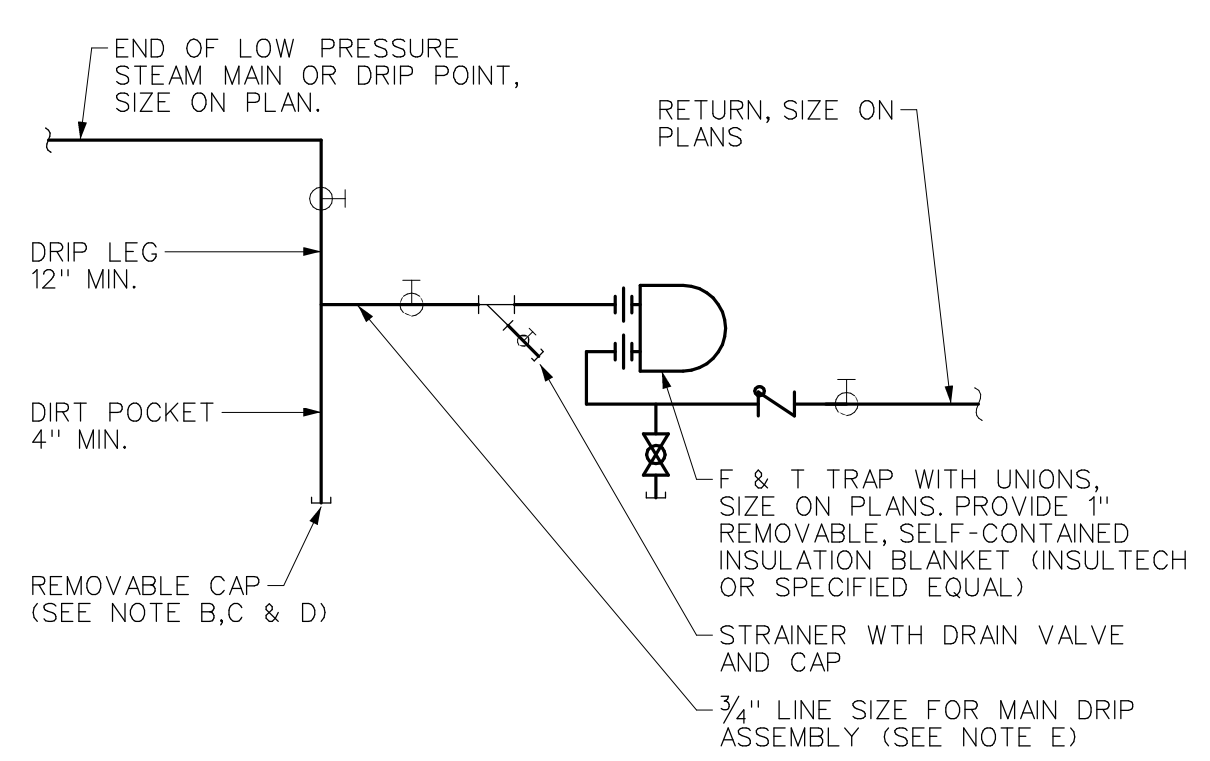
**8 COOLING COIL PIPING DETAIL - 2 WAY**  
NOT TO SCALE

**7 CONCRETE EQUIPMENT BASE DETAIL**  
NOT TO SCALE



- DETAIL NOTES:**
- ARRANGE PIPING TO ALLOW REMOVAL OF COIL WITHOUT REMOVAL OF PIPING AHEAD OF UNIONS AND TO ALLOW ACCESS TO FILTERS AND ACCESS PANELS.
  - WHERE THERE IS MORE THAN ONE COIL SECTION, PROVIDE ISOLATION VALVES, AIR VENTS, DRAIN CONNECTIONS, TEST PLUGS, UNIONS AND FLOW BALANCER FOR EACH SECTION. PIPE SIZE TO EACH COIL SECTION SHALL MATCH THE COIL CONNECTION SIZE. PIPE COILS IN A REVERSE RETURN CONFIGURATION.
  - PIPE COIL TO MATCH EXISTING ARRANGEMENT (COUNTERFLOW OR PARALLEL FLOW). PIPING SIZES SHALL MATCH EXISTING. CONFIRM PRIOR TO DEMOLITION.
  - CONTROL VALVE SHALL BE EXISTING TO REMAIN.

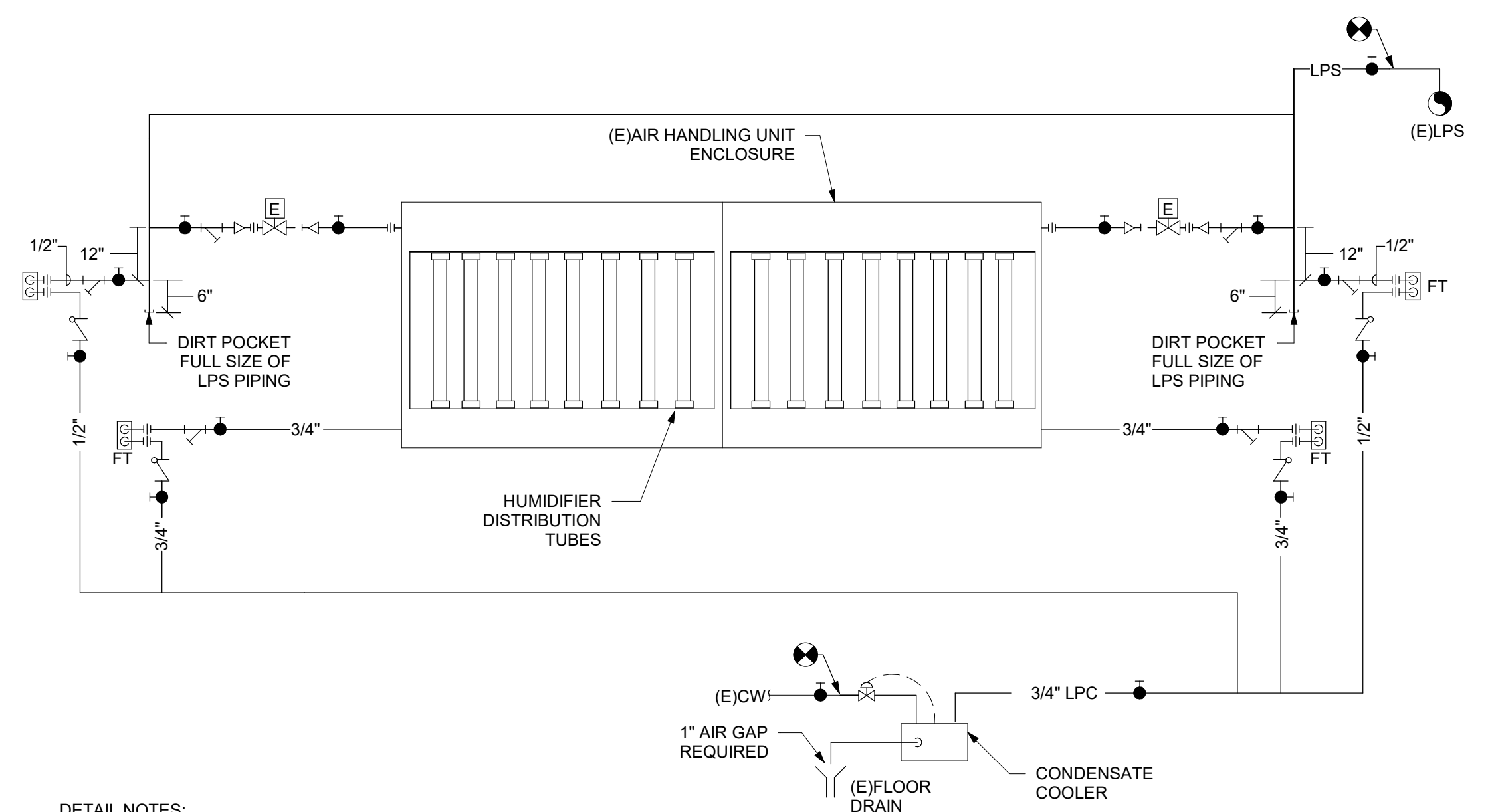
**5 HEATING COIL PIPING DETAIL - 2 WAY**  
NOT TO SCALE



- DETAIL NOTES:**
- UNLESS OTHERWISE INDICATED - PIPING, STRAINERS, UNIONS AND VALVES SHALL BE SAME SIZE AS TRAP.
  - ALL DRIP LEGS LESS THAN 4" SHALL HAVE REMOVABLE CAP.
  - ALL DRIP LEGS 4" AND GREATER SHALL HAVE 1/2" DRAINS WITH 1/2" BLOW-OFF GLOBE VALVE INSTALLED IN DIRT POCKET.
  - MAIN SIZE DRIP LEG SIZE
- |          |                                  |
|----------|----------------------------------|
| UP TO 2" | SAME AS MAIN                     |
| 2" TO 4" | 2"                               |
| ABOVE 4" | 1/2 OF MAIN SIZE BUT NOT OVER 4" |
- PROVIDE PIPE AND TRAP SIZES PER MANUFACTURER'S RECOMMENDATIONS FOR EQUIPMENT AND PRESSURE REDUCING VALVE DRIP ASSEMBLIES.
  - PROVIDE DRIP ASSEMBLY EVERY 75'-0" IN STEAM SYSTEM.

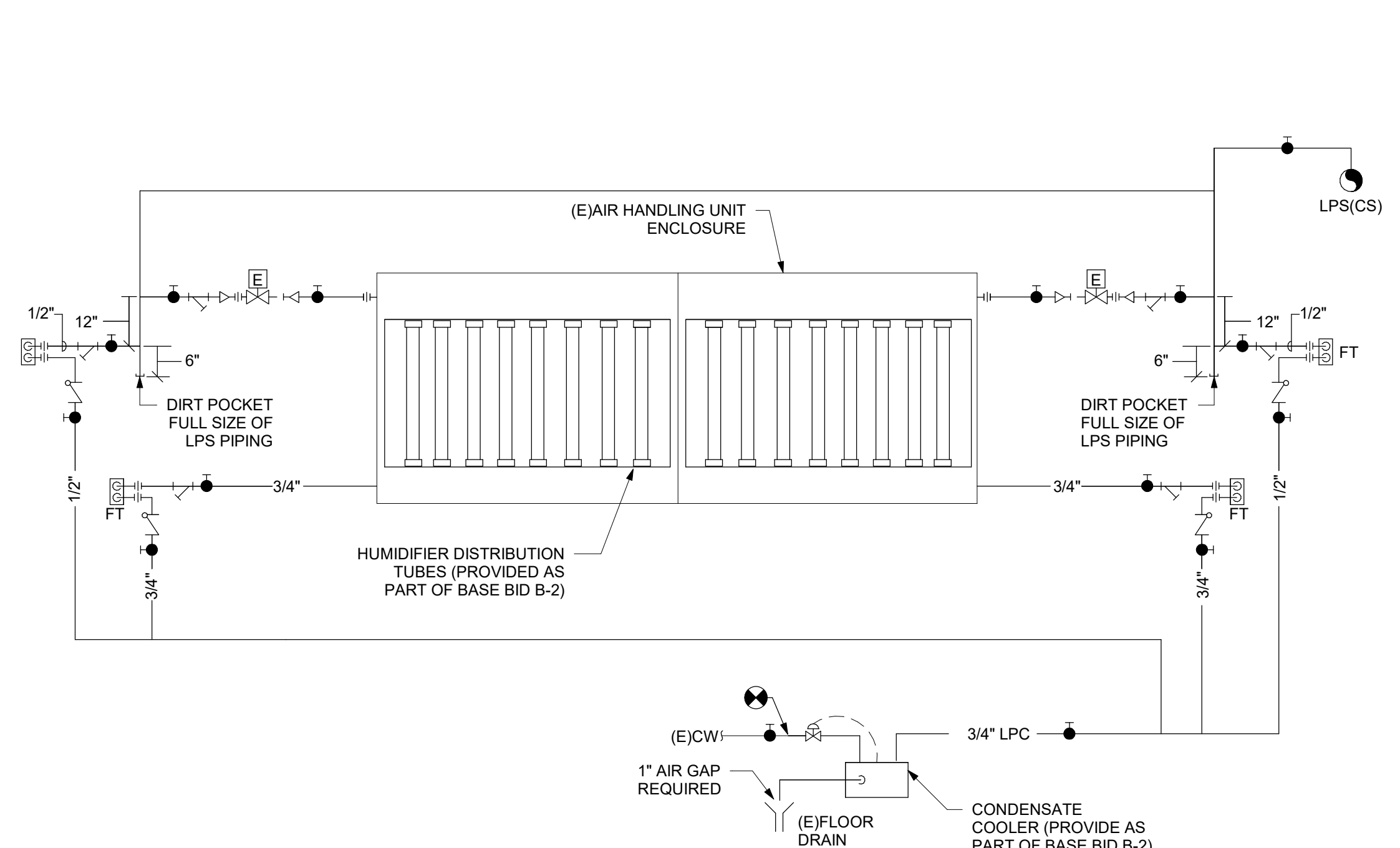
SYMBOL INDICATED ON DRAWINGS  FT

**4 F&T TRAP ASSEMBLY DETAIL**  
NOT TO SCALE



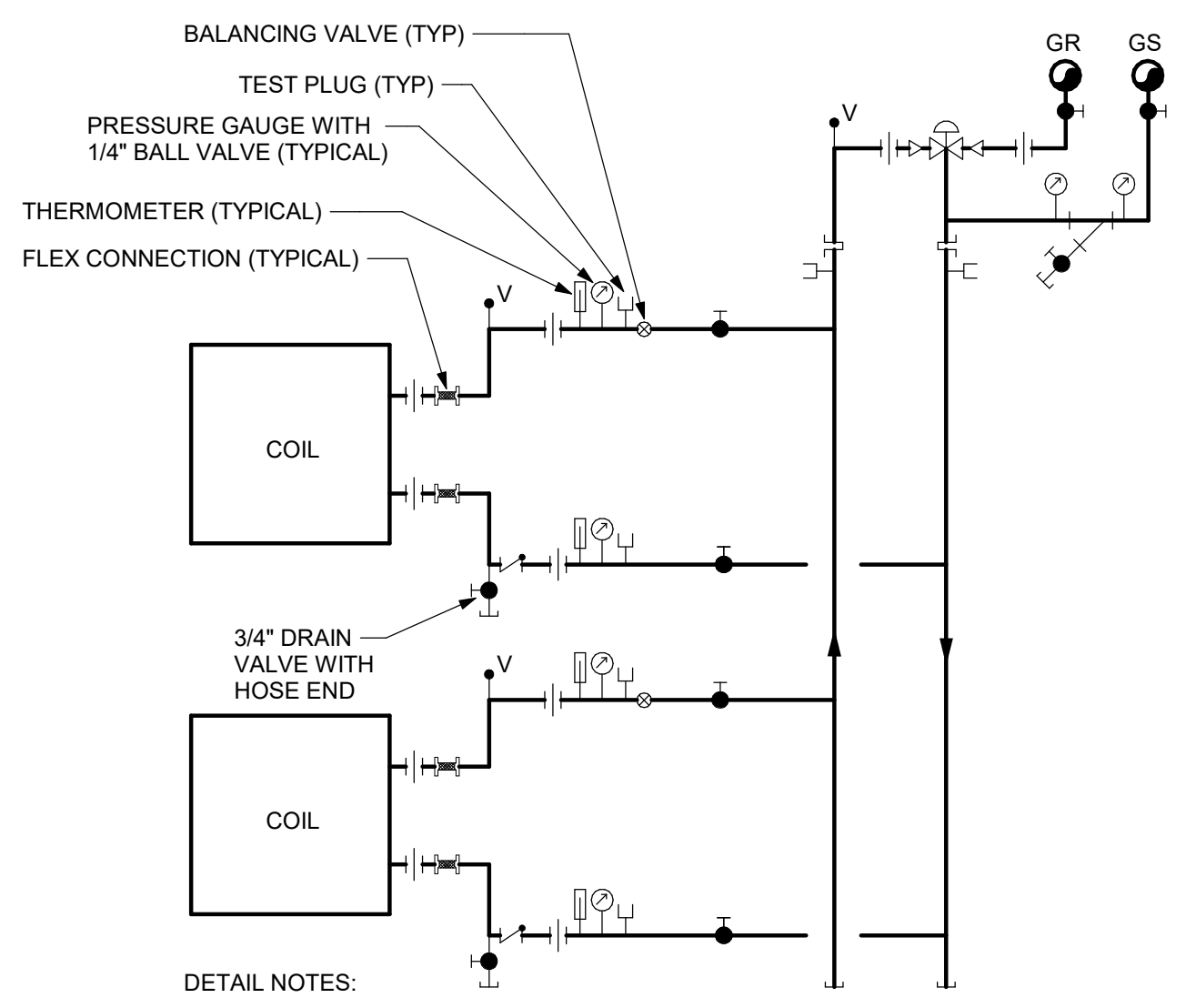
- DETAIL NOTES:**
- ALL CONDENSATE PIPING SHALL BE REPLACED AND RE-PIPED TO THE NEW HUMIDIFIER DISTRIBUTION TUBES. THE STEAM BRANCH PIPING TO THE NEW HUMIDIFIER DISTRIBUTION TUBES SHALL BE REPLACED AND RE-PIPED.

**6 HUMIDIFIER PIPING DETAIL (BASE BID B-3)**  
NOT TO SCALE



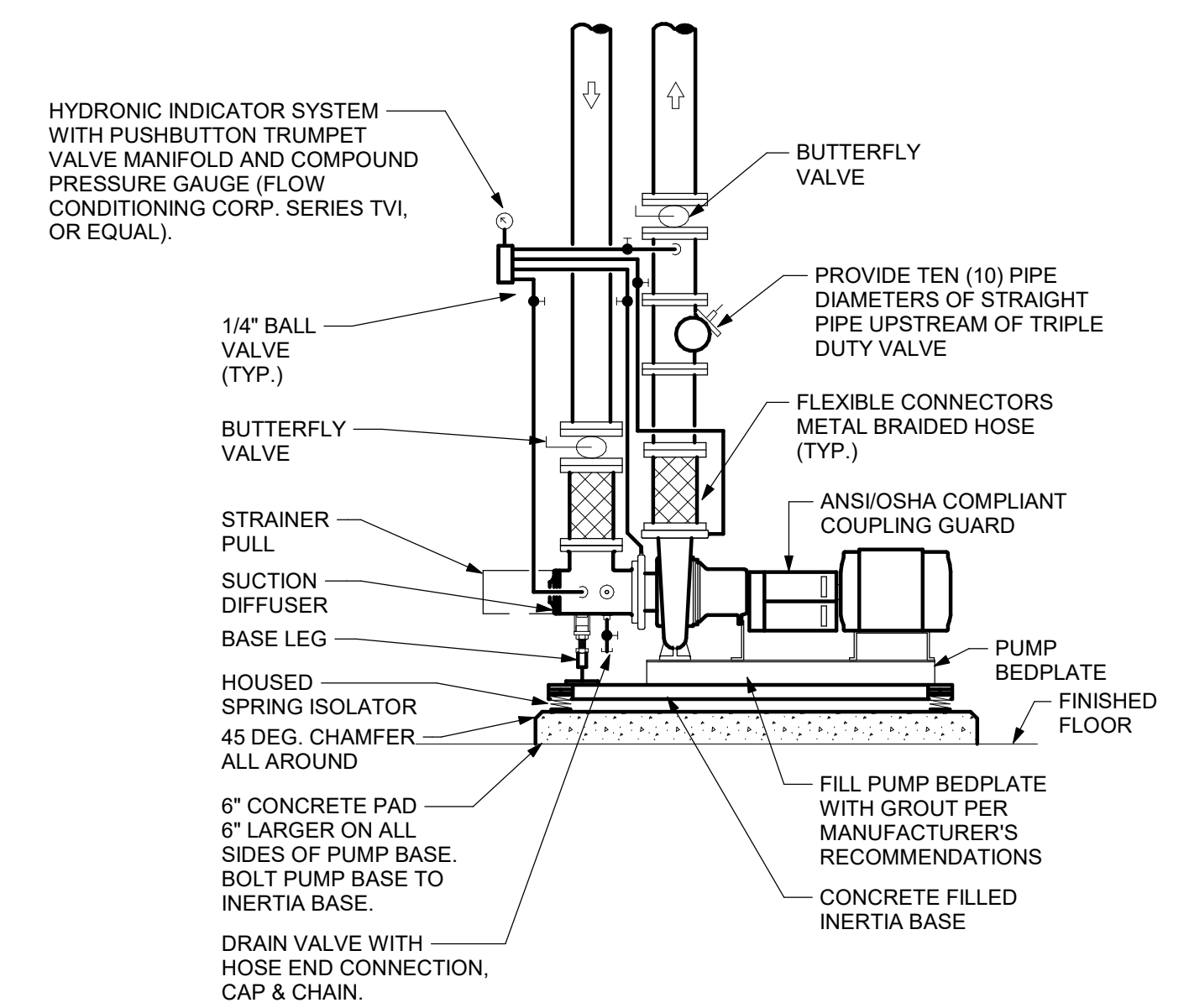
- DETAIL NOTES:**
- ALL STEAM AND CONDENSATE PIPING SHALL BE REPLACED AND RE-PIPED PER THE DETAIL. ALL PIPING SHALL BE STAINLESS STEEL CONSTRUCTION.

**3 HUMIDIFIER PIPING DETAIL (ALTERNATE A-2)**  
NOT TO SCALE



- DETAIL NOTES:**
- ARRANGE PIPING TO ALLOW REMOVAL OF COIL WITHOUT REMOVAL OF PIPING AHEAD OF UNIONS AND TO ALLOW ACCESS TO FILTERS AND ACCESS PANELS.
  - WHERE THERE IS MORE THAN ONE COIL SECTION, PROVIDE ISOLATION VALVES, AIR VENTS, DRAIN CONNECTIONS, TEST PLUGS, UNIONS AND FLOW BALANCER FOR EACH SECTION. PIPE SIZE TO EACH COIL SECTION SHALL MATCH THE COIL CONNECTION SIZE. PIPE COILS IN A REVERSE RETURN CONFIGURATION.
  - REFER TO PIPING SCHEMATIC FOR PIPING SIZES.
  - CONTROL VALVE SHALL 3-WAY FOR SUPPLY COILS AND 2-WAY FOR EXHAUST COILS.

**2 GLYCOL HEAT RECOVERY COIL PIPING DETAIL**  
NOT TO SCALE



**1 FLOOR MOUNTED PUMP PIPING DETAIL - END SUCTION WITH INERTIA PAD**  
NOT TO SCALE

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**REVISIONS**

No.	Date	By	Description
1	10/13/21	ME	ADDENDUM 1

**DRAWING TITLE  
DETAILS - HVAC**

**DRAWING NO. M-500R**  
Drawn By: NMJ  
Checked By: GDD  
Project Mgr: GDD  
Project No: 200213

**ISSUE DATE 09/23/2021**  
100% CONSTRUCTION DOCUMENTS

**ENERGY RECOVERY "RUN-AROUND" COIL SCHEDULE**

UNIT NO.	LOCATION	SERVICE	TYPE	CAPACITY (MBH)	AIR SIDE					WATER SIDE					NUMBER IN FACE	ROWS DEEP	FINS PER INCH	COIL FACE...		EFFICIENCY	MANUFACTURER & MODEL NO.	REMARKS	
					AIR FLOW (CFM)	ENT. AIR TEMP. (DEG. F)	LVG. AIR TEMP. (DEG. F)	AIR P.D. (In. W.C.)	MAX. FACE VELOCITY (FPM)	PUMP NO.	WATER FLOW (GPM)	WATER P.D. (FL. HD)	ENT. WATER TEMP. (DEG. F)	LVG. WATER TEMP. (DEG. F)				FLUID	LENGTH (In.)				WIDTH (In.)
HRC-1	BASEMENT	OUTSIDE AIR - MAU-1	STANDARD	2,048	70,000	-5	22.2	0.78	410	HRP-1	200	13.96	34.6	11.9	40% PG	6	8	12	98	42	51%	AEROFIN TYPE W	1,3
HRC-2	PENTHOUSE	OUTSIDE AIR - AHU-1	STANDARD	2,048	70,000	-5	22.2	0.78	410		200	13.96	34.6	11.9	40% PG	6	8	12	98	42	51%	AEROFIN TYPE W	1,4
HRC-3	PENTHOUSE	EXHAUST - EF-3	STANDARD	1,230	30,000	70	32.1	0.64	520		120	16.10	11.9	34.6	40% PG	2	8	12	80	45	51%	AEROFIN TYPE W	1,2,3
HRC-4	PENTHOUSE	EXHAUST - EF-4	STANDARD	1,230	30,000	70	32.1	0.64	520		120	14.51	11.9	34.6	40% PG	2	8	12	30	31	51%	AEROFIN TYPE W	1,2,3
HRC-5	PENTHOUSE	EXHAUST - EF-5	STANDARD	1,433	35,000	70	32.1	0.64	520		140	16.10	11.9	34.6	40% PG	2	8	12	100	49.5	51%	AEROFIN TYPE W	1,2,3
HRC-6	PENTHOUSE	EXHAUST - EF-6	STANDARD	1,433	35,000	70	32.1	0.64	520		140	16.10	11.9	34.6	40% PG	2	8	12	100	49.5	51%	AEROFIN TYPE W	1,2,3

REMARKS:  
1. COIL PERFORMANCE BASED ON TURBULATORS INSIDE OF THE TUBES.  
2. PROVIDE WITH HERESITE COATING.  
3. BASE BID B-4.  
4. ALTERNATE A-1.

**COOLING COIL SCHEDULE - CHILLED WATER**

UNIT NO.	LOCATION	SERVICE	MOUNTING	CAPACITY SENSIBLE (MBH)	TOTAL (TONS)	AIR SIDE				WATER SIDE					ROWS DEEP	FINS PER INCH	COIL FACE DIMENSIONS		MANUFACTURER & MODEL NO.	REMARKS			
						AIR FLOW (CFM)	AIR P.D. (In. WC)	EAT (DEG. F) DB	WB	LAT (DEG. F) DB	WB	MAX. FACE VELOCITY (FPM)	WATER FLOW (GPM)	WATER P.D. (FL. HD)			ENT. WATER TEMP. (DEG. F)	LVG. WATER TEMP. (DEG. F)			FLUID	LENGTH (In.)	WIDTH (In.)
CC-1	TOGGING	MICROSCOPY	FLANGED	27.6	2.3	1430	0.44	70	58	52	52	360	3.4	9.1	47	63	WATER	8	12	24	24	COIL MASTER CWD08C12	1,2,3

REMARKS:  
1. INSULATED COIL BOX.  
2. STAINLESS STEEL DRAIN PAN.  
3. ALTERNATE A-3.

**AIR FILTER SCHEDULE**

FILTER BANK NO.	LOCATION	SERVICE	TYPE	SYSTEM AIR FLOW (CFM)	MAX RATED VELOCITY (FPM)	INITIAL P.D. (In. WC)	FINAL P.D. (In. WC)	CARTRIDGES			ARRANGEMENT	HOLDING FRAME	EFFICIENCY MERV RATING	EFFICIENCIES (%)	MEDIA AREA (Sq. Ft.)	MANUFACTURER & MODEL NO.	REMARKS
								NO.	SIZE	LENGTH							
TYPE 1	CLEAN ROOMS	HEPA	2x4 T-GRID	500-600	75	0.4	0.8	1	48	24	6	-	99.99	-	TRIDIM TRI-PURE	2,5	
TYPE 2	CLEAN ROOMS	HEPA	2x2 T-GRID	250-300	75	0.4	0.8	1	24	24	6	-	99.99	-	TRIDIM TRI-PURE	2,5	
F-1	MAU-1	FINAL FILTER	REAR ACCESS	70,000	500	0.23	1.5	35	24	24	12	7W X 5H	CLARK AIR V BANK	MERV 13A	170	VILEDON MV 85	3
F-2	AHU-1	FINAL FILTER	REAR ACCESS	70,000	500	0.23	1.5	35	24	24	12	7W X 5H	CLARK AIR V BANK	MERV 13A	170	VILEDON MV 85	4
F-3	RAHU	PRE-FILTER	SIDE ACCESS	9,500 - 12,000	375	0.31	1.0	2	24	64	2	1W X 2H	EXISTING	MERV 9	-	TRIDIM TRI-DEK 15/40	1,5
F-4	RAHU	PRE-FILTER	SIDE ACCESS	<9,500	375	0.31	1.0	2	20	60	2	1W X 2H	EXISTING	MERV 9	-	TRIDIM TRI-DEK 15/40	1,5

REMARKS:  
1. LINK PANEL.  
2. OWNER FURNISHED, CONTRACTOR INSTALLED.  
3. BASE BID B-4.  
4. ALTERNATE A-1.  
5. BASE BID B-2.

**PUMP SCHEDULE**

PUMP NO.	LOCATION	SERVICE	UNIT TYPE & DESCRIPTION	PUMP CAPACITY		MAX WWP	MOTOR CHARACTERISTICS				IMPELLER SIZE (DIA. In.)	FLUID TEMP. (DEG. F)	MIN. PUMP EFF. (%)	MAX. BHP	SUCTION & DISCHARGE SIZES (In.)	MANUFACTURER & MODEL NO.	REMARKS	
				FLOW (GPM)	TOTAL HEAD IN FEET		RPM	HP	VOLTS	PHASE								STARTER
HRP-1	PENTHOUSE	HEAT RECOVERY	BASE MOUNTED	400	160	175	3600	30	480	3	ASD	7	25	81.3	23.9	3/2.5	BELL & GOSSET E-1510 2.5AC	1,2,3

REMARKS:  
1. GLYCOL - PROPYLENE, 40%  
2. INVERTER DUTY MOTOR  
3. BASE BID B-4.

**STEAM HUMIDIFIER SCHEDULE - DIRECT INJECTION**

UNIT NO.	LOCATION	SERVICE	AIR FLOW (CFM)	EAT (DEG. F)		LAT (DEG. F)		HUMIDIFICATION RATE (LBS/HR)	DISTRIBUTOR TYPE	NO. OF STEAM DISTRIBUTORS	MAX. ABSORPTION DISTANCE (In.)	MANIFOLD SIZE		STEAM PRESSURE (PSIG)	MANUFACTURER & MODEL NO.	REMARKS
				DB	WB	DB	WB					LENGTH (In.)	HEIGHT (In.)			
H-1	MAU-1	MAU-1 SOUTH TUNNEL	35,000	58	37	58	50	990	PRESSURIZED	15	15.6	95.5	113.5	10	CAREL USAM SAT	1
H-2	MAU-1	MAU-1 NORTH TUNNEL	35,000	58	37	58	50	990	PRESSURIZED	15	15.6	95.5	113.5	10	CAREL USAM SAT	1

REMARKS:  
1. BASE BID B-3.

**FAN SCHEDULE**

UNIT NO.	LOCATION	SERVICE	FAN CHARACTERISTICS				MOTOR CHARACTERISTICS								MANUFACTURER & MODEL NO.	REMARKS		
			TYPE	BLADE TYPE	CFM	S.P. (In. WC)	MAX. BHP	FAN RPM	SONES	DRIVE	RPM	HP	VOLTS	HZ			PHASE	STARTER
SF-1	TOGGING	MICROSCOPY	INLINE	BI	1430	1.5	0.64	1,416	11.3	DIRECT	1725	3	208	60	3	VFD	GREENHECK SQ-160HP-VG	1

REMARKS:  
1. ALTERNATE A-1.

**VAV - SINGLE DUCT - AIR TERMINAL UNIT SCHEDULE**

UNIT NO.	SERVICE	MAX AIR FLOW (CFM)	MIN AIR FLOW (CFM)	MIN INLET PRESS AT MAX CFM (In. WC)	INLET SIZE (In.)	RAD N.C. AT 1" S.P.	DISCH N.C. AT 1" S.P.	MANUFACTURER & MODEL NO.	REMARKS

REMARKS:  
1. FIBER FREE LINER  
2. MAX AIR FLOW TO BE CONFIRMED BY PRE-BALANCE.

**CORNELL UNIVERSITY**  
**DUFFIELD HALL**  
**CLEAN ROOM HVAC REHABILITATION**  
**ITHACA, NY 14853**

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**REVISIONS**

No.	Date	By	Description
1	10/13/21	ME	ADDENDUM 1

**DRAWING TITLE**  
**SCHEDULES - HVAC**

DRAWING NO. **M-600R**  
 Drawn By: NMJ  
 Checked By: GDD  
 Project Mgr: GDD  
 Project No: 200213

ISSUE DATE **09/23/2021**

100% CONSTRUCTION DOCUMENTS

RFI Form

RFI/ Response Index	Page/ Dwg./Spec./Rep. Number	Section/ Paragraph/Topic	RFI	Design Team Response
1			Who is responsible to hire and pay for the CxA?	Cornell will procure the services of a Commissioning Agent.
2			Is there a professional cleaning service you have used before that you know does a sufficient cleaning for cleanroom operations?	No. The facility has not used any professional cleaning service other than Cornell Building Care.
3	M-101	Note 3	Refer to note 3 on sheet M-101, please confirm if the pre-installation testing for the cleanroom (by certified cleanroom vendor) is to be hired by the GC or if Cornell will take care of this.	The General Contractor is to hire.