

**ADDENDUM NUMBER: 1**  
**UNC CHARLOTTE CAMPUS INFRASTRUCTURE RENEWAL (ATKINS)**  
**SCO ID# 13-11993-01A**  
**May 4, 2017**

**NOTICE TO CONTRACTORS**

This Addendum issued prior to receipt of Bid shall and does hereby become a part of the Construction Documents for the above project.

All principal Contractors shall be responsible for seeing that their Subcontractors are properly apprised of the contents of this Addendum.

All information contained in this Addendum shall supersede and shall take precedence over any conflicting information in the original Bidding Documents dated 04/03/17.

All Contractors shall acknowledge receipt of this Addendum in the space provided in the Proposal Form. Failure to do so may subject Bidder to disqualification.

**A. PREBID REQUESTS FOR INFORMATION**

QUESTIONS RECEIVED BY MSWG	RESPONSES
Is it permissible to have one superintendent from the GC on site and an HVAC superintendent on each floor since they have the bulk of the work?	In lieu of the general contractor providing a superintendent on each floor, at the contractor's option, a project superintendent may be provided by the GC with an HVAC superintendent on each of floors 5 through 8 and one HVAC superintendent for floors 9/10 and the penthouse (resulting total of 5 HVAC superintendents on site during the project).
Who is the manufacturer of the existing controls in the building?	Johnson Controls
The 2 alternates would increase the scope significantly. If accepted, should we plan a second shift to meet the 3 month duration? Please advise if an increase in schedule is possible or if the original 3 month duration is required of the expanded scope as well.	The schedule for completion will as noted in this addendum.
Please confirm schedule dates; start Dec. 15, 2017 after exams and complete Mar '18 before spring break is over (Probably by 3/10, 2018)	Start – December 12, 2017 Penthouse complete January 8, 2018 Floors 5 through 10 complete March 30, 2018 Contractor may start preliminary staging prior to construction start date.
Please provide us with the supplemental general conditions referenced in the front ends	There are no supplemental general conditions. Refer to section 010000 for additional information specific to the project for UNC Charlotte.
Please confirm if you want the contractor to purchase full builder's risk, per article 34 of the	Contractor to purchase full builder's risk, per article 34 of the instructions to bidders

instructions to bidders	
Please confirm if a Superintendent / Foreman from the GC is required on every floor and on every shift when work is being completed. This will substantially increase the cost of the project.	In lieu of the general contractor providing a superintendent on each floor, at the contractor's option, a project superintendent may be provided by the GC with an HVAC superintendent on each of floors 5 through 8 and one HVAC superintendent for floors 9/10 and the penthouse (resulting total of 5 HVAC superintendents on site during the project).
Please note CFM for the linear diffusers that will remain on floors 5-8	Airflows are not required. Balance associated terminal unit to specified air flow only.
Please note if TAB is by the GC or by UNCC? Spec section 23 05 93-1 states by UNCC, but I heard in the prebid that it was by the GC	TAB is provided by the GC and report will be confirmed by the CxA.
Please clarify scope of TAB	Refer to section 230593.
Please describe how students will have access to the construction floors while contractors are not on site	The elevators will be programmed during construction to limit access to the floors to the contractor and library personnel. Library personnel shall have access to the floors on a daily basis for a specified time frame to access material as needed. Time frame for bidding purposes is 1 hour in the morning.
Should the same notes (within the box) at the bottom of E300 - E303 be included on E304 – E307, except referencing Alternate #2?	Yes.
Please confirm new acoustical ceiling per note 1, sheet M311. ME102 references Level 7.	New ceiling is required per note. Reference should be sheet ME105.
Please provide, if any, all past asbestos testing documentation that has occurred in the contract areas.	For the purposes of bidding the contractor is to assume there is no asbestos in the construction area.
We don't have defined liquidated damages – probably in the missing supplemental general conditions? Please clarify.	The project does not have liquidated damages.
Are we responsible to relocate/move all furniture in all affected areas, i.e.: chairs, tables, study carrels?	The contractor is required to relocate any furniture on site as required to perform the work. The relocated furniture shall be stored within the construction area.
Is there a location for an office trailer at Conex location with power and data/phone. Will space be available in Atkins for a construction office with power and data/phone?	There will not be a location for a Conex with power and data/phone. The contractor may set up an office within the construction area.
Will space be made available outside the construction areas to store electrical devices that are to be cleaned, repaired & reused per note 6 on electrical dwgs? Note says they are to stored/protected "on the site". Does "on the site" mean in the Atkins building or on campus?	Space will not be available outside the construction area. Devices must be stored within the construction areas.

Which devices will the Owner want to retain that are not required to be re-installed – Per note 1 on electrical dwgs. Will the Owner remove from construction area immediately upon removal from ceilings? What is the timeframe of removal by Owner? Same day, in 5 days?	The Owner will identify items to be turned over to them prior to demolition and will remove them from the construction area in a timely manner.
What is the rating of the existing paver system?	22,000 lbs.
What is the rating of the elevator?	2,000 lbs.

**B. REQUESTS FOR SUBSTITUTION**

Subject to compliance with the contract documents, the following manufacturers will be considered as substitutions to the specified equipment:

- Valves – Nexus
- Louvers and Dampers – United Enertech

**C. CHANGES TO PRIOR ADDENDA**

No changes.

**D. CHANGES TO BIDDING REQUIREMENTS**

No changes.

**E. CHANGES TO CONDITIONS OF THE CONTRACT**

No changes.

**F. CHANGES TO NOTICE TO BIDDERS**

No changes.

**G. CHANGES TO INSTRUCTION TO BIDDERS**

Add "UNC Charlotte Good Faith Effort Requirements" document.

**SECTION – 23 05 93 TESTING, ADJUSTING, AND BALANCING**

Part 1 1.1 C. Deleted.

**SECTION - 23 73 13 BUILT UP AIR HANDLING SYSTEMS**

Delete section in its entirety and replace with attached.

**H. CHANGES TO DRAWINGS**

**SHEET – M311 LEVEL 10 MECHANICAL NEW WORK PLAN**

Sheet reissued dated 5/4/17

**SHEET – E304 LEVEL 7 ELECTRICAL DEMOLITION PLAN ALTERNATE NO. 2**

Sheet reissued dated 5/4/17

**SHEET – E305 LEVEL 7 ELECTRICAL NEW WORK PLAN ALTERNATE NO. 2**

Sheet reissued dated 5/4/17

**SHEET – E306 LEVEL 8 ELECTRICAL DEMOLITION PLAN ALTERNATE NO. 2**

Sheet reissued dated 5/4/17

**SHEET – E307 LEVEL 8 ELECTRICAL NEW WORK PLAN ALTERNATE NO. 2**

Sheet reissued dated 5/4/17

**ENCLOSURES: UNC CHARLOTTE GOOD FAITH EFFORT REQUIREMENTS,  
SPECIFICATION SECTIONS, DRAWING M311, DRAWING E304, DRAWING E305,  
DRAWING E306, DRAWING E307**

End of Addendum

## UNC Charlotte “Good Faith Effort” Requirements

This information is provided as a guide for firms who may be new to UNC Charlotte and may not be familiar with our expectations regarding minority business participation on University Managed Projects (UMP) projects. Bidders should be familiar with the ***Guidelines for Recruitment & Selection of Minority Businesses for Participation in State Construction Contracts*** as well as the applicable bid forms;

**Identification of HUB Certified/Minority Business Participation form** – Only list minority firms that you will use as construction subcontractors, vendors, suppliers or professional service providers on this project. The bidder cannot list himself on this form as he cannot subcontract to himself. **Note:** This form should be submitted with your bid, even if left blank.

**Affidavit A – Listing of Good Faith Efforts** – the bidder is certifying that he has made a good faith effort to comply under those areas checked on the form. Do not check a Good Faith Effort item unless you can provide the following;

1. Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists **at least 10 days before the bid or proposal date** and notifying them of the nature and scope of the work to be performed.

**Example:** Copies of written (emailed or faxed) notification to minority businesses and copies of quotes/proposals received for work solicited to minority businesses. Notification should include, at a minimum, project location, location where plans and specifications may be obtained or viewed, trade or scopes of work for which subcontracts are being solicited, contact person within the prime contractor organization.

***Be sure to maintain a telephone log to confirm that minority firms received your IFB.*** The log should contain the date contacted, telephone number, and name of the individual representing the minority firm who acknowledged receipt of your IFB. ***Also maintain a telephone log to confirm that minority firms acknowledged a “bid/no bid” to your IFB.*** The log should contain the date contacted, telephone number, and name of the individual representing the minority firm who acknowledged “bid/no bid” to your IFB.

2. Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.

**Example:** Copies of written (emailed or faxed) notification to minority businesses should include, at a minimum, project location, location where plans and specifications may be obtained or viewed, trade or scopes of work for which subcontracts are being solicited, contact person within the prime contractor organization.

3. Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

**Example:** Document steps taken to segment elements of work into economically feasible units to meet minority business availability. Identify sub-contractors/suppliers/consultants and scope of work involved in segmenting.

Be sure that you are soliciting quotes from **at least** three (3) minority firms in scopes of work that typically have adequate numbers of minority firms available that can perform the work required (hauling, concrete, flooring, masonry, painting, electrical suppliers, etc.). Do not solicit quotes from minority firms in those scopes of work that typically do not have minority firms available that

can perform the work required (elevators, fire suppression systems, roofing, etc.). If there are minority firms that you typically use on your projects then by all means, feel free to use them, if you are sure you are receiving reasonable pricing and quality work.

4. Working with minority trade, community or contractor organization identified by the Office for Historically Underutilized Businesses (HUB) and included in the bid documents that provide assistance in recruitment of minority businesses. **Note:** Minority plan rooms are not applicable.  
**Example:** Provide a copy of meeting minutes between prime contractor and minority trade, community or contractor organization. At minimum the following topics should be discussed/reviewed during the meeting: project location; location where plans and specifications may be obtained or viewed; trade or scopes of work for which subcontracts are being solicited; bonding requirements; insurance requirements; prime contractor's contact person; minority trade, community or contractor organization contact person; strategies to segment elements of the work into economically feasible units to meet minority business availability; strategies to increase minority business utilization through joint ventures and/or partnerships; notification that the meeting will be counted toward the contractor's good faith effort.  
**Example:** Maintain a copy of the request, and have the date, telephone number and name of the individual who acknowledged receipt of your request and information regarding any/all assistance provided by the organization
5. Attending any pre-bid meetings scheduled by the public owner.  
**Example:** Attendance will be verified by conference sign-in sheet.
6. Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.  
**Example:** Documentation describing the type of assistance provided or offered to minority businesses. Provide names and contacts of minority businesses to which assistance was offered and names of the contact person of bonding companies or financial institutions offering assistance.
7. Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.  
**Example:** Document number of bids received from minority businesses in the trade or scopes of work for which subcontracts are being solicited, the number of minority businesses that submitted low bids or proposals, the number of minority businesses the bidder has offered to negotiate prices or services, and the number of minority businesses the bidder has agreed to utilize on the project, outline steps taken.
8. Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required or assisting minority businesses in obtaining the same unit pricing with the bidders supplier.  
**Example:** Document names, addresses and telephone numbers of minority businesses to which assistance was offered, outline steps taken. Give dates assistance was offered and document outcome.
9. Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.  
**Example:** Provide a copy of joint venture or partnership arrangements between bidder and minority business.

10. Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

**Example:** Provide a copy of quick pay agreements and/or policies and document the number of minority businesses that will utilize the quick pay agreement. Provide a copy of the quick pay agreement between bidder and minority business.

**Note: Referencing the Good Faith Efforts listed above in your IFB is not enough. You must be able to document your efforts.**

**Affidavit B – Intent to Perform Contract with Own Workforce** – In making this certification the bidder is stating that he does not customarily subcontract elements of this type project and normally performs and has the capability to perform and will perform all elements of the work on this project with his own current workforce. The bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible. “**Self-performing**” means the contractor has all equipment, personnel and supplies on hand to perform the contract. If the contractor needs to purchase supplies or rent equipment and operators to perform the work, then the contractor **is not** self-performing and should make efforts to purchase supplies or equipment, or temporary labor from minority firms. **Note:** No other Affidavits are required if the Bidder meets this criteria.

**Affidavit C – Portion of the Work to be Performed by HUB Certified/Minority Businesses** – This form is to be submitted only by the apparent lowest responsible, responsive bidder with equal to or greater than 10% minority participation.

**Affidavit D – Good Faith Efforts** – This form is to be submitted only by the apparent lowest responsible, responsive bidder with less than 10% minority participation along with their backup documentation.

**Minority-owned Pre-qualified Bidders** – **must also** meet the minority participation goals set for the project. Work performed by the minority-owned pre-qualified bidder will be counted towards the minority participation goal **only if** the minority contractor is **self-performing** and submitted Affidavit B.

**Certification Requirements** – Ensure the minority firms you contact for subcontracting opportunities are listed in the Statewide Uniform Certification (SWUC) Vendor database as **only firms** listed in the SWUC Vendor database, at the time of contract award, **will be counted** towards the minority participation goal for this project. Go to <http://www.doa.nc.gov/hub/searchhub.aspx> for access to the SWUC Vendor database.

#### **Assistance:**

**Email** the UNC Charlotte HUB Coordinator, Dorothy Vick (704-687-0527), **no later than 12:00 PM Wednesday April 26, 2017** at [dlvick@uncc.edu](mailto:dlvick@uncc.edu) (**Email Subject: Campus Infrastructure Renewal (Atkins)**) for the following;

1. **Assistance in finding certified minority firms who have worked on UNC Charlotte projects and who can perform the scopes of work (site work, concrete, electrical, etc.) you are seeking, and/or**
2. **A list of minority trade, community or contractor organizations** identified by the Office for Historically Underutilized Businesses that provide assistance in recruitment of minority businesses.

## SECTION 230593

## TESTING, ADJUSTING, AND BALANCING

## PART 1 GENERAL

## 1.1 SCOPE

- A. The provisions of Section 230500 apply to all the work in this Section.
- B. Work shall be performed by an independent balancing company certified by AABC or NEBB. Technicians shall be competent in the trade of testing and balancing environmental systems and shall be done in an organized manner utilizing appropriate test and balance forms.
- ~~C. The test and balance contractor shall be a separate contractor hired by the University. This section is included for information only.~~
- ~~D.~~ The test and balance report shall be submitted prior to the final inspection. The TAB sub-contractor shall attend the final to spot check air and water flows.

## 1.2 SUBMITTALS

- A. Submit the following in accordance with Section 230500.
  - 1. Manufacturer's cut sheets for all equipment to be used.
  - 2. Sample balancing charts and forms.
  - 3. Completed final balancing data.

## PART 2 PRODUCTS

## 2.1 INSTRUMENTATION

- A. Instruments for use in the test and balancing procedures shall be of first quality and be accurately calibrated at the time of use. The following list is provided to indicate the instruments expected, however, other instruments as necessary to properly perform the work will be provided and subject to approval of the Architect.
  - 1. Inclined manometer calibrated in no less than .006-inch divisions.
  - 2. Combination inclined and vertical manometer (0 to 10 inch is generally the most useful).
  - 3. Pitot Tubes. (Usually and 18 and 48 inch tube covers most balance requirements.



4. Tachometer. This instrument should be of the high quality self-timing type.
  5. Clamp-on ampere meter with voltage scales.
  6. Deflecting vane anemometer.
  7. Rotating vane anemometer.
  8. Thermal type (hot wire) anemometer.
  9. Hook gage.
  10. Dial and glass stem thermometers.
  11. Sling psychrometer.
- B. The accuracy of calibration of the field instruments used is of the utmost importance. All field instruments used in the balance should have been calibrated at least within the previous three months. Naturally, any suspect instruments should be checked more frequently.

### PART 3 EXECUTION

#### 3.1 SYSTEM START-UP

- A. Starting date for mechanical system shall be scheduled well in advance of expected completion date and shall be established a minimum of two weeks prior to acceptance date. The system shall be in full operation with all equipment functional prior to acceptance date.
- B. Performance readings shall be taken and recorded on all air and water distribution devices and the system shall be balanced out prior to acceptance. Balancing of the system shall be accomplished with duct dampers and only minor adjustments made with grille dampers. Record and submit results in table form along side of scheduled quantities.
- C. All controls shall be calibrated by qualified personnel prior to acceptance date. Thermostats shall be in close calibration with one another and shall operate their respective units without interference from adjacent units.
- D. All units shall be checked out thoroughly and the following information recorded on each machine which shall include, but not be limited to information listed below. Check sheets shall be included in Operating and Maintenance instructional Manual.
  1. Coils (Each)
    - a. Unit Number and Location
    - b. Manufacturer and Model No.
    - c. Return Air, Supply Air and Outside Air Temperature

- d. Discharge Temperature, Cooling or Heating
  - e. Air Flow CFM, Entering and Leaving Static Pressure
  - f. Hot Water, Pressure Drop, and EWT, LWT
  - g. Water Flow
2. Terminal Units (Each):
- a. Unit No. and Location
  - b. Supply Air Static Pressure and Temperature
  - c. Control Air Pressure
  - d. Maximum and Minimum CFM Settings
  - e. Check Control Sequence
  - f. Check Fan Operation
  - g. Check Hot Water Coil Water Pressure Drop
  - h. Check EAT and LAT at Hot Water Coil
3. Fans and Miscellaneous
- a. Unit No. and Use
  - b. Manufacturer and Model
  - c. Motor Nameplate Data
  - d. Motor Amps and Volts
  - e. Entering and Leaving Static Pressure
  - f. Fan RPM
  - g. Damper Operation
- E. Contractor shall have in his possession a copy of a letter from the responsible Control Representative stating that the controls have been installed according to the plans; that the control sequence has been checked and that all controls have been calibrated.
- F. Permanently mark damper shafts and valve stems to identify device positions after TAB report is approved.
- G. Replace fan sheaves as necessary to produce design air volume.

### 3.2 SPECIAL REQUIREMENTS

- A. Variable Air Volume Duct Pressure Setpoint. TAB contractor shall determine the optimum duct pressure setpoint as follows: Determine and record in the TAB report, the hydraulically most remote terminal and lock its damper in fully open position. Set all other terminals downstream of control duct pressure transmitter to maximum volume setpoint. Adjust fan speed manually until most remote terminal volume equals its maximum volume setpoint. Record the corresponding sensed static pressure at the duct pressure sensor location as the optimum duct pressure setpoint. If necessary to provide diversity, terminals that are not downstream of the duct pressure transmitter may be closed.

- B. Minimum Outside Air Volume for Variable Air Volume Air Handling Units: Variable volume air handling systems that have economizer dampers with a specified minimum quantity of outside air shall be balanced as follows: Determine the unique damper control signal which results in the specified minimum outside air volume, at each of four different conditions of fan speed: 100%, 80%, 60%, 40%. Record the four damper control signals in the TAB report. Space temperature setpoints shall be manipulated to cause variation in system load while specified controls are completely functional. If direct volume measurement is impractical, use the temperature mixing method when outside air temperature is more than 30°F. different than return air temperature. Confirm that exhaust fans serving same areas of the building are energized during the balancing operation.
- C. Variable Volume Pumping System Differential Pressure Setpoint: TAB contractor shall determine the optimum differential pressure setpoint as follows: Determine and record in the TAB report, the hydraulically most remote coil. Lock its control valve in fully open position and open the balancing valve. Set all other coils downstream of control differential pressure transmitter to balanced flow with control valve in wide open position. Adjust variable volume pump speed manually until most remote coil flow equals its design value. Record the corresponding sensed differential pressure at the differential pressure sensor location as the optimum differential pressure setpoint. If necessary to provide diversity, coil control valves that are not downstream of the duct pressure transmitter may be closed.
- D. Variable Volume Pumping System Pump Balancing: After optimum differential pressure setting has been determined as described above, open all coil control valves and balance coil flows to 120% of specified values while pump speed is under automatic control maintaining the optimum setpoint. Record pump data, including pump speed, under these conditions. Turn variable volume pump off. Start constant volume pump. Throttle pump discharge valve until control differential pressure falls to the recorded optimum setpoint. Record constant volume pump data. Do not throttle pump discharge valve on variable volume pumps. Leave discharge valve on variable volume pumps wide open.
- E. Calibrate controls flow meters for chilled water and steam.
- F. Provide TAB result to ATC contractor for use in control logic.

END OF SECTION

## SECTION 237313

## BUILT UP AIR HANDLING SYSTEMS

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

## 1.2 SUMMARY

- A. This section of the work includes the design, fabrication, testing, cleaning and packaging, shipment and installation of assemblies and components i.e.; fans, dampers, filters, coils, motors and any specialty equipment as indicated by the Contract Documents with supplementary items necessary for proper installation custom field assembled air handling unit under the direct supervision of the unit manufacturer.
- B. The air handling unit manufacturer shall assume all responsibility to assure equipment installation including field assembly of individual equipment components as required.
- C. Installation of the unit(s) shall be considered to be complete and ready for duct, pipe, control and electrical connections, lighting, service outlets as described by this Section and when placed into operation passing design performance requirements. Coordinate installation of equipment and routing of conduit, electrical boxes and the wiring and mounting of instrument devices with air handler manufacturer.
- D. This Specification applies to all site built air handling unit for applications as scheduled on the Drawings. Custom site built unit(s) shall be of the configuration, capacity and style as indicated on the drawings and the air handler schedule and as specified herein. Through properly designed access; ease of maintenance, removability of components, and unit(s) serviceability shall be assured.
- E. The air handler manufacturer shall confirm rigging and installation limitations and shall design, the panel's package sections and ship the complete unit based on these limitations.

## 1.3 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

- C. Equipment furnished under this specification shall be in accordance with the following industry, association and government codes and standards, as applicable to their design, fabrication, and assembly and testing. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
1. AMCA 99 - Standards Handbook.
  2. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
  3. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
  4. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
  5. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
  6. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
  7. ARI 610 - Central System Humidifiers.
  8. NEMA MG1 - Motors and Generators.
  9. NFPA 70 - National Electrical Code.
  10. NFPA262 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
  11. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
  12. UL 900 - Test Performance of Air Filter Units.
  13. NEC - National Electric Code.
  14. Equipment within unit shall be UL listed where applicable.
  15. ANSI/ASHRAE/IESNA Standard 90.1 – Energy Standard for Buildings Except Low Rise Residential Buildings.

#### 1.4 QUALITY ASSURANCE

- A. All equipment or components of this specification section shall meet or exceed the requirements and quality of the items herein specified or as denoted on the drawings and schedule.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience, who issues complete catalog data on total product.

#### 1.5 WARRANTY

- A. All equipment, materials, and workmanship shall be warranted for (12) months from startup. During the warranty period, the manufacturer shall repair or replace, at no additional cost to the Owner, any equipment, material, or workmanship in which defects may develop.

## 1.6 SUBMITTALS

### A. Product Data Record Documents

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, unit's configuration, major component locations, access door locations, show access door swings, duct connection sizes and locations, and shipping split locations, gages and finishes of materials, location of electrical service lights, service outlets and connection requirements. Refer to detailed list of submittal data in the paragraph 3.0 of this Specification.
2. Submit step by step assembly instructions as part of the unit submittals. The assembly instructions shall detail each step of the assembly process along with the required field issues needed to maintain unit quality.
3. Submit, as part of the submittals, a unit assembly drawing which details the order in which the panels and components will be installed based on this particular project. Generic assembly plans are not acceptable. The panel and component assembly drawing must be project specific with written recommendations for field storage, on indoor and / or outdoor unit(s).
4. The manufacturer shall submit for Owner approval a unit assembly plan that details each step of the construction process that affects construction trades, required utilities and a timeline for unit completion.
5. If specifically applicable to the components and accessories specified for each unit, the electrical data, wiring diagrams, and accessory panel layouts shall clearly differentiate between portions of wiring that are factory-installed and portions that are field-installed.
6. If specifically applicable based on design factory testing procedures for review and acceptance.
7. Provide data of filter media, filter performance data on efficiency, and pressure drop, filter assembly and filter frames size as tested and certified per ASHRAE 52.2 and UL-900 class 1.
8. Provide fan curves with specified operating point clearly plotted, as tested and certified per AMCA standards. Ratings to include system effects. Bare fan ratings will not satisfy this requirement but shall be submitted for comparison purposes. All fan data shall be generated from specified testing. The fan shall compare favorably with the scheduled data listed in the Drawings. Where two fans

are operated in parallel, provide Hagen's Line plots on fan curves to prove that fans will not be operating in the unstable region.

9. Submit sound power level data for both fan outlet and casing radiation at rated capacity, as tested and certified per AMCA standards. All fan data shall be generated from specified testing. The fan shall compare favorably with the scheduled data listed in the construction drawings. The selected unit will not exceed the scheduled sound power data.
10. Unit manufacturer shall submit full sound performance data to the Project sound consultant for evaluation. Unit shall be finally configured so as not to exceed sound levels as scheduled on Contract Documents.
11. Provide data on all coils as tested and certified per ARI standards.
12. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
13. Wiring shall have smoke and flammability rating of 25/50 or better per test method of NFPA 262.
14. Calculations: Provide total sum of the internal pressure losses for each component section of the unit based on design air flow rate which will be used to determine the proper height requirement on the submittal drawing to allow for proper condensate trapping and coil condensate drainage based on and external pressure requirements which is dependent on the location of the fan.

B. Operation and Maintenance Data

1. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists and wiring diagrams.
2. Provide Operating and Maintenance (O&M) Manuals for air handling unit(s). In addition to a full set of manual(s) with closeout documentation, condensate trapping calculation each unit shall ship with its own manual. Manufacturer's literature describing each piece of equipment including operation instructions and literature with step by step preparation of starting, shutdown, and draining and maintenance instructions, including lubrication.
3. Manufacturer's Instructions: Provide Start-up information and maintenance required prior to Start-up.

1.7 PRODUCT CLEANING DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to the Project Site under provisions of Division 01.

- B. Thoroughly clean equipment, components and subassemblies of water, dirt, debris, weld splatter, grease, oil and other foreign matter prior to shipment.
- C. The manufacturer shall design base sections, components and component crating to allow rigging in via the space available. Coordination of component size limitations shall be the responsibility of the air handler manufacturer.
- D. Components shall be crated to minimize construction space requirements. Construction space is limited and the manufacturer shall design the unit crating to respect this limitation. Specifically, the manufacturer shall crate wall sections and necessary wall assembly components in individual crates allowing for assembly from one crate at a time.
- E. Units delivered with scratched, dented, or dirty surfaces or damage of any type shall be restored to “as new” condition as directed by the Architect/Engineer/Owner at no cost to Owner.
- F. If equipment is to be stored before use, shipping protection provided by the unit manufacturer shall remain on the unit until the unit is installed. Manufacturer shall submit written recommendations for field storage.
- G. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- H. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finishes.
- I. Protect openings in casing and seal them with plastic wrap to keep dirt and debris, also protect coils from entry of dirt and debris with pipe caps or plugs.

#### 1.8 EXTRA MATERIALS

- A. The Contractor shall furnish and maintain clean filters in each air handler as listed in the equipment schedule on the Owners drawings. The contractor shall furnish and install one complete set of new filters for each unit after it has been tested and operated and receives final acceptance by the Owner. Tag the filter products with the scheduled equipment number assigned to the appropriate air handling unit.

#### 1.9 SCHEDULES ON DRAWINGS

- A. In general, all capacities of equipment and motor and starter characteristics are shown in schedules on the Drawings. Reference shall be made to the schedules for such information. The capacities shown are minimum capacities. Variations in the capacities of the scheduled equipment supplied under this contract will be permitted only with the written direction of the Owner.
- B. Insofar as is possible, all items of the same type (i.e., coils, fans, etc.) shall be by the same manufacturer.



- C. Where installation instructions are not included in the Contract Documents, the manufacturer's instructions shall be followed.
- D. Fan quantity shown on the fanwall schedule is the minimum. Motor and wheel diameters shown on the fanwall schedules are the minimum. If a larger wheel diameter or horsepower is required, it shall be so quoted and noted on evaluation forms in this section.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Configuration: Fabricate and assemble the air handling unit with accessories and components as indicated on the Drawings, including but not limited to:
  - 1. Preheat coil section.
  - 2. Mixing box section.
  - 3. Filter sections.
  - 4. Supply Fan (with motor(s) and variable frequency drive(s).
  - 5. Relief Fan Section (with motor(s) and variable frequency drive(s) remote mounted.
  - 6. Access doors.
  - 7. Isolation Dampers.
- C. Base performance on sea level conditions, unless otherwise scheduled.
- D. Fabrication: Conform to AMCA 99 in the absence of direction in this Specification.
- E. Performance: Refer to schedule in Drawings.
- F. Provide a unit with a total footprint size (length and width) that will not exceed the one shown on the Drawings, including the height of individual unit components.

### 2.2 UNIT CASING, FRAME, AND GENERAL CONSTRUCTION

- A. Unit Casing
  - 1. The units shall consist of the applicable sections outlined in this specification and / or scheduled on the Owner's equipment schedule drawings.

2. Air handling unit casing shall be built up from the unit base or floor with panels. The unit manufacturer shall be the manufacturer of the panel system. Panels shall be load bearing and capable of forming the enclosure without additional structural members. Panels shall be joined together with independent joining member and fastened with closed end aluminum rivets or stainless steel fasteners. Plated fasteners will not be accepted.
3. All panels shall be double wall all-aluminum construction with minimum 0.040" exterior and interior skin thicknesses. Interior finish to be smooth, mill finish; exterior finish to be a low-reflective textured mill finish. Each panel shall contain an integral frame or be properly supported by a structural framing system. Panel shall have continuous tight seal at the interior and exterior skins completely encapsulating the insulation.
4. The minimum panel thickness shall be 2-1/2" thick with 3-pcf high polyisocyanurate foam insulation. The panel R value shall be a minimum of 12]. Thermal drift from degassing shall be accounted for during the manufacturers design wall thickness of the unit wall and ceiling panels.
5. Panel system shall incorporate an integral thermal break system downstream of cooling coil such that there is no through metal path between the interior and exterior surface of the unit casing at all locations. The thermal break shall consist of a minimum 1/2" structural epoxy bridge. Adhesive tapes or gaskets do not constitute an acceptable thermal break. Criteria to evaluate requirement for thermal break system shall be based upon scheduled unit performance and ambient conditions anticipated around the units.
6. Thickness of the panel skin, core density, rib structural frame spacing shall be regulated to eliminate panel pulsation and restrict the maximum deflection to 1/200 of any span at design load of 1-1/2 times the design positive or negative pressure.
7. Casing system shall be guaranteed to assure the owner that system capacity, performance, and cleanliness standards specified are not compromised and prevent microbial growth on the interior wall, floor ceiling panels.
8. Casing leakage to be guaranteed at no more than 1/2% of the design volume or 30 cfm whichever is greater when measured at the larger of 1-1/2 times design operating pressure or 10 in. wg." Manufacturer shall submit maximum allowable leakage (cfm) and corresponding test pressures for positive and negative parts of the unit for approval prior to testing.
9. All sheet metal joints throughout the air-handling unit and between panelized sections shall be sealed with butyl sealant between panels and mullions and foam to fill the voids.
10. Where the air unit casing encloses the building columns, provide airtight enclosure. Leakage rate will not exceed that allowed for the unit casing.

11. Provide a thermal break consisting of a minimum 1/2" structural epoxy bridge between exterior panel and frame to ensure an air-tight fit. Configure casing assembly to eliminate all through-metal portions of the unit so that there will be no external condensation.
12. Panel surfaces shall be non-condensing per ASTM D 4230, Measuring Humidity with Cooled Surface Condensation.
13. Supply air openings to be framed with 2" high water dam continuously welded to the pan to allow proper duct connections and to prevent moisture from entering the openings. Framed openings shall be provided with removable 304 stainless steel grating designed and fabricated for a live load of 100 pounds per square foot. Galvanized or painted steel grating will not be accepted.
14. Provide the minimum access space sections for maintenance of individual components such as fans, filters, coils, etc., as scheduled or shown on the Drawings. Arrange these components in a manner that allows for ease of replacement. Provide a plenum section downstream of the cooling coil with sufficient distance to preclude the moisture carryover from the cooling coils into the fan section.

B. Casing Integrity

1. Conduit, piping, tubing, instrument field penetrations of the air handler casing are to be coordinated by the trades created and sealed by the air handler manufacturer.
2. All unit base service openings shall be framed with a minimum 2" high water dam continuously welded to the floor. All pipe and electric conduit chases with openings to building or elements shall be covered with thin gage aluminum or 304 stainless steel. Penetrations by contractors shall be sealed by the respective contractor.
3. All ductwork penetrations to the unit casing shall be provided with framed openings of size and arrangement as indicated on drawing.
4. Coordinate with the manufacturer to allow for all necessary penetrations to provide a complete, functioning, and maintainable system.
5. Any equipment flashing, internal partitions or other attachments to the casing shall be made in such a way as to ensure a permanent leak-tight connection. Attachments that are bolted, screwed, or welded to or through the casing creating air bypass, air leakage or rust propagation areas are not acceptable.
6. Provide non-corrosive nameplate permanently attached to the equipment containing the following information:
  - a. Manufacturer's project number / serial number
  - b. Plant name and location
  - c. Customer equipment identification number

## d. Date of manufacture

## C. Drain Pans

1. Provide IAQ style drain pan under the entire cooling coil section, which is in compliance with ASHRAE Standard 62.
2. Drain pan shall extend at least a minimum 24 inches downstream of the cooling coil section.
3. Construct drain pan of Type 304 stainless steel; minimum 18-gage.
4. Manufacturer shall determine if drain pan on a stacked coil will require insulation to preclude the formation of water carry over from the formation of condensation on the outside surfaces of the drain pan. If condensation occurs, the manufacturer shall take whatever steps are necessary to prevent condensation, at the manufacturer's expense. Install and seal insulation as is appropriate for the equipment construction.
5. Drain pan triple sloped  $\frac{1}{4}$ - inch / ft. to the drain connection to prevent accumulation of standing water to meet the requirements of ASHRAE 62.
6. Condensate from drain pans shall be piped as indicated on the Drawings. The pipe size shall be 1-inch minimum diameter, insulated as specified for condensate water piping. A trap as required to prevent the escape or entry of air through the drain piping shall be provided as indicated on the Drawings.
7. Provide an insulated intermediate drain pan for all coils above another coil, factory piped to main drain pan. Drain pans shall be triple sloped and constructed of 16 gage Type 304 stainless steel to match the main drain pan and shall be extended 6 inches from the coil face.

## D. Base and Floor

1. The unit shall be constructed on an all-aluminum or stainless steel structural base. The base shall be designed to distribute loads properly to a suitable mounting surface and be braced to support internal components without sagging, pulsating or oil canning.
2. Fabricate base of connections with shielded gas welded structural aluminum members.
3. The unit base shall be provided with (min.  $\frac{1}{4}$  - inch per foot) sloped sumps on the entering and leaving side of hot water inlined tube coils for coil cleaning maintenance purposes. The NPT end capped drain pipes are to be located on the same side(s) as the cooling coil condensate drain pan drain piping. The recessed sumps shall be welded and guaranteed waterproof to prevent trapping that might cause water damage from the unit. The cooling coil drain pan shall be double-

- sloped (min.  $\frac{1}{4}$  - inch per foot) towards the unit's drain piping to positively remove condensate from the unit.
4. The base floor shall be minimum 3/16" thick aluminum plate welded at all joints and to structural members. Floor material shall have safety-tread surface. The base floor shall be designed for a minimum live load of 100 pounds per square foot throughout the unit. The base floor is to be supported with adequate stiffening members to prevent oil canning.
  5. The base floor and wall panel joints are required to pass a leak tightness acceptance test of sump base with a minimum of 2 inches of standing water for the duration of 12 hours to guarantee caulking, gaskets, mechanical fasteners and seals and water tightness of joints.
  6. Removable access panels shall be provided as indicated on the drawings for service and maintenance. Access panels shall be of the same construction as panels described above. Removable access panels shall be designed and constructed such that removal and replacement may be accomplished without disturbing adjacent panels. Airtight integrity must be maintained.
  7. Base shipping splits shall be provided as needed based on unit rigging limitations. Shipping splits shall be designed with a raised flange for connecting of base sections. The raised flange shall allow the base sections to be bolted together and maintain a minimum of 2" deep sump drain. Each sump in the floor will have a piping drain connection equipped with a capped NPT end to drain via a hose to the nearest floor drain. Base joining methods that require field welding are not acceptable.
  8. The perimeter support members shall be properly sized to support all major components and the housing during rigging, handling and operation of the unit.
  9. The underneath side of the base pan and base perimeter shall be insulated with a minimum of not less than 2-1/2 inch thick high (1.5-pcf) density polyisocyanurate of R-12 foam insulation to form a vapor barrier. The bottom of the vapor barrier is then protected by a 0.040 - inch thick aluminum sheet attached to the bottom of the base. Insulation shall be water impervious rigid type, after curing, and shall occupy all voids and areas between drain pan and outer wall to prevent the occurrence of trapped water, condensation, and microbial growth.
  10. Each section of the unit base shall contain a minimum 1 - inch NPT drain to facilitate system wash down, maintenance and condensate removal. Areas in the base where potential standing water cannot be removed through drains or weep holes are not acceptable. Clean out drains shall be provided with removable caps of non-corrosive material.
  11. All equipment within air handling unit shall be provided with a minimum 2 - inch high base to raise equipment off unit floor for housekeeping. Equipment footings shall be welded to the unit base and designed so that equipment connections

are bolted and no field welding is required. Equipment mounted directly on unit floor is not acceptable.

12. Complete perimeter channel base shall be a minimum 6 inches in height. Select base rail size appropriate to the drain trap depth.
13. All points of contact between the floor, vapor barrier and structure shall be thermally isolated with gasketing of closed-cell soft rubber or EPDM.

E. Access Doors

1. Provide access doors to allow access to both sides (upstream and downstream) of the filter racks, both sides of the fan section, and both sides of all coils. Access doors shall be capable of opening full 90 degree swing with allowance to preclude the door from opening into and causing damage to coil, filter bank, etc, or opening out and interfering and causing damage to insulation on the piping connection to a coil.
2. Access doors shall be double wall, insulated the same as wall panels, and the access door and framed opening shall also include thermal break construction. Door and wall panels shall have be single point roller type.
3. Provide minimum 24" wide access doors for access to all internal components and full panel height up to 72-inch tall units. For units above 72 inches tall, provide, 72-inch high doors. For removable panels over 78-inches tall provide a minimum of six latches. Provide minimum 24" wide access doors for access to all internal components.
4. Access door construction shall equal or exceed the quality of air handler casing materials as specified herein.
5. Each access door shall contain a thermopane safety glass window (min. 10" square), capable of withstanding the total developed pressure of the unit.
6. Provide a 1" diameter test ports with screwed caps on casing upstream and downstream of all coils and filters for pressure and temperature measurement.
7. Doors shall be hinged using either heavy-duty adjustable stainless steel butt hinges or a continuous adjustable stainless steel piano hinge, extending along the entire edge of the door, except for a maximum of 2-inches at each end. If butt hinges are used, provide two (2) per door for up to 36-inch high doors and three (3) per door for taller doors.
8. Each access door shall have a least a minimum of two (2) non-corrosive handles operable from either side.
9. The access doors shall incorporate two continuous separate gasket seals around the inner and outer mating surfaces entire periphery of the door to make and air tight seal. Gasket material shall be UV-resistant, closed cell neoprene; gaskets

shall be attached by adhesive and not mechanically held in place. Single gasket seals will not be accepted.

10. Access doors shall be installed to open against the greatest pressure relative to air pressure on each side of access door, unless approved by the Owner in writing.

F. Rigging Performance Requirements

1. Provide units that include lifting lugs and are suitable for rigging without requiring additional support frames or rails.
2. Provide units that may be lifted without permanent deformation to the housing, base or internal components.
3. Indicate physical balance point on unit bases.

2.3 FANS AND RELATED COMPONENTS

- A. The multiple fan array systems shall include multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified class III as required. Class I fans are not acceptable. Fans shall be rated in accordance with and certified by AMCA for performance. All fans shall be selected to deliver the specified air flow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan array shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed.
- B. Each fan/motor cube or cell shall include a minimum 10 gauge, G 90 Galvanized steel intake wall, .100 aluminum spun fan inlet funnel, and a 10 gauge G90 Galvanized steel motor support plate rail and structure. All motors shall be standard foot mounted type TEAO selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2. Motors shall be as manufactured by Baldor, Siemens, or Toshiba for use in multiple fan arrays that operate at varying synchronous speeds as driven by an approved VFD. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedule(s). Steel cased motors and/or ODP motors are not acceptable. All motors shall include permanently sealed (L10-400,000 hr) bearings and AEGIS™ shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .022" per second peak, filter in. Fan and motor assemblies submitted for approval incorporating larger than 22" wheel size and 215 T frames size motors shall be balanced in three orthogonal planes to demonstrate compliance with the G.55 requirement with a maximum rotational imbalance of .022" per second peak filter in. Copies of the certified balancing reports shall be provided with the unit O&M manuals at the time of shipment.
- C. The fan array shall consist of multiple fan and motor "cubes" or "cells", spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the

entire air way tunnel cross section and components contained therein. In order to assure uniform velocity profile in the cross section, the fan cube dimensions must be variable, such that each fan rests in an identically sized cube or cell, and in a spacing that must be such that the submitted array dimensions fill a minimum of 90% of the cross sectional area of the air way tunnel. There shall be no blank off plates or “spacers” between adjacent fan columns or rows to position the fans across the air way tunnel. The array shall produce a uniform air flow profile and velocity profile within the airway tunnel when measured at a point 36” from the intake side of the fan array intake plenum wall, and at a distance of 72” from the discharge side of the fan array intake plenum wall. Submittals for units providing less than the scheduled quantity of fans and/or spacing of the fans for multiple fan arrays shall submit CFD modeling of the air flow profile for pre-bid approval that indicates uniform velocity and flow across all internal components without increasing the length of the unit or changing the aspect ratio of the unit casing as designed.

- D. Each individual cube or cell in the multiple fan arrays shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan or multiple fans become disabled. The system effects for the back flow prevention device(s) shall be included in the criteria for TSP determination for fan selection purposes, and shall be indicated as a separate line item SP loss in the submittals. Back Draft Damper performance data that is per AMCA ducted inlet and discharge arrangements will not be accepted. Damper data must be for the specific purpose of preventing back flow in any disabled fan cube and that is mounted directly at the inlet of each fan. Motorized dampers for this purpose are not acceptable. Submitted fan performance data which only reflect published performance for individual fans in AMCA arrangement “A” free inlet and discharge will not be accepted. Manufacturers that do not manufacture the fans being submitted on must provide certified performance data for fans as installed in the AHU unit with Back Draft damper effects included. At the sole discretion of the engineer, such performance testing may be witnessed by the engineer and/or the owner’s representative.
- E. Each fan motor shall be provided with a dedicated VFD. Wire sizing shall be determined, and installed, in accordance with applicable NEC standards and local code requirements. The multiple fan array electrical panel shall include system optimization controls to actively control fan speed and to enable and disable fans in the multiple fan array. The number of active fans in the array shall be automatically determined, and the speed of the enabled fans shall be adjusted to produce the required coincidental flow and pressure at the perimeter boundary of the unit at substantially peak efficiency. The system optimization controls shall continuously monitor required flow and pressure and shall automatically optimize the operating array configuration and speed for peak efficiency. System optimization controls shall be provided that will interface with, and be compatible with the BAS as specified elsewhere. It is the responsibility of the contractor to assure that the fan system optimization controls are compatible with the BAS system. System optimization controls shall be provided by the fan array manufacturer to assure single source responsibility for fan volume controls, and shall require only an input control signal from the controls contractor for SP or flow for proper operation of the system optimization controls. The unit manufacturer shall provide a single communication interface with the BAS and shall coordinate with the controls contractor to make sure that all necessary data points are communicated.



- F. The fan array control panel shall be controlled via a programmable logic controller (PLC) as an integral part of the fan system electrical panel. The fan array control panel shall come with an integrated 6" HMI touchscreen, embedded into the front panel door face of the fan array control panel. The touch screen shall be able to do start/stop control, common alarm output VFD faults, power failures, speed set point scaled from 0 to 120Hz and provide total CFM.
- G. All motors in the array shall be provided with individual motor protection for thermal overload protection. All motor circuit protectors can be located in starting device enclosure or, if required by design, in a separate enclosure. Motor circuit protector enclosure must be located and mounted at a minimal distance from motors in the array. Provide remote indication by means of aux contacts wired in series.
- H. Provide individual Frequency Drives for each motor in the Array. Provide service disconnects with fuses or circuit breaker. Drives shall be as specified in section 230514.

#### 2.4 FILTER SECTION

- A. Filters shall have a maximum width of 24 inches.
- B. Side Access Housings
  1. Fabricate of not less than 16-gage galvanized steel.
  2. Each filter section shall be equipped with hinged access doors at both ends, provision for receiving filters of any manufacturer without alteration to the housings and extruded aluminum channels capable of receiving both the after filters and 2-inch deep panel type pre-filters.
  3. The filter section shall incorporate a permanent provision for sealing filters against leakage around the entire perimeter of each filter, eliminating the need to purchase replacement filters with factory applied gasket strips.
  4. Replaceable woven pile seals shall be an integral component of the downstream flange of each extrusion so that the seals are compressed by the pressure drop across the filters, preventing bypass of unfiltered air.
  5. Filter sections shall not exceed 21 inches in direction of airflow and shall be of all welded construction with factory pre-punched standing flanges for ease of attachment to adjacent equipment and/or ductwork.
  6. Doors are to be fitted with positive sealing, heavy duty multiple latches and with sponge neoprene gaskets.
- C. Unitary front access holding frames shall be fabricated of not less than 16-gage galvanized steel with holes pre-punched for convenient assembly into banks. Frames shall be a minimum of 2-5/8 inches deep for maximum structural strength and resistance to racking. All joints in the field-assembled banks of frames shall be thoroughly caulked to prevent bypass of unfiltered air between frames and surrounding ductwork or plenum

chambers. Frames shall each be fitted with polyurethane foam gaskets, held in place by long lasting adhesive and with a minimum of four heavy-duty spring type fasteners. Fasteners shall attach to the frames without requiring tools and shall be capable of withstanding 25 pounds of pressure without deflection.

- D. Filter sections for four inch MERV 13 disposable filters shall be of modular design with each module
- E. The air handling unit manufacturer shall provide one (1) set of scheduled filters for each air handling unit as shown on the Drawings. The filters shall be boxed and placed within the air handling unit during shipment. The box shall identify the type of filter and be labeled with the corresponding air handling unit number.

## 2.5 DAMPERS

### A. Mixing Box Section

- 1. Factory built, field mounted, Flanged outside and return air dampers with extruded aluminum air-foil profile blades with aluminum end caps press fitted into blade ends to seal the blade edges against 4-inch aluminum damper frame to reduce air leakage rate. Seals are to be secured in an integral slot within the aluminum extrusions.
  - 2. The blade and frame seals are to be mechanically fastened to eliminate shrinkage and movement. Clip-on type blade seals or seals fastened by adhesives are not acceptable.
  - 3. The reinforced aluminum damper blades shall be attached to aluminum axles that pivot in maintenance-free synthetic bearings.
  - 4. The outside air and return air dampers shall be an opposed blade arrangement with damper blades positioned across short air opening dimension. Parallel blade arrangement should only be used if outside air dampers are used for full open and full closed isolation purposes.
  - 5. Dampers shall be sized for a face velocity range between 1000 to 1500 FPM.
  - 6. Acceptable manufactures Ruskin, Inc. or Tamco Products, Inc.
- B. Dampers shall be rated Leakage Class 1 at 4.0 cfm at 6- inches w.g. static pressure differential. Standard air leakage data shall be certified per AMCA 511 for a Maximum allowable leakage 40.6 cfm per square foot at 4-inches w.g. differential pressure.

## 2.6 AIR HANDLING UNIT SPECIALTIES

### A. Ultra Violet Germicidal Irradiation Systems

- 1. Where scheduled on the Drawings, provide Ultra Violet (UV) Germicidal Irradiation lamps. Lamps shall provide a minimum irradiance of 9 Watts per square

foot or 96.54 Joules per square meter at the cooling coil surface and at the coil leaving air temperature scheduled on the Drawings.

2. UV lamps shall be located:
  - a. Downstream of cooling coils.
  - b. Above condensate drain pans.
  - c. Up-stream of final filtration sections.
3. Lamps shall be UL listed for application in air handling systems.
4. Lighting systems shall be moisture resistant with electronic ballasts and shall be wired using moisture resistant conduit.
5. UV Light fixtures shall be capable of being switched on and off at the respective AHU section access door.
6. Lamps shall be interlocked with access door position limit switches such that they are de-energize when the doors open.
7. Lamps shall be installed on a stainless steel grid using stainless steel fasteners in accordance with the manufacturer's installation instructions.
8. Units with view ports from which the lamps can be seen. All access shall be labeled to warn of possible eye damage.
9. Replacement lamps for UV systems shall be standard types which are not proprietary and are available from multiple sources.
10. Provide UV intensity monitor (stationary radiometer). Monitor shall be mounted in the built up system adjacent to the UV lamps. Unit shall communicate with the building automation system to indicate a reduction in lamp output below 70%.

#### 2.87 STEAM HUMIDIFIERS

- A. Unit shall be of steam jacketed manifold type, providing clean, dry steam humidification without condensate drip or objectionable steam noise.
- B. Furnish unit complete with control valve, inlet strainer, inverted bucket trap or F & T trap according to manufacturer's recommendation.
- C. Humidifiers shall be designed for complete absorption of steam within 18 inches of distribution grid.
- D. Provide temperature switch to prevent humidifier from operating before start-up condensate is drained.
- E. Provide multiple dispersion tubes where indicated or required for uniform steam distribution.
- F. Steam Control Valve:

1. Control valve shall be normally closed modulating type with equal percentage flow characteristic. Valve trim shall be stainless steel and designed to resist erosion of seat and plug.
2. Control valve full capacity shall not exceed scheduled humidifier capacity by more than 20%. Control valve rangeability shall be 40:1 minimum.

## 2.9 ELECTRICAL PROVISIONS

- A. Fan motors shall be mounted and wired to an external disconnect switch within sight of the motor access door. Fan motors shall be interlocked with fan access door to shut down fan when door is opened. Refer to NEMA standards and publications relevant to applications and use of both EMT and liquid tight flexible conduit.
- B. VFD with integral disconnect switch or remote disconnect switch shall be mounted independent of the unit to allow for maintenance access and access to AHU components. Locate disconnect switches within close proximity and sight of the electrical component. Interlock fan motor starters with a position limit switch located at the fan section access door. The limit switch shall de-energize the fan motor or other electrical components when the access door is opened.
- C. Provide water-proof, two-lamp linear fluorescent light fixtures with electronic ballasts manufactured by Lithonia DMW 2 32 120 GEB101S, or equivalent, and water-proof GFI convenience outlets inside sections before and after coil; before filter, at fan and before silencer compartments. Light fixtures in each air handling unit section shall be switched. Wire lights and service outlets to two external 120V, 20A power connections (one for each service) for connection by Division 26. Fixtures and lamps shall comply with Division 26 requirements.
- D. All wiring shall be 600V rated type MTW/THWN #12 stranded copper in EMT or liquid tight conduit (maximum three feet). All junction boxes shall be UL approved and gasketed. All conduits installed on the floor inside air handling units shall be rigid steel with steel fittings and diecast boxes. All EMT conduit and fittings on unit walls and ceiling shall be water tight type.
- E. Provide liquid tight flexible connection to motor; 36-inch maximum length.
- F. All conduit penetrations through the unit casing shall be non-metallic with insulated metallic fittings to maintain water tight thermal break barrier. All electrical and control wiring penetrations shall be made and sealed before unit testing.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Air handling unit shall be installed in accordance with the manufacturer's recommendations.

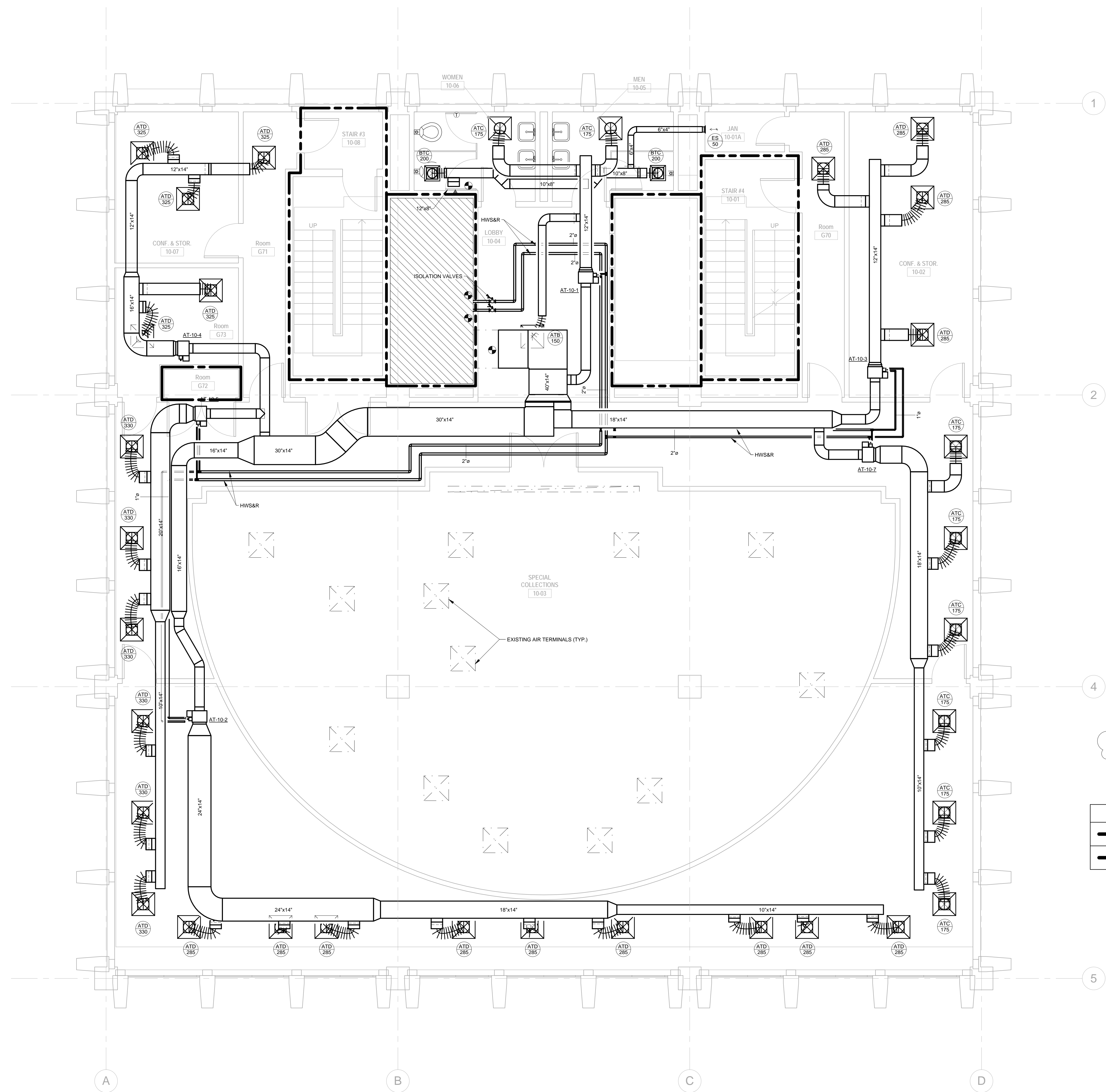
- B. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- C. Unit manufacturer shall be responsible for the complete installation of the air handling unit. The unit manufacturer shall coordinate with other trade contractors, all necessary requirements to assure proper air handling unit installation.
- D. Unit manufacturer shall coordinate with construction trades for exact quantity and locations on casing penetrations.
- E. The unit manufacturer shall coordinate unit shipping and installation schedule with mechanical contractor.
- F. Mechanical contractor shall provide rigging for mechanical components and make all final ductwork and piping connections required for a complete operating system.
- G. Unit manufacturer shall provide all conduits, fixtures, motor wiring and lighting within unit per the requirements of this and referenced specifications.
- H. The temperature controls contractor shall install temperature controls and panel, including, control wiring, etc., required for a complete and operating control system. Electrical contractor shall make final connections to the temperature control panel after the unit is installed. All penetrations shall be sealed.
- I. The Controls contractor shall coordinate with other work, including ductwork, piping, and controls as necessary to interface installation of air handling units with other work.
- J. The Mechanical contractor shall provide access space requirements around air handling units for service as indicated and/or required, but in no case less than that recommended by air handling unit manufacturer.
- K. The Mechanical contractor shall provide trapped copper drain line for indoor air handling units from each drain pan connection and run drain line to nearest floor drain. The piping drain trap shall be constructed with depth as indicated on the Drawings to provide proper coil drainage.
- L. Install in conformance with ARI 435.
- M. Install factory assembled unit on vibration isolators, where fans are not internally isolated.
- N. Grounding: It is imperative to the unit manufacturer and also the Electrical contractor to assure the equipment is properly grounded for air handling unit components, and also the air handling unit to the building ground system.
- O. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation of the Owner's representative(s).

### 3.2 TESTING

- A. Units with cabinet mounted fans shall be tested and certified at rated conditions using AMCA test procedures with fan mounted in the cabinet. Bare fan data will not be accepted.
- B. With unit set in place, leveled and ready to receive ductwork connections, unit shall be tested for casing leakage by sealing all openings and pressurizing to the parameters set forth within this specification.
- C. Test shall be performed by the manufacturer using certified flow measurement devices and shall be witnessed by a representative of the Test and Balance Firm. Demonstrate deflection limit of 1/200th and confirm fan/motor vibration limits.

END OF SECTION

SEE M400 FOR LEGENDS



SHEET NOTE(S):  
 1. INSTALL NEW ACOUSTICAL CEILING TILE AND GRIDS IN AREA OUTSIDE OF SPECIAL COLLECTIONS, LOBBY, CONF. AND STOR. ROOMS, AND RESTROOMS. REFER TO DWG ME105.

FIREWALL LEGEND		LEGEND	
	2 HR FIRE BARRIER		NEW EQUIPMENT
	1 HR FIRE BARRIER		EXISTING
			EXISTING THERMOSTAT
			CONNECT TO EXISTING

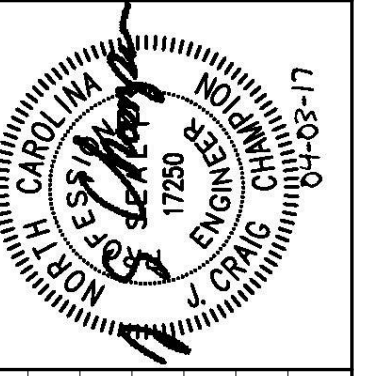
KEY PLAN

GRAPHIC SCALE

1/4" = 1'-0"

1 LEVEL 10 MECHANICAL PLAN - NEW WORK  
 M311 1/4" = 1'-0"

BID SET

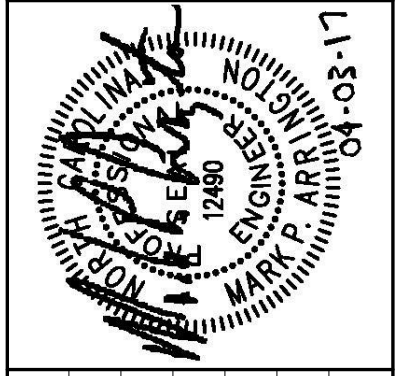


REVISION DATES	15-204	15-204	15-204
ADDRESS CHANGE	CCR	CCR	CCR
DATE	04-03-2017	04-03-2017	04-03-2017

JOB TITLE  
**UNC CHARLOTTE CAMPUS  
 INFRASTRUCTURE RENEWAL  
 (ATKINS)**  
 NORTH CAROLINA  
 CHARLOTTE

SHEET TITLE  
**LEVEL 10 MECHANICAL - NEW  
 WORK PLAN**

SHEET  
**M311**

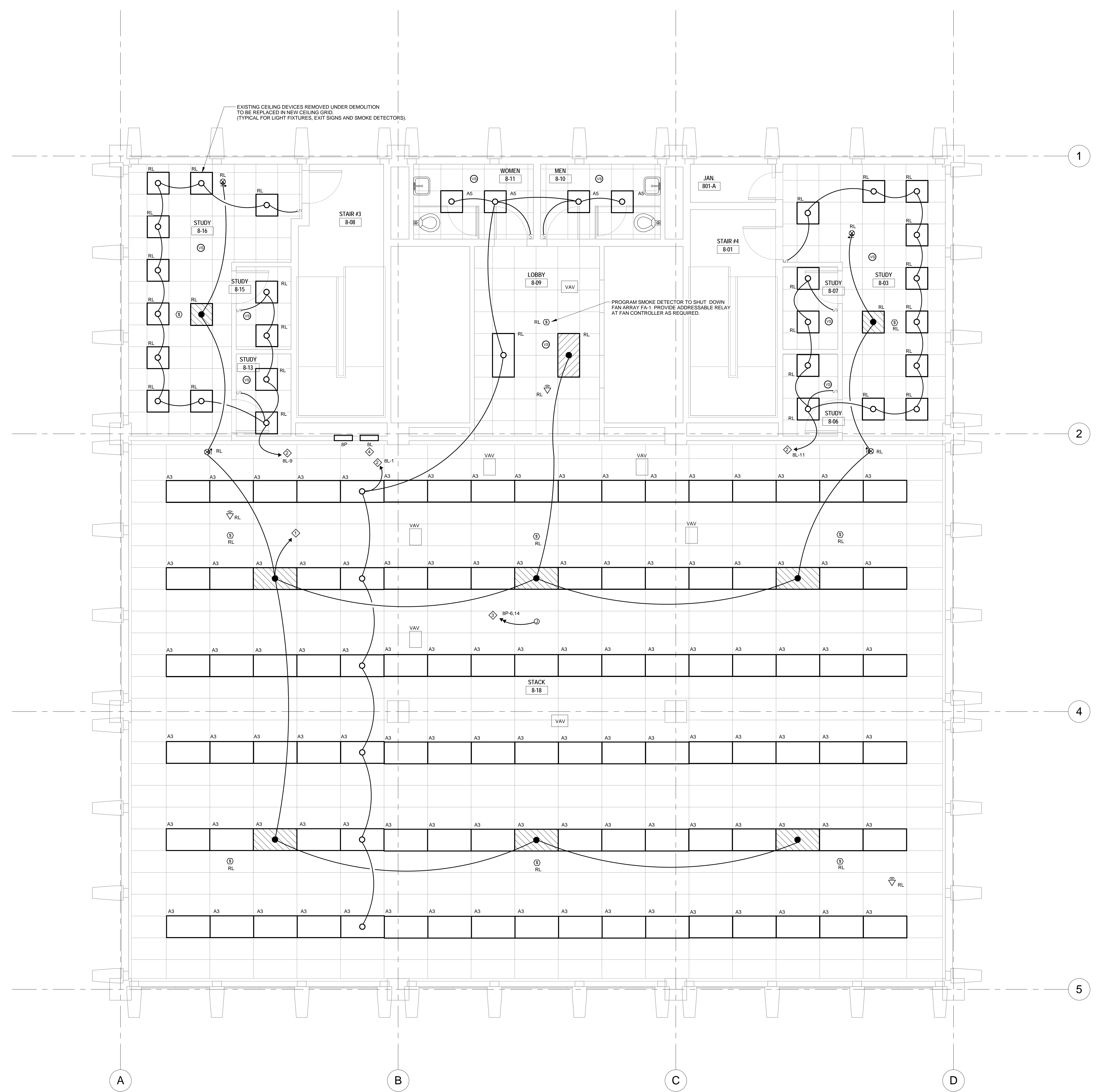


REVISION DATES	ADDITIONAL NO. 1: 05-04-2017
JOB NUMBER	15-064
DRAWN BY	TJW
CHECKED BY	MPA
DATE	04-03-2017

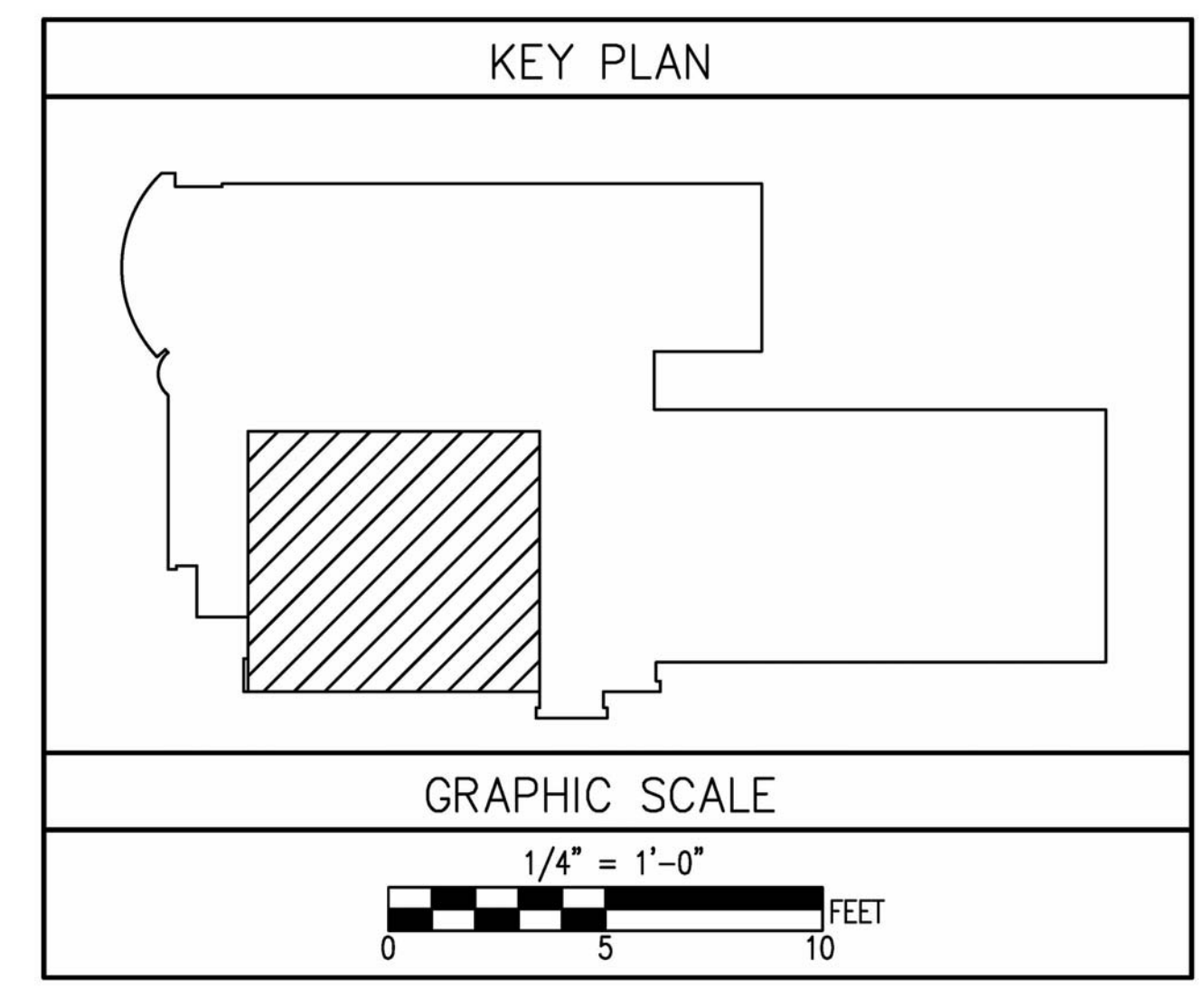
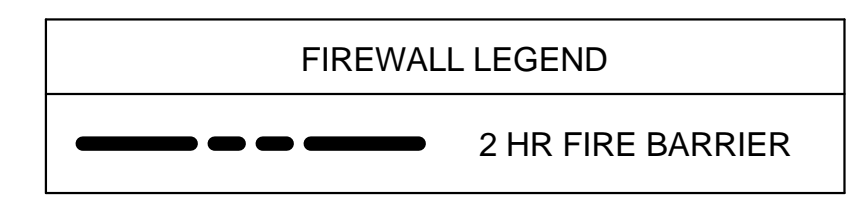
JOB TITLE  
**UNC CHARLOTTE CAMPUS  
INFRASTRUCTURE RENEWAL  
(ATKINS)**  
NORTH CAROLINA  
CHARLOTTE

SHEET TITLE  
**LEVEL 8 ELECTRICAL - NEW WORK  
PLAN - ALTERNATE NO.2**

SHEET  
**E307**



- NOTES:**
- ◆ CONNECT TO EXISTING LIGHTING EMERGENCY CIRCUIT SERVING THIS AREA WITH 2#12, 1#120, 1/2" C.
  - ◆ CONNECT TO LIGHTING CIRCUIT IN PANEL BL AS INDICATED AND MADE SPARE BY THIS WORK. CONNECT WITH 2#12, 1#120, 1/2" C. FIELD VERIFY AVAILABILITY OF BRANCH CIRCUIT.
  - ◆ PROVIDE JUNCTION BOX ABOVE CEILING FOR POWER TO THE VAV BOX CONTROLS. MAXIMUM OF 5 VAV BOXES PER CIRCUIT. CONNECT TO SPARE 30" CIRCUIT BREAKERS AS INDICATED IN PANEL BP WITH 4#12, 1#120, 1/2" C. FIELD VERIFY AVAILABILITY OF BRANCH CIRCUIT.
  - ◆ IN EXISTING PANEL BL, PROVIDE NEW 200A MECHANICALLY HELD CONTACTOR IN PLACE OF EXISTING CONTACTOR FOR LIGHTING CONTROL AS INDICATED BY CONTROL DIAGRAM.



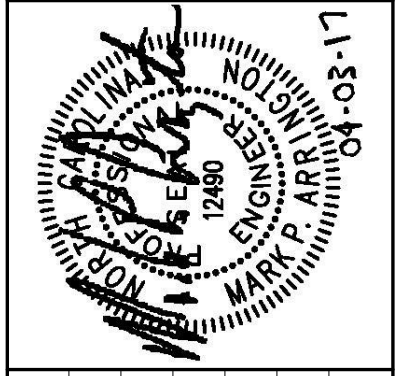
**NOTES:**

ALL WORK SHOWN ON THIS SHEET MUST BE PROVIDED UNDER ADD ALTERNATE NO. 2 EXCEPT:

1. NEW MECHANICALLY HELD LIGHTING CONTACTOR IN PANEL BL AND ASSOCIATED CONTROLS SHALL BE PRICED UNDER BASE BID.
2. REPROGRAMMING OF LOBBY SMOKE DETECTOR TO SHUT DOWN AHU SHALL BE PRICED UNDER BASE BID.

**1 LEVEL 8 ELECTRICAL - NEW WORK PLAN**  
E307 1/4" = 1'-0"





REVISION DATES	15-004
ADDITIONAL NO. 1: 05-04-2017	
JOB NUMBER	15-004
DRAWN BY	TJW
CHECKED BY	MPA
DATE	04-03-2017

JOB TITLE  
**UNC CHARLOTTE CAMPUS  
INFRASTRUCTURE RENEWAL  
(ATKINS)**  
NORTH CAROLINA  
CHARLOTTE

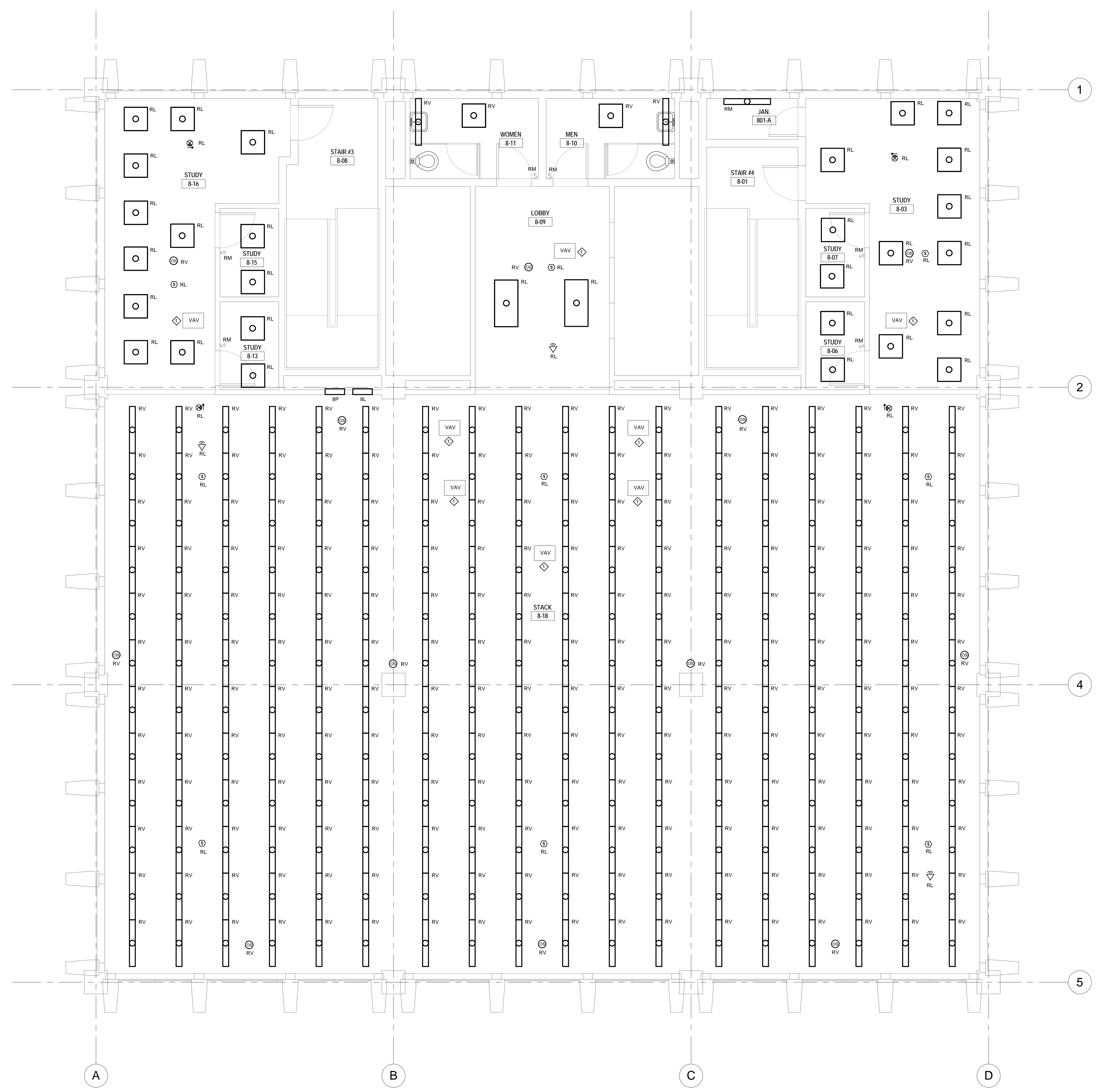
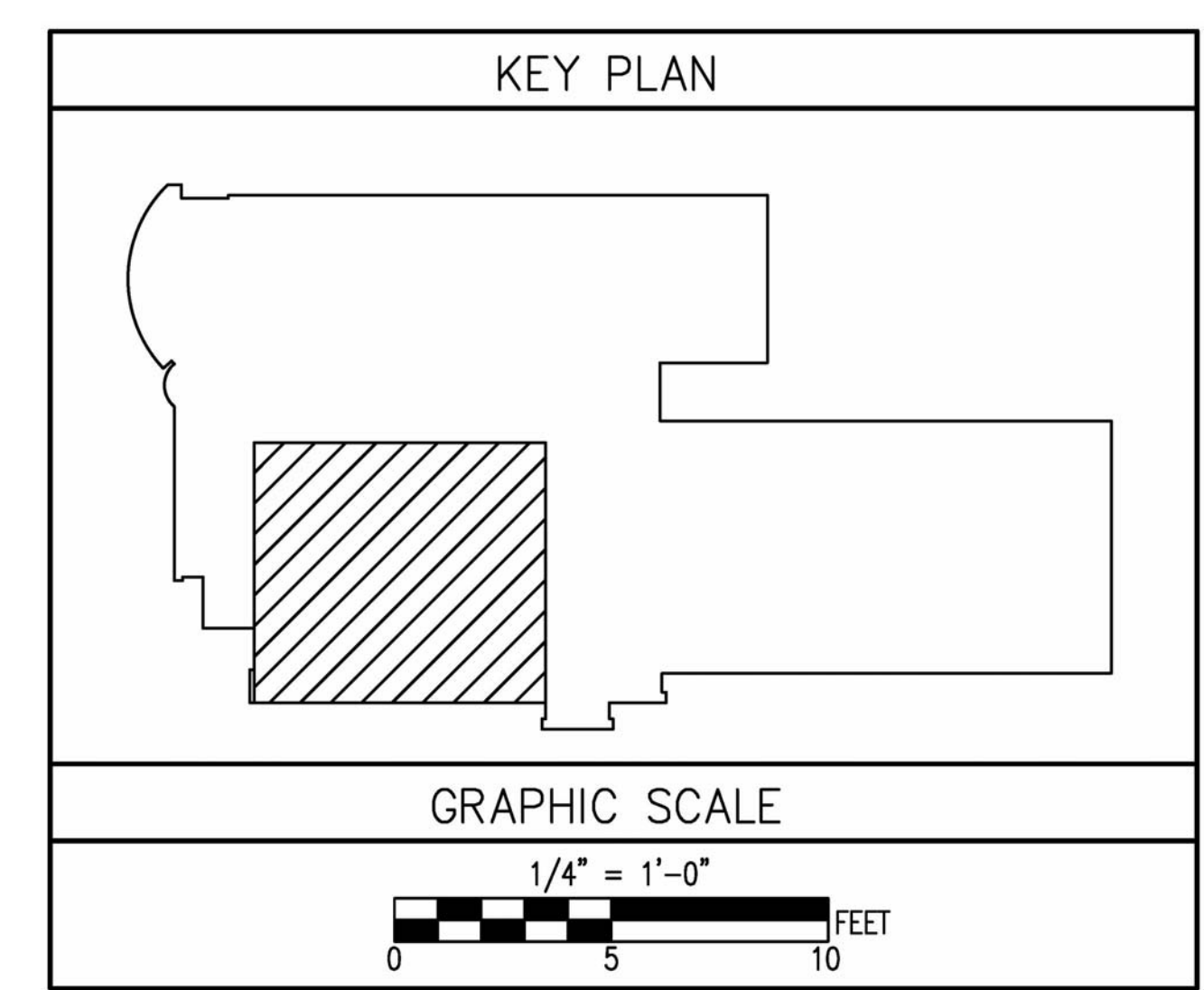
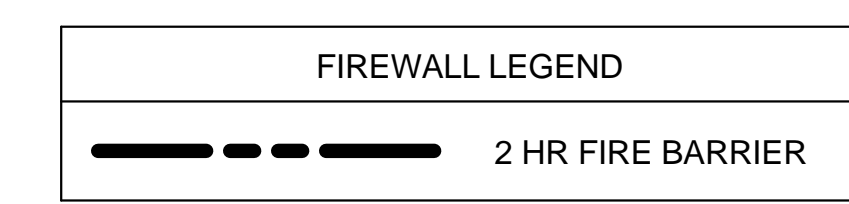
SHEET TITLE  
**LEVEL 8 ELECTRICAL -  
DEMOLITION PLAN - ALTERNATE  
NO.2**

SHEET  
**E306**

**DEMOLITION LEGEND**  
RV - EXISTING TO BE REMOVED  
RL - EXISTING TO BE RELOCATED TO NEW CEILING  
RM - EXISTING TO REMAIN  
RP - EXISTING TO BE REPLACED

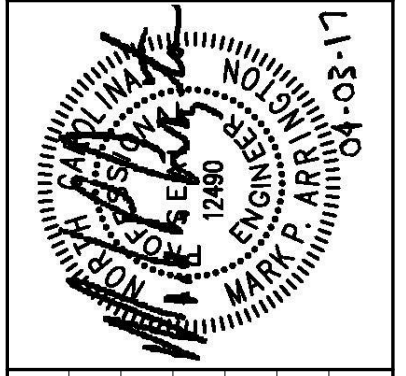
- DEMOLITION NOTES:**
1. UNC CHARLOTTE SHALL BE GIVEN THE OPPORTUNITY TO RETAIN ALL ELECTRICAL MATERIALS WHICH ARE BEING REMOVED. UNLESS OTHERWISE RETAINED BY UNC CHARLOTTE, THEY SHALL BECOME THE PROPERTY OF THE CONTRACTOR.
  2. ALL ABANDONED CONDUITORS SHALL BE REMOVED BACK TO POINT OF SUPPLY.
  3. WHERE ACCESSIBLE, ALL ABANDONED CONDUIT SHALL BE REMOVED. ALL CONDUIT REMAINING SHALL BE MECHANICALLY SECURED.
  4. WHERE DEVICES ARE REMOVED, CIRCUIT WIRING AND CONDUIT SHALL BE RE-WORKED AS REQUIRED TO PERMIT REMAINING DEVICES TO CONTINUE TO FUNCTION AS NECESSARY.
  5. ALL EXISTING ELECTRICAL DEVICES AND EQUIPMENT NOT SHOWN AS BEING ABANDONED SHALL BE RECONNECTED.
  6. MATERIALS INCLUDING LIGHT FIXTURES NOTED TO BE REUSED IN THE NEW WORK SHALL BE CLEANED, REPAIRED, STORED AND PROTECTED ON THE SITE.
  7. TEMPORARY CONNECTIONS SHALL BE PROVIDED TO ALLOW UNINTERRUPTED SERVICE DURING THE PERIOD OF CONSTRUCTION EXCEPT AS SCHEDULED. ALL INTERRUPTIONS SHALL BE SCHEDULED AND MUST HAVE PRIOR APPROVAL FROM THE OWNER.
  8. RELOCATE ANY EXISTING CONDUITS, CONDUCTORS, FIXTURES AND OUTLETS AS INDICATED BY THE DRAWINGS.
  9. BACKBOXES OF OUTLETS AND SWITCHES SHOWN TO BE REMOVED FROM WALLS AND FLOORS REMAINING SHALL BE REMOVED AND THE WALLS AND FLOORS PROPERLY PATCHED.
  10. WHERE NEW WALL FINISHES REQUIRE ADDITIONAL BOX DEPTH, PROVIDE OUTLET BOX EXTENSIONS OF THE NECESSARY DEPTH.
  11. ALL ELECTRICAL PANELS AFFECTED BY THIS WORK SHALL HAVE THEIR PANEL DIRECTORIES UPDATED. ELECTRICAL CONTRACTOR SHALL PROVIDE A TYPED UPDATED PANEL DIRECTORY WITH THE DATE FROM THESE DRAWINGS. FOR EVERY PANEL WHERE ELECTRICAL LOAD IS REMOVED OR ADDED BY THIS WORK.

**NOTES:**  
◇ EXISTING VAV BOXES TO BE REMOVED.



**1 LEVEL 8 ELECTRICAL - DEMOLITION PLAN**  
E306 1/4" = 1'-0"

**NOTE:**  
ALL WORK SHOWN ON THIS SHEET MUST BE PROVIDED UNDER ADD ALTERNATE NO. 2.

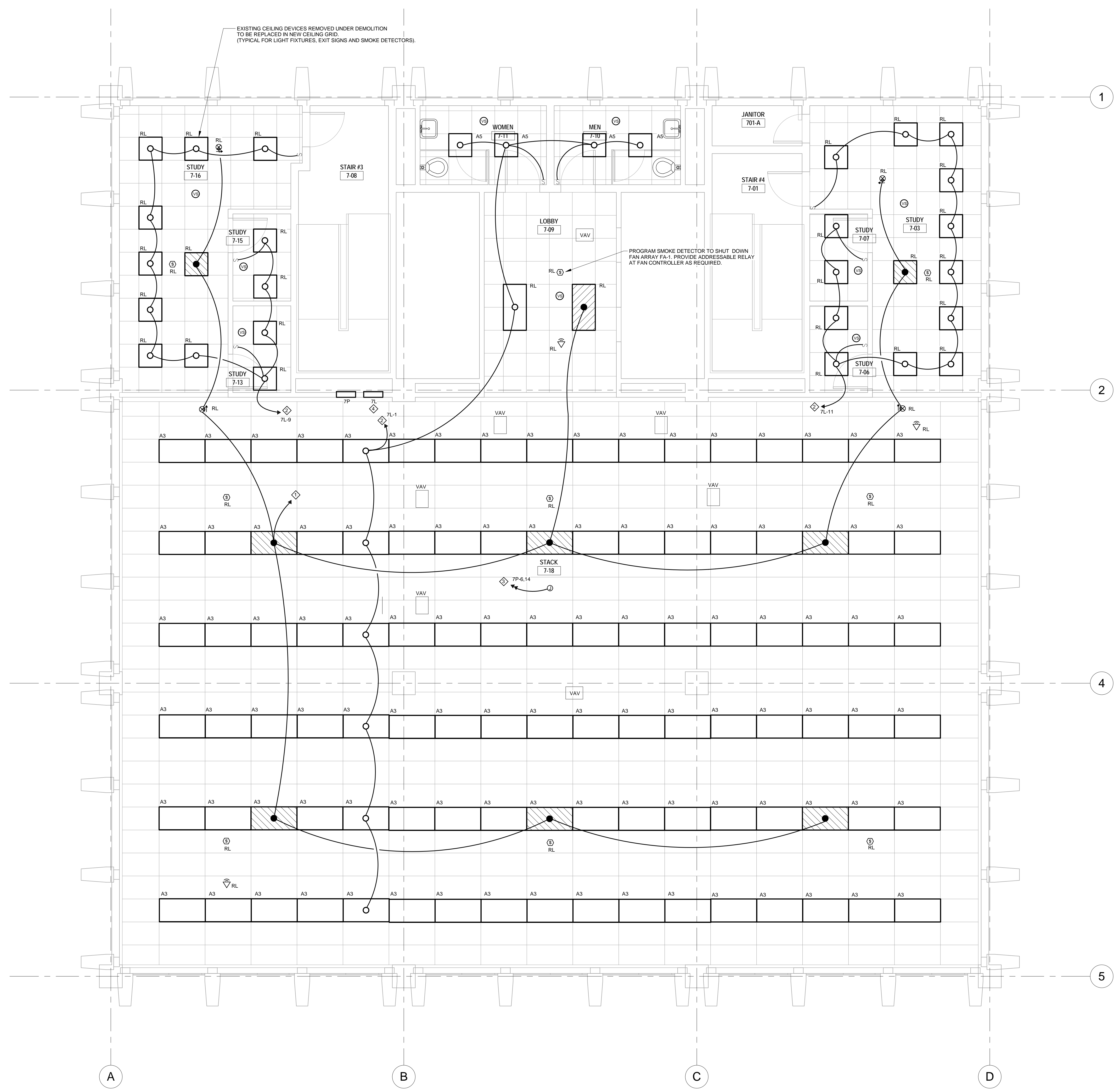


REVISION DATES	15-064	Author	04-04-2017
		Checker	04-03-2017
JOB NUMBER	15-064	Author	04-04-2017
DRAWN BY		Checker	04-03-2017
CHECKED BY		DATE	

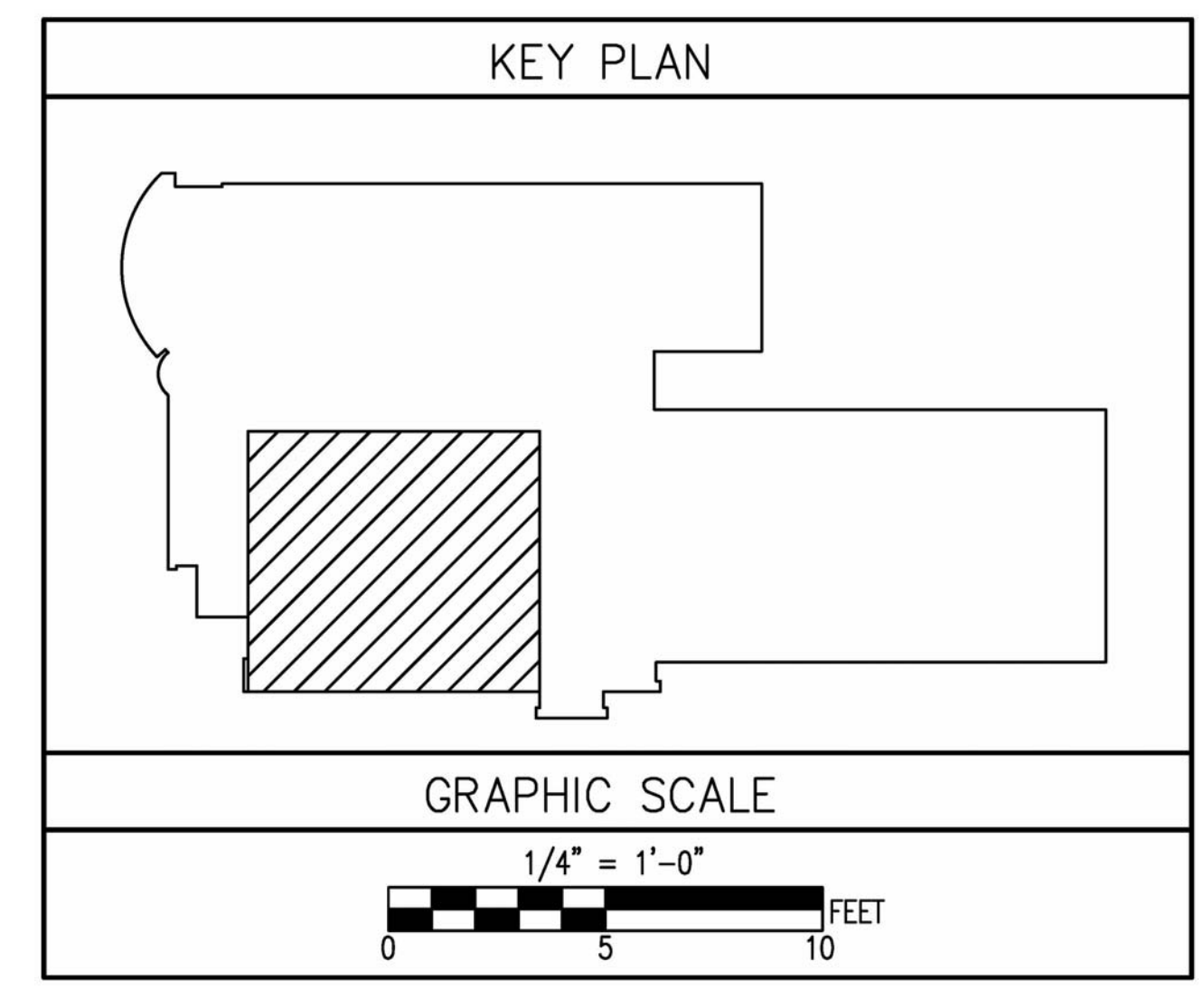
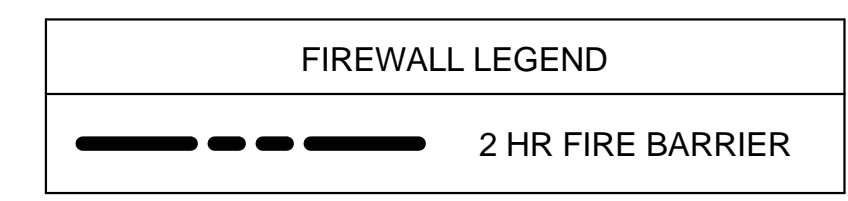
JOB TITLE  
**UNC CHARLOTTE CAMPUS  
INFRASTRUCTURE RENEWAL  
(ATKINS)**  
NORTH CAROLINA  
CHARLOTTE

SHEET TITLE  
**LEVEL 7 ELECTRICAL - NEW WORK  
PLAN - ALTERNATE NO.2**

SHEET  
**E305**



- NOTES:**
- ◇ CONNECT TO EXISTING LIGHTING EMERGENCY CIRCUIT SERVING THIS AREA WITH 2#12, 1#120, 1#2"C.
  - ◇ CONNECT TO LIGHTING CIRCUIT IN PANEL 7L AS INDICATED AND MADE SPARE BY THIS WORK. CONNECT WITH 2#12, 1#120, 1#2"C. FIELD VERIFY AVAILABILITY OF BRANCH CIRCUIT.
  - ◇ PROVIDE JUNCTION BOX ABOVE CEILING FOR POWER TO THE VAV BOX CONTROLS. MAXIMUM OF 5 VAV BOXES PER CIRCUIT. CONNECT TO SPARE 30" CIRCUIT BREAKERS AS INDICATED IN PANEL 7P WITH 4#12, 1#120, 1#2"C. FIELD VERIFY AVAILABILITY OF BRANCH CIRCUITS.
  - ◇ IN EXISTING PANEL 7L, PROVIDE NEW 200A MECHANICALLY HELD CONTACTOR IN PLACE OF EXISTING CONTACTOR FOR LIGHTING CONTROL AS INDICATED BY CONTROL DIAGRAM.

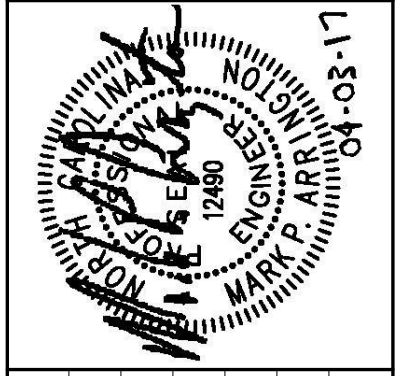


**1 LEVEL 7 ELECTRICAL - NEW WORK PLAN**  
E305 1/4" = 1'-0"

**NOTES:**

ALL WORK SHOWN ON THIS SHEET MUST BE PROVIDED UNDER ADD ALTERNATE NO. 2 EXCEPT:

1. NEW MECHANICALLY HELD LIGHTING CONTACTOR IN PANEL 7L AND ASSOCIATED CONTROLS SHALL BE PRICED UNDER BASE BID.
2. REPROGRAMMING OF LOBBY SMOKE DETECTOR TO SHUT DOWN AHU SHALL BE PRICED UNDER BASE BID.



REVISION DATES	15-204
ADDITIONAL NO. 1: 05-04-2017	Author
	Checker
	DATE
	04-03-2017

JOB NUMBER: 15-204  
 DRAWN BY: [Blank]  
 CHECKED BY: [Blank]  
 DATE: 04-03-2017

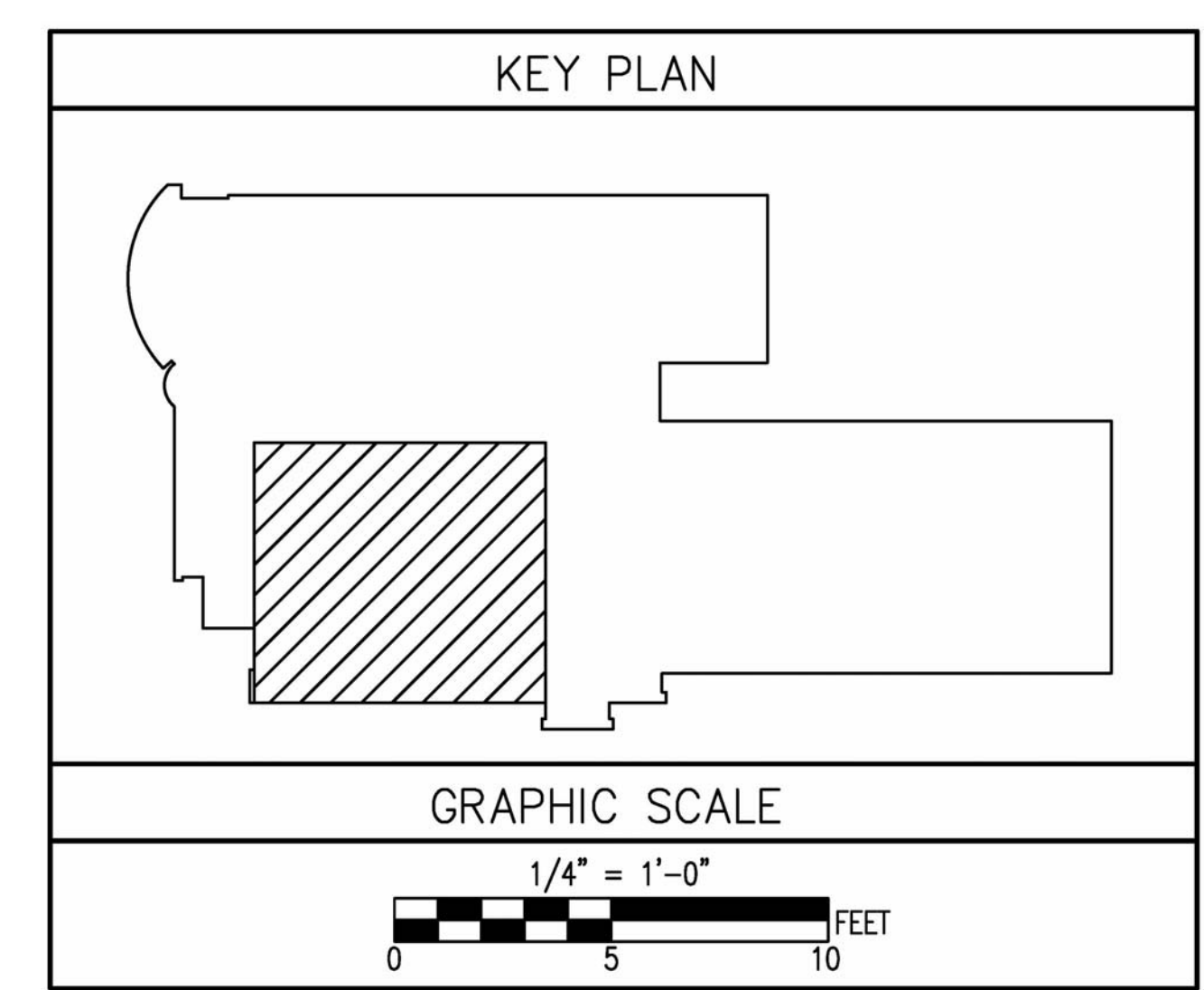
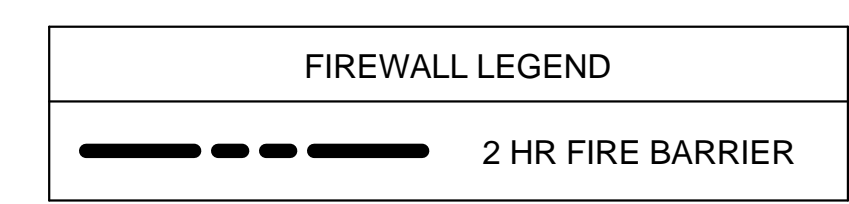
JOB TITLE: UNC CHARLOTTE CAMPUS INFRASTRUCTURE RENEWAL (ATKINS) NORTH CAROLINA  
 CHARLOTTE

SHEET TITLE: LEVEL 7 ELECTRICAL - DEMOLITION PLAN - ALTERNATE NO.2

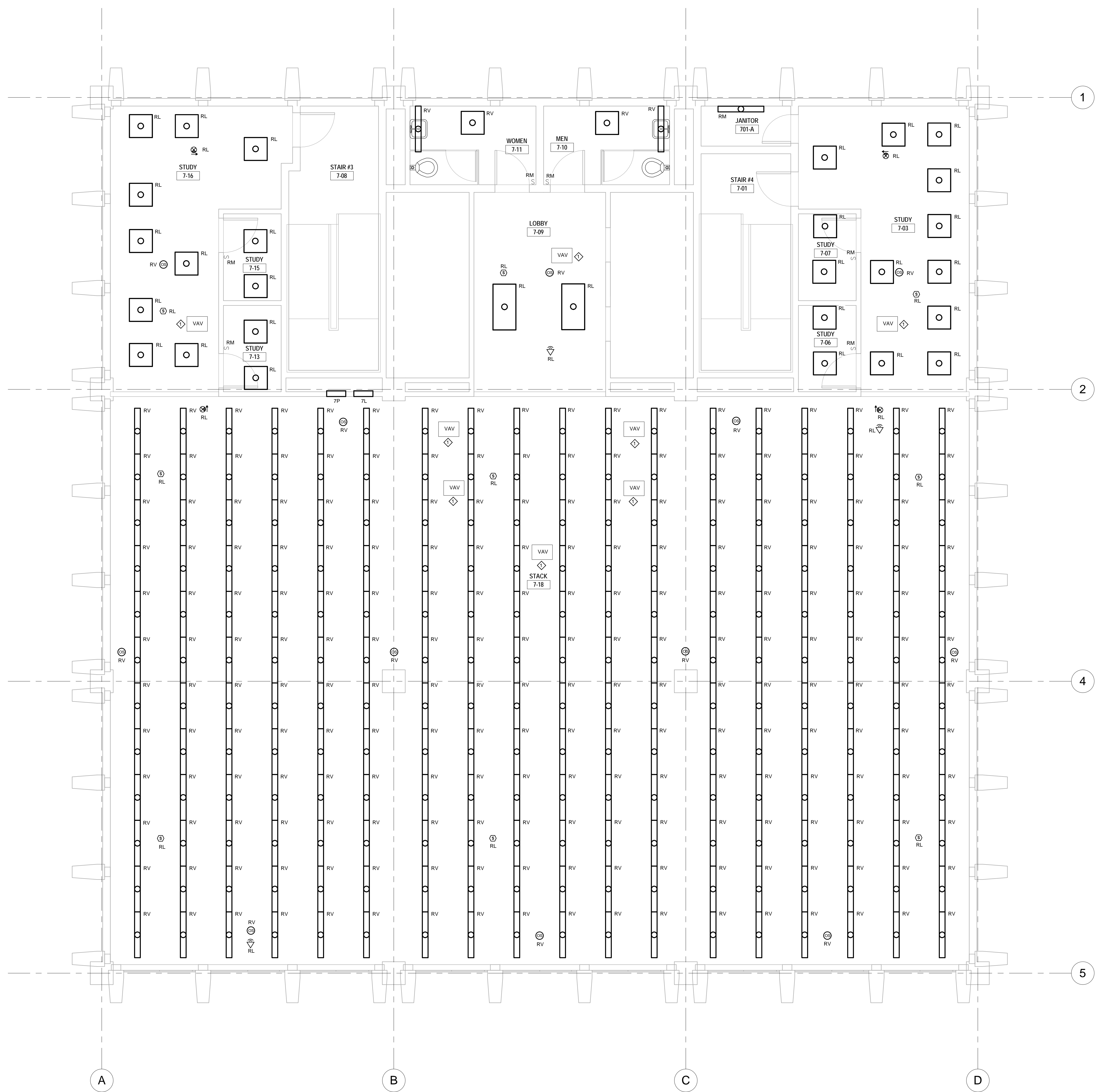
- DEMOLITION LEGEND**
- RV - EXISTING TO BE REMOVED
  - RL - EXISTING TO BE RELOCATED TO NEW CEILING
  - RM - EXISTING TO REMAIN
  - RP - EXISTING TO BE REPLACED

- DEMOLITION NOTES:**
1. UNC CHARLOTTE SHALL BE GIVEN THE OPPORTUNITY TO RETAIN ALL ELECTRICAL MATERIALS WHICH ARE BEING REMOVED UNLESS OTHERWISE RETAINED BY UNC CHARLOTTE, THEY SHALL BECOME THE PROPERTY OF THE CONTRACTOR.
  2. ALL ABANDONED CONDUCTORS SHALL BE REMOVED BACK TO POINT OF SUPPLY.
  3. WHERE ACCESSIBLE, ALL ABANDONED CONDUIT SHALL BE REMOVED. ALL CONDUIT REMAINING SHALL BE MECHANICALLY SECURED.
  4. WHERE DEVICES ARE REMOVED, CIRCUIT WIRING AND CONDUIT SHALL BE RE-WORKED AS REQUIRED TO PERMIT REMAINING DEVICES TO CONTINUE TO FUNCTION AS NECESSARY.
  5. ALL EXISTING ELECTRICAL DEVICES AND EQUIPMENT NOT SHOWN AS BEING ABANDONED SHALL BE RECONNECTED.
  6. MATERIALS INCLUDING LIGHT FIXTURES NOTED TO BE REUSED IN THE NEW WORK SHALL BE CLEANED, REPAIRED, STORED AND PROTECTED ON THE SITE.
  7. TEMPORARY CONNECTIONS SHALL BE PROVIDED TO ALLOW UNINTERRUPTED SERVICE DURING THE PERIOD OF CONSTRUCTION EXCEPT AS SCHEDULED. ALL INTERRUPTIONS SHALL BE SCHEDULED AND MUST HAVE PRIOR APPROVAL FROM THE OWNER.
  8. RELOCATE ANY EXISTING CONDUITS, CONDUCTORS, FIXTURES AND OUTLETS AS INDICATED BY THE DRAWINGS.
  9. BACKBOXES OF OUTLETS AND SWITCHES SHOWN TO BE REMOVED FROM WALLS AND FLOORS REMAINING SHALL BE REMOVED AND THE WALLS AND FLOORS PROPERLY PATCHED.
  10. WHERE NEW WALL FINISHES REQUIRE ADDITIONAL BOX DEPTH, PROVIDE OUTLET BOX EXTENSIONS OF THE NECESSARY DEPTH.
  11. ALL ELECTRICAL PANELS AFFECTED BY THIS WORK SHALL HAVE THEIR PANEL DIRECTORIES UPDATED. ELECTRICAL CONTRACTOR SHALL PROVIDE A TYPED UPDATED PANEL DIRECTORY WITH THE DATE FROM THESE DRAWINGS. FOR EVERY PANEL WHERE ELECTRICAL LOAD IS REMOVED OR ADDED BY THIS WORK.

**NOTES:**  
 ◇ EXISTING VAV BOXES TO BE REMOVED.



**NOTE:**  
 ALL WORK SHOWN ON THIS SHEET MUST BE PROVIDED UNDER ADD ALTERNATE NO. 2.



**1 LEVEL 7 ELECTRICAL - DEMOLITION PLAN**  
 E304 1/4" = 1'-0"