KU#076/8853 - Murphy Hall Deferred Maintenance – Mechanical and Electrical Improvements

The University of Kansas is soliciting qualifications packages from engineering consultants for the above titled construction project.

Introduction

State of Kansas funding has been identified for a project to replace certain mechanical and electrical equipment located in Murphy Hall on the University of Kansas Lawrence campus.

The equipment to be replaced has for some time been included on a more comprehensive list of deteriorated campus infrastructure that has typically been referred to as the deferred maintenance backlog. The primary objective of the project is to directly replace obsolete, deteriorated, and dysfunctional equipment with new.

Project Budget

Package “A” - Mechanical (HVAC) Improvements	$3,094,171
Package “B” - Electrical Improvements	1,315,829
Project total, including project “soft” costs	**$4,410,000**

Program Scope

In order to maintain clearly separate accountability between two separate funding sources, a detailed program is being prepared that describes requirements for preparation of two separate, but coordinated, construction packages for work in the original 1957 music and dramatic arts wings of Murphy Hall. The program anticipates that a single A/E team will be retained to complete both construction packages.

Package “A” describes the work of replacing major pieces of air handling equipment. The scope of work will replace up to four 1955-vintage multizone, and ten (10) single zone, air supply units that serve nearly all of the 140,500-sq.ft. of occupied space in Murphy Hall. The original construction documents refer to the single zone units as “A.C. Blower Units”. The current total air volume of the building air handling units is approximately 122,000-cfm, with total cooling coil capacity of approximately 400-tons. There will be selected cleaning and/or replacement of distribution ducting throughout the building.

Package “B” describes the work of replacing major electrical devices. The scope of work will replace the original 1957 wing main electrical service switchboard and distribution panel, step-down transformers, feeder panels, and cabling associated with the electrical service throughout the building. There will be selected review of the lighting levels and completion of modifications to same, as necessary to achieve necessary improvements

In order to insure coordination between packages, the program anticipates that the packages will feature concurrent 12-month construction periods of May 2010 thru May 2011.

Architectural Program

Murphy Hall Deferred Maintenance – Mechanical and Electrical Improvements

KU Project No. 076-8853

Date: October, 2009

Prepared by:

The University of Kansas, Lawrence Campus
Office of Design & Construction Management

Program Committee

Warren Corman, University Architect

Jim Modig, Director –Design & Const. Mngm't (DCM)

Doug Riat, Director –Facilities Operations and Planning

Tom Waechter, Asst. Director - Planning – DCM

Gary Lawson, Engineering Project Manager – DCM

Contents

Introduction

State of Kansas funding has been identified for a project to replace certain mechanical and electrical equipment located in Murphy Hall on the University of Kansas Lawrence campus. The equipment to be replaced has for some time been included on a more comprehensive list of deteriorated campus infrastructure that has typically been referred to as the deferred maintenance backlog. The primary objective of the project is to directly replace obsolete, deteriorated, and dysfunctional equipment with new.

Because the funding sources for replacement of the mechanical components vs. the electrical components that are described in this program are separate and distinct, the total scope of work must be contained in two separate construction document packages. The individual package titles and budgets will be as follows:

Pkg. A - Mechanical (HVAC) Improvements	$3,094,171
Pkg. B – Electrical and Elevator Improvements	1,315,829
Project total, including project "soft" costs	**$4,410,000**

See detailed Project Budget elsewhere in this program.

Original Construction

Murphy Hall has been the home of the University performing arts departments since construction completion in 1957. The configuration for the building features an east side "music wing" and west side "dramatic arts wing". It is named for Franklin Murphy, chancellor 1951-60 and a generous patron of the arts. The yellow-buff brick and crab-orchard limestone building was designed by Brinkman and Hagan of Emporia and dedicated Nov. 10, 1957.

Building occupied spaces include practice studios, rehearsal and performance spaces; costume and stage shops; a recording studio; music therapy labs; and faculty and staff offices for the music, dance and theater departments. The administrative offices for the School of Music are also in Murphy Hall.

The total 1957 building area comprises approximately 140,500-gross sq.ft.

1999 Addition

The new wing, built at the south side of the courtyard between the west and east wings of the original Murphy Hall, is 52,000 square feet in size and includes large rehearsal halls, the Ron McCurdy Jazz Studio, a recording studio, 14 faculty studios, two chamber music rehearsal rooms, a large percussion room, a sheet music library, a band storage room, a classroom, a new music library with a computer music lab. The connection between the addition and the original Murphy Hall was built at the end of the east music wing, with a new stair tower and elevator added. KU dedicated the Murphy Hall addition on February 18, 2001. The total 1999 building addition area comprises approximately 50,000-gross sq.ft.

This program does not anticipate completing any work in the 1999 addition.

Description of Existing Mechanical System

The existing mechanical equipment was installed as part of original building construction in 1955/56 and is essentially unchanged since that time. A general description of the original building mechanical equipment is contained in the original construction specification section 60 – Heating-Air Conditioning-Ventilation. The description is transcribed on attached T*able 1 – Original Specification Document Basis of Design Text.*

Key criteria for the four multizone, and ten (10) single zone, air supply units that serve nearly all of the 140,500-sq.ft. of original wing space is given on *Table 2 - Murphy Hall AHU Schedule* . The original construction documents refer to the single zone units as "A.C. Blower Units". The current total air volume of the building air handling units is approximately 122,000-cfm, with total cooling coil capacity of approximately 400-tons.

Airside Equipment

The air handling units and wall-mounted unitary devices that are mentioned in (a) & (b) of the referenced specification section are essentially unchanged from the original installation.

This program anticipates that all AHU's will be replaced and all unitary devices will be inspected and possibly replaced.

Water Chiller Equipment

The original steam-driven compressor-based water chiller equipment referenced in (c) has been updated. The current VFD electric-motor drive water chiller and cooling tower were both replaced within the past 10-years. Capacities of water chiller equipment are expected to be adequate for the cooling loads associated with the new air handling equipment installed as part of this project.

This program does not anticipate any work associated with the existing chiller or cooling tower. However, as noted elsewhere, electrical service to the chiller compressor motor and the secondary recirculating pumping equipment will be modified.

Heating/Cooling Piping Utility

As indicated in (b) the original design employed a "two-pipe" water circulation system that was/is switched seasonally between chilled water for building cooling and hot water for building heating. In "heating mode" all building multizone units and AC blower units receive hot water from a central building steam-to-hot water convertor. In "cooling mode" all air units receive chilled water from the central building water chiller system. This design approach offers cost advantages and minimizes piping, coils, and controls. However, it also results in considerable loss in flexibility to simultaneously satisfy demands of building zones that have different heating and cooling loads. Such a system is also problematic in terms of quickly responding to large changes in zone loads such as occurs in the large occupancy recital halls and theater space.

This program anticipates that the air units, piping, and controls will be modified so as to allow simultaneous heating and cooling of zones with different loads.

Program Scope and Design Criteria for Package A – Mechanical Systems Improvements

Provide New Air Handling Units

During completion of the Schematic Design phase of this project, options for appropriate system types for replacement of the existing multizone and A.C. blower units will be investigated. This program anticipates that the approved design solution will feature one or more central station air handlers. The new units should be specified with dual wall construction with dual sloping IAQ condensate drain pans, chilled water coils, filter/mixing section, high efficiency variable speed fan motors, and outside air ventilation measuring stations. The outside air ventilation measuring stations allow the control system to maintain the minimum outside air rates independent of the varying supply air delivered by the unit. The new units would be fitted with new Direct Digital Controls (DDC) and interfaced with the University BAS system.

Replacement of these units will necessarily be accompanied by replacement of associated chilled water and steam/condensate piping, electrical feeders, and mechanical controls.

Key design issues that will be investigated and resolved during Schematic design include the following:

Specify code compliant outside air rates: Code requirements for outside air rates have dramatically changed in the 50-plus years since the original design for Murphy Hall. The replacement HVAC system should be designed per 2006 issue of the International Building code (IBC) and the International Mechanical code (IMC) for occupancy and outside air ventilation rates.

Consider the use of dedicated outside air pre-treat units (DOAS). Ventilation rates required by the ’06 IMC are significantly greater than rates assumed for the original Murphy Hall mechanical systems design. These greater ventilation rates will have the effect of creating larger cooling loads to be experienced at the air unit cooling coils. To assist the conditioning process, dedicated outside air pre-treat units (DOAS) should be considered. These units are typically provided with supply fans, exhaust/pressure relief fans and total energy recovery heat wheels that are able to transfer both latent (moisture) and sensible (heat) energy from the exhaust/pressure relief air stream to the outside air stream.

A primary benefit of employing DOAS units is reduction in cooling load that is experienced by the chilled water system and resulting reduced energy usage. Additional benefits typically realized as a result of incorporating outside air pre-treatment units include:

The air handling units in the building, that receive the pre-treated air, have lower moisture removal requirements, resulting in less water in the form of condensate being present within the units.

Cooling coils in new air handling units located in the building can be specified for less moisture removal, resulting in fewer rows of tubes and wider fin spacing at the coil face. Fewer rows and fins in the cooling coils results in lower first cost at the time of equipment purchase and lower operating cost due to less air side pressure drop during the life of the system.

Design a unit enclosure with good serviceability and maintainability

Design a unit with negligible potential for any type of water freezing within the unit.

Design a unit with good access to all replaceable parts, belts, and filters.

Specify a unit with adequate capacity to control the humidity ratio of supplied air during cooling season

Current building codes related to requirements for introducing outdoor air to occupied spaces frequently result in summertime moisture loads that are a challenge for air supply equipment cooling coils to accommodate without loss of humidity control in those same spaces. Psychrometric specifications for the replacement unit should require capability to achieve a supply air state point with a humidity ratio of 40-grains of moisture per pound of dry air, or lower.

Specify a unit with a chilled water coil temperature rise that is appropriate for the existing chiller system

The existing air units were specified to operate with a 45^{O}F entering and 52^{O}F leaving water temperature at design load. The designer should review existing chiller control capabilities and space load characteristics and specify new chilled water coil temperature rises that minimize overall system energy use and maximize space comfort conditions.

Specify a unit with capability of maintaining minimum space humidities during heating season

The contents of Murphy Hall include instruments whose intonation, function, and longevity can be adversely impacted by extended exposure to low humidity ambient conditions. For example, the building contains as many as fifty (50) Steinway pianos with a total monetary value of approximately $4-million. The design for mechanical systems improvements must include reliable, controllable, and serviceable humidification equipment that will prevent wintertime drying out of studio and performance spaces.

The University has a history of unsatisfactory operation of humidification equipment. Problems and concerns include:

- Concerns with potential for chemical carryover from direct plant steam injection.
- Problems with mineralization within steam-to-steam humidifiers
- Problems with plugging or fouling of air atomization humidifiers

The Schematic Design submittal should include a discussion of options for humidification and the recommendation of equipment type for which there is the best expectation for reliable long-term operation.

Specify a unit with enhanced energy conservation features

The designer should evaluate the following energy conservation features as to their applicability on this project:

- Air-side economizer cooling (dry bulb and/or enthalpy).
- Heat-recovery of exhausted air for fresh air intake pre-conditioning.
- Supply air temperature reset.

Provide New Unitary Devices

Certain classrooms and offices are not supplied by central station ducted conditioning air; but rather are furnished with unitary devices for heating, cooling, and ventilation. Examples include units referred to in the original construction documents as room air conditioning units, wall cabinet heaters, ceiling cabinet unit heaters, and steam and water convectors. The project schematic design will include a recommendation for cleaning, repairing, or replacing all of these units that are determined to be non-functional. This program anticipates that most of these units will require replacement.

Modify Building Air Distribution

Much of the distribution ductwork associated with the air supply units was lined during original building construction. A component of the scope of work for this project will be to evaluate the condition of all distribution ducting (and particularly the lined ducting).

The existing air distribution systems feature zoned, constant volume air supply and return ducting. Although the original construction documents are somewhat vague regarding the extent of its use, duct liner was used throughout the building. The original specification documents describe the system as 1-inch fireproof acoustical insulation applied with bolts or screws and washers on 24-inch centers both ways and covered with galvanized fly screen. This program anticipates that the interior of all existing ducting will be inspected for dirt and debris, including spalled liner material. Excessive dirt, dust, and liner deterioration may dictate replacement. The project Schematic Design submittal documents will include a recommendation for cleaning, replacing or leaving "as is" all existing distribution ducting. The recommendation is to be accompanied by a cost estimate for the recommended course of action.

Modify the Water Recirculation Systems

As noted in the Description of Existing Conditions paragraphs above, the existing air handling units and room AC units are supplied by two-pipe heating/cooling piping systems. This program anticipates that the replacement units will be specified with separate heating and cooling coils. The design must make provisions for providing separate cooling and heating piping utility. Options for a design solution for this issue must be presented as part of the Schematic Design submittal.

Modify the Mechanical System Controls

Original construction featured the use of pneumatic controls for all automatic modulating valve and damper operators. This program anticipates replacing all remaining pneumatic devices with electric operators. Construction documents should indicate that the resulting surplus air compressors are to be salvaged by the contractor and turned over to KU-Facilities Operations.

Document the University's expectations for utility outages & work-arounds during construction periods

Identify feasible solutions to the following critical logistical issues:

Nearly all air units to be replaced in this project are located in mechanical equipment rooms with limited access. The designer is to determine a mode of removal, and a building exit pathway for removal, of the existing air handling equipment. The removal solution must be code compliant, acceptable to the authority having jurisdiction (AHJ), and compatible with the ongoing functions of the building. Typically these equipment rooms feature at least one exterior building wall exposure. It is anticipated that the design for replacement of these units will necessarily include detailing the work of opening these exterior walls for removal of old and replacement with new air units.

Evaluate the duration and consequences of, and areas affected by, the loss of ventilation/conditioning air supply during completion of the project; and design compensating measures necessary to minimize the impact to ongoing functions of the building.

Identify an acceptable contractor staging area.

Document the University's expectations for protection and restoration of building finishes

Although much of the work described in this scope package will be in mechanical and electrical equipment rooms, some disturbance of building finishes is anticipated. The designer should provide specification information and drawing details that will result in maintenance of existing building finishes and restoration of disturbed finishes to original condition and quality. Exposed piping and conduits will be discouraged in all cases.

Schematic Design Options and Deliverables

Evaluate the existing multizone units and A.C. blower units and make a recommendation as to replacement system types.

Examples of system types that should be evaluated include Dedicated Outdoor Air Units coupled with either fan coil units or fan-powered variable air volume control boxes.

Evaluate options for piping separate cooling and heating utility to the new air units.

Since steam piping is extended to each mechanical room that contains air units, an option that should be considered is the direct use of steam for heating through the use of steam available from existing piping.

Another option that should be considered is the installation of steam-to-hot water heat exchangers at each mechanical room.

Evaluate options for inclusion of humidification capability in the replacement AHU's and A.C. Blower Units.

Evaluate condition of existing duct liner and make a recommendation regarding replacement.

Murphy Hall is the University's performing arts building. As a result, it will be critical that the design for replacement of air handling equipment, including both supply units and distribution ductwork, include provisions for limiting noise contribution to the occupied spaces served.

Complete an inventory and evaluate the condition of all unitary devices in the building, including:

- Room Air Conditioning Units
- Wall Cabinet Unit Heaters
- Ceiling Cabinet Unit Heaters
- Steam Convectors
- Water Convectors

The schematic submittal will include a listing of all units and all associated piping that require replacement.

Prepare a Basis of Design document conforming to the general guidelines of ASHRAE Guideline 1 - Guideline for Commissioning of HVAC Systems.

The Basis of Design document should be included in preliminary review submittals as an aid to those reviewing the design for conformity with the program and with University standards and preferences.

The Basis of Design document should also be included in the project bid and construction documents as an aid to the contracting team in interpreting the various equipment specifications and expectations for their performance.

Design Criteria for Package A - Mechanical Systems Improvements

Designers shall verify that all applicable portions of the published KU Design & Construction Standards are incorporated into the project's design, drawings, specifications, and final construction. Variances from these standards are to be submitted for written approval, using the KU Standards Variance Request Form in Appendix A1.1. Reference Division 15 – Mechanical and other pertinent section of the standards on … http://www.dcm.ku.edu/standards/design/. Certain specific criteria for system design are given on Table 3 – Mechanical Systems Design Criteria.

University Energy Policy

The University has adopted an Energy Policy that includes requirements for project to be designed and constructed so as to minimize energy use. The full policy is found at… https://documents.ku.edu/policies/provost/EnergyPolicy.htm#measures. The project designer should become acquainted with this policy in its entirety. The following is from a paragraph titled *B. New Construction.* The design requirements included in this paragraph are considered to be requirements of this project.

New construction should be designed and built to minimize energy use. The most recent version of ASHRAE Standard 90.1 - Energy Efficient Design of New Buildings Except Low Rise Residential Buildings should be set as the minimum energy efficiency guideline, since it has been shown that further reductions in energy use are economically achievable. The current KU standard for new construction is 30% improvement on ASHRAE 90.1. The design process should include energy life cycle costing analyses. New construction should be added to the existing building automated control system for enhanced energy management capabilities. Alternative energy sources such as passive solar heating and heat recovery should be considered, as well as daylighting and other strategies for decreasing building energy consumption. Primary consideration should be given to connecting and/or extending central systems for heating, cooling and other mechanical systems. Year-round cooling needs should be met by utilizing the most energy efficient systems, for example plate-and-frame heat exchangers versus less efficient air-cooled systems. All new construction should include utility metering (electricity, natural gas, steam, and water).

Description of Existing Electrical System

The key components of the building electrical system are illustrated on the original construction drawing sheet E-3. This diagram has been included in this program as *Figure 5 - Electrical Distribution Riser Diagram.*

Modifications to the Building Original Electrical System

At the time of original construction the campus electrical distribution voltage was 4,160-V. Subsequent electrical system improvements upgraded campus distribution to 12,470-V. As a result the original indoor-mounted transformer (TS-M) was decommissioned and replaced with an outdoor oil-filled, pad-mount 750kVA, 12.47-kV/480-V transformer.

This program does not anticipate modifying this transformer.

At the time of conversion of the building cooling plant from steam-driven to electric motor-driven chiller compressors, the capacity of the then-existing electrical service was not adequate to support the added electrical load. As a result an additional outdoor oil-filled, pad-mount 500kVA, 12.47-kV/480-V transformer with associated metered, fused disconnect was added to the system. This transformer is dedicated to serving the chiller compressor motor only.

This program does not anticipate modifying the existing pad-mount transformer. The metered, fused disconnect may require relocation or replacement depending on the designed configuration within the existing electrical equipment room 350.

Records are incomplete; but, at sometime in the life of the building, the Crafton-Preyer Theatre stage lighting dimmer panel was re-fed. Originally fed from a dry-type transformer TS-3 by way of panel 2DA in ME Room 207, this load is now fed from an outdoor oil-filled, pad-mount 300-kVA, 12.47-kV/120/208-V transformer located in the inner courtyard between building wings.

This program does not anticipate modifying this transformer. However, the transformer feeder may be modified depending on the designed configuration of the new building electrical feeder system.

The 1999 building addition construction project featured three work items that modified the then existing electrical system.

A 600-Amp fused disconnect was tapped to feed a new 480/277-V subpanel to support most of the addition electrical loads.

A 60-Amp disconnect, fused at 40-Amp, was tapped to feed certain 277-V building addition lighting loads.

This program anticipates that the design for this project will include re-feeding both of these 1999 addition services.

A recent project has replaced the original emergency power generator and automatic transfer switch that provides backup electrical service to the building exit lights, emergency lighting fixtures, and fire alarm system.

This program does not anticipate modifying the existing generator system. However, all existing emergency power branch circuit panels will be replaced.

Program Scope and Design Criteria for Package B – Electrical Systems Improvements

Provide New Major Electrical Devices

All of the major electrical devices in the original 1957 wings of Murphy Hall are to be replaced as work of this project. Key information regarding the major devices to be replaced is contained on Table 4 – Murphy Hall Electrical Equipment Schedule. The riser diagram includes certain service panels that are not included on the summary Table 4; but, which are to be evaluated for replacement.

Provide Coordination between bid document packages

As noted in the introductory paragraphs of this program, multiple funding source types necessitate the development of two separate bid set packages. The mechanical and electrical designers should jointly evaluate options for the appropriate line of demarcation for providing the electrical service to new mechanical equipment.

Provide a Short Circuit Coordination Study for the replacement system design

The electrical system designer's scope of work will include completion of a coordination study is to determine satisfactory ratings and settings for the electric system protection devices in the completed design, both new and old. The protection devices should be chosen so that pickup currents and operating times are short but sufficient to override system transient overloads such as inrush current experienced when energizing transformers or starting motors. Further, the devices should be coordinated so that the circuit interrupter closest to the fault opens before other devices. The completed short circuit coordination study should be submitted for review during the design review process and is expected to become a part of the final bid document set for use by the installing contractor and for inclusion in the project Electrical Operation and Maintenance Manuals.

Determining the ratings and settings for protective devices requires familiarity with NEC requirements for the protection of cables, motors, and transformers, and with ANSI/IEEE C57.12.00-1980 for transformer magnetizing inrush current and transformer thermal and magnetic stress damage limits.

Document the University's expectations for utility outages & work-arounds during construction periods

Identify feasible solutions to the following critical logistical issues:

The designer is to determine a mode of removal, and a building exit pathway for removal, of the existing electrical equipment. The removal solution, and subsequent installation of replace equipment, must be code compliant, acceptable to the authority having jurisdiction (AHJ), and compatible with the ongoing functions of the building.

The design should evaluate the duration and consequences of, and areas affected by, the loss of electrical service during completion of the project; and design compensating measures necessary to minimize the impact to ongoing functions of the building.

Identify an acceptable contractor staging area.

Document the University's expectations for protection and restoration of building finishes

Although much of the work described in this scope package will be in mechanical and electrical equipment rooms, some disturbance of building finishes is anticipated. The designer should provide specification information and drawing details

that will result in maintenance of existing building finishes and restoration of disturbed finishes to original condition and quality. Exposed piping and conduits will be discouraged in all cases.

Confirm Code Compliance of the Existing Fire Alarm System

The 1999 south sing construction project featured an upgrade of the building fire alarm system, combined original wings and new addition. The present building fire alarm system is believed to be fully functional and code compliant. The designer should review the existing system to confirm compliance as part of preparation of the Code Footprint for this project. This program does not anticipate a requirement for work on the system.

Confirm Adequate Lighting Levels at Selected Locations

The building occupants have expressed dissatisfaction with lighting levels in selected areas of the building, generally corridor spaces and lobby areas adjacent to performance spaces. The designer should evaluate areas in question and make recommendations are to possible improvements, if any. This program includes a budget line item for selected lighting improvements. The program anticipates that the University will make decisions as to the priority of this work based on the designer's recommendations.

Design Criteria for Package B - Electrical Systems Improvements

Designers shall verify that all applicable portions of the published KU Design & Construction Standards are incorporated into the project's design, drawings, specifications, and final construction. Variances from these standards are to be submitted for written approval, using the KU Standards Variance Request Form in Appendix A1.1. Reference Division 26 – Electrical and other pertinent section of the standards on … http://www.dcm.ku.edu/standards/design/.

Design Standards & Consultant Services

The consultant team shall comply with the latest provisions of The University of Kansas Design and Construction Standards, as maintained by the Office of Design and Construction Management (DCM).

These standards are available at the DCM website: (http://www.dcm.ku.edu/standards/design/).

The consultant team shall also comply with supplemental updates to these standards which may be issued during the course of the project.

The University's Project Representative shall be a DCM staff person assigned to serve as KU's Project Manager, and who shall be the primary point of contact for all communications between the Owner, A-E and Contractor.

Special Consultants that will be required on the A-E team, in addition to the usual architectural and engineering disciplines:

Acoustical Engineer (to evaluate and advise on sound isolation provisions from M/E rooms and equipment, and the acoustical requirements of meeting spaces)

Telecommunications System Engineer (must be pre-approved by KU)

Electronic Files: Consultants shall deliver to KU complete sets of electronic drawing and spec files for each project's submittal stage, bid sets and as-built sets, and shall include both PDF and AutoCAD .dwg files.

Historic Preservation Reviews

This existing building is not located within 500 feet of any properties currently listed on either the State or National Registers of Historic Places.

Hazardous Materials

The KU Environmental Health & Safety Office has performed tests of some, but not all, of the existing materials in the affected equipment and piping insulation systems. These tests have found some asbestos-containing materials, which typically consists of piping and pipe fitting insulation materials.

A complete set of hazmat tests will be needed prior to construction to verify exact locations of remaining materials that will need to be abated.

Abatement costs are estimated to be approximately $40,000.

KU policy is to remove all hazardous materials when undertaking major renovations of existing buildings.

The University will separately contract for this work, using departmental funding that is separate from the proposed project funding.

Annual Maintenance & Operating Costs

Murphy Hall is a State-owned, Academic building. As a consequence, costs of maintenance and operations, including energy use, are a component of the budget of the department of Facilities Operations. Net changes to the cost of maintaining and operating Murphy Hall as a result of the work of this project will become either an increase or decrease to the department of Facilities Operations budget. The designer should include a calculation of the net changes, including energy use, as a component of the schematic design submittal.

Code Requirements

Codes currently used on KU projects include the following:

International Building Codes, 2006 editions.

Kansas Fire Prevention Code, KSFMO, current edition.

Other codes as listed at the State of Kansas, Division of Facilities Management (DFM) website.

Code Footprints of the existing buildings shall be prepared by DCM and shall be furnished to the design team on DCM's standard 11x17 code footprint sheets.

The design team shall update these drawings to reflect all proposed work and submit them for approval to DFM through the KU-DCM office, immediately following approval of the Design Development phase.

Electronic files of the approved code drawings shall be forwarded to DCM in both .PDF and .DWG formats.

Construction Exiting: Where applicable, temporary fire-rated exit corridors shall be provided through the construction site, to direct occupants from all required exits in the existing buildings to a public way. They shall remain in-place at all times while construction work is underway.

Fire alarm systems shall comply with current code and KU requirements for an intelligent addressable system.

Project Budget

Package A – Mechanical Systems Improvements	
Arch/Structural – exterior & interior finishes	$800,000
Central Station Air Handlers	750,000
Unitary Devices	50,000
Distribution Ducting Modifications	350,000
Piping & Insulation Modifications	254,000
Controls Equipment	225,000
Design Phase Duct Inspections	25,000
Design Phase Acoustical Baseline Testing	20,000
Misc./Soft Costs - 25% of est. constr. Costs (1)	620,171
Total Estimated Project Costs	$3,094,171
Package B – Electrical Systems Improvements	
Arch/Structural – interior finishes	$200,000
Replace Main Switchboard	250,000
Replace Step-down Transformers	50,000
Distribution Panelboards	230,000
Replace Circuit Feeders	225,000
Miscellaneous Lighting Fixture Replacements	85,000
Misc./Soft Costs - 25% of est. constr. Costs (1)	275,829
Total Estimated Project Costs	$1,315,829
TOTAL PROJECT COSTS	$4,410,000

1) Miscellaneous / soft costs will need to cover A-E fees, state agency fees for DFM and DCM, FO support costs, survey and soil borings, printing of bid documents, furnishings and loose equipment, commissioning and contingency funds.

Project Schedule [1]

Funding Confirmation	September 2009
Program Submission to Board of Regents	October 2009
Interview & Select Consultants	November 2009
Negotiate Fees & Process Contracts	November 2009
Program Review & Preliminary Design (1 mo.)	December 2009
Design Development (1 mo.)	January 2009
Construction Documents (2 mos.)	Feb. 2010 - March 2010
Bidding (4 weeks)	April 2010
Contract Award & Notice to Proceed (1 mo.)	May 2010
Construction (12 mos.)	May 2010 – May 2011
Project Completed	June 2011

1) Project schedules for packages A & B will necessarily be concurrent. A coordinated construction schedule will be included in the separate bid packages for the two projects.

Appendix A – Tables

Table 1 – Original Specification Document Basis of Design Text

(a) Year round air conditioning, in general, will be accomplished by means of units installed as shown on the plans, deriving their fresh air from intakes as provided.

(b) Air handling wall and central units will be supplied with chilled water during cooling season and hot water during the heating season.

(c) Chilled water will be derived from steam driven centrifugal compressor units, equipped with shell and tube condensers and shell and tube water chillers, factory tested as complete units. Refrigerant shall be Freon 11.

(d) Hot water will be derived from a central station supply of steam through heat exchangers. The temperature of the hot water will be automatically adjusted to the temperature required by outside conditions.

(e) Pumps shall distribute chilled water for cooling to the air conditioning units by means of a system of water piping as shown on the drawings. A system of low pressure steam to the air conditioning units and/or other heating equipment for use a s a heating medium. A system of condensate drains shall remove condensate moisture from the cooling coils.

(f) A system of supply and return ducts will carry conditioned air from the units on the areas served by the air handling units as shown on the plans.

(g) A complete system of summer-winter temperature controls shall be installed as specified hereinafter.

Table 2 - Murphy Hall AHU Schedule

AHU Number	Originally Scheduled CFM	Cooling Coil Capacity	Number of Zones	Area Currently Served
Multizone #1	14,880	502,000	4	East Music Wing, Choral Areas
Multizone #2	10,100	602,000	5	East Music Wing, 2nd & 3rd fl. Studios and practice rooms
Multizone #3	14,400	630,000	4	North & East Music Wings, 4th floor studios, classrooms & practice rooms
Multizone #4	11,010	500,000	5	North & East Music Wings, 5th floor practice rooms
AC Blower #1	5,910	300,000	1	Northeast corner Music Wing, 4th & 5th floors (former Library)
AC Blower #2	3,560	100,000	1	Green Room
AC Blower #3	5,500	164,000	1	Theater Lab
AC Blower #4	4,300	96,000	1	Theater storage area
AC Blower #5	3,560	105,000	1	Theater Wing - east corridor
AC Blower #6	540	20,000	1	Swarthout Recital Hall East Lobby
AC Blower #7	2,500	72,000	1	Swarthout Recital Hall West Lobby and Theater offices
AC Blower #8	18,000	725,000	1	Theater – balcony
AC Blower #9	18,000	725,000	1	Theater - main floor
AC Blower #10	9,375	335,000	1	Swarthout Recital Hall
Building Totals	121,635	4,876,000	**- btu/hr**	
		406	**- tons**	

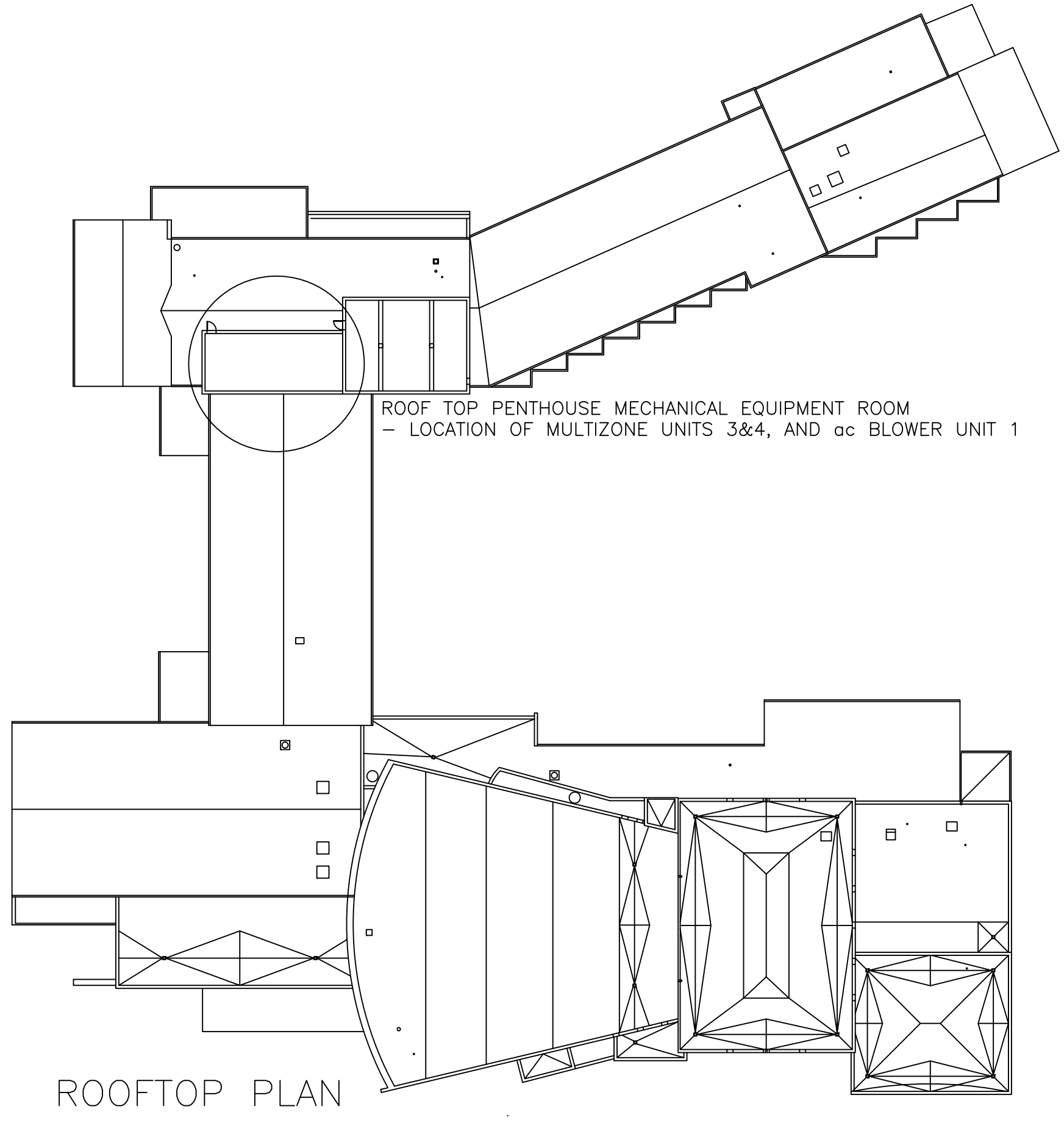
Table 3 – Mechanical Systems Design Criteria

Outdoor Design Conditions:			Filtration:	
Winter Dry Bulb Temperature	-10^{O}F		Pre-filter	35% (ASHRAE 52 – Atmospheric Dust Spot)
Summer Design Dry Bulb Temperature	101^{O}F		Final Filter	80% (ASHRAE 52 – Atmospheric Dust Spot)
Summer Coincident Wet Bulb	72^{O}F		Noise Criteria Conditions:	
Summer Design Wet Bulb Temperature	79^{O}F		Music teaching studios	NC<25
Indoor Design Conditions:			Music practice Rooms	NC<25
Winter Dry Bulb Temperature (All Areas)	68^{O}F		Theatre, concert and recital hall	SEE NOTE
Summer Dry Bulb Temperature (All Areas)	74^{O}F		NOTE: The designer should retain a Acoustical Engineer to evaluate and advise on sound isolation provisions from the M/E rooms and equipment and the acoustical requirements of all performance spaces. This evaluation should include acquisition of baseline data that documents the current contribution of M/E equipment to background noise within the performance spaces.	
Relative Humidity				
Summer (All Areas)	50%, max.			
Winter (All Areas)	30%, min.			
Ventilation & Pressurization:				
Min. ventilation rates				
NOTE: employ IMC Equation 4-1 for determination of individual space ventilation rates				
Min. pressurization rates				
Performance and practice spaces	+0.05-in.W.G. - relative to ambient			
Laboratory and support spaces	+/- relative to adjacent spaces			

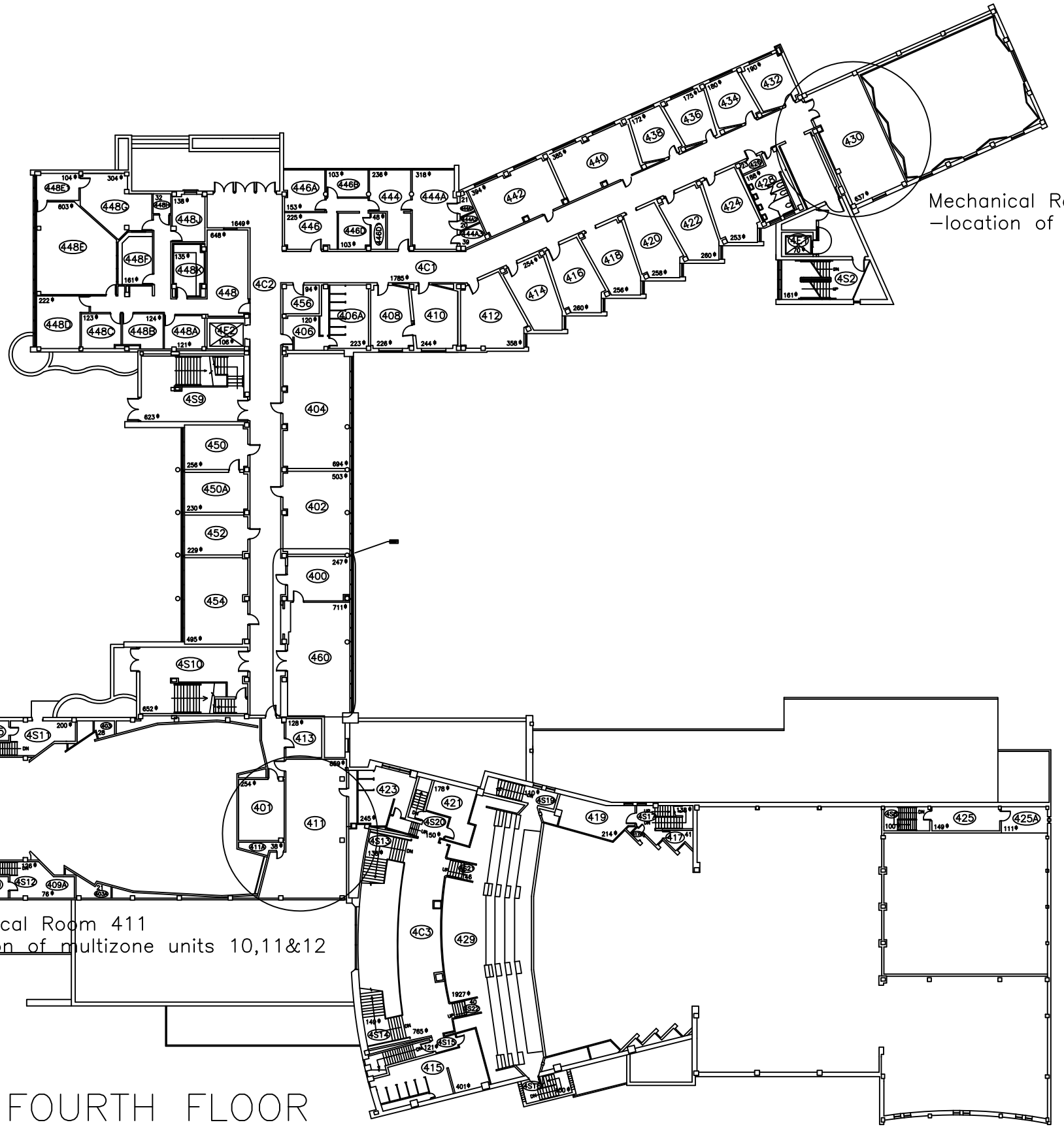
Table 4 – Murphy Hall Existing Electrical Equipment Schedule

Device Label	Description	Supplies	Location	Replace within this project
TS-M	750kVA transformer	Formerly the primary building xformer, this device has been replaced.	-	No
TS-1	150kVA transformer	Panel 3DA	Electrical Rm 350	Yes
TS-2	150kVA transformer	Panel 3DB	Rm 354D, under stairway S10.	Yes – new location
TS-3	150kVA transformer	Panel 2DA	ME Rm 207	Yes
TS-4	15-kVA tranformer	Formerly the emergency power xformer, this device has been replaced.	-	No
3PM	800-amp Switchboard	Disconnect switches for panelboards 2PA, 3PA, 4PA, 4PB,&6PA; transformers TS-1, TS-2, TS-3 & TS-4.	Electrical Rm 350	Yes
2DA	400-Amp, 120/208-V distribution panel for lighting circuits.	Branch circuit panels for loads in dramatic arts wing – “back of house”	ME Rm 207	Yes –replace this distribution panel, including secondary feeders and all branch panels supported.
3DA	400-Amp, 120/208-V distribution panel for lighting circuits.	Branch circuit panels for loads in 2nd, 3rd, 4t, & 5th floors – music wing	ME Rm 352.	Yes – new location
3DB	400-Amp, 120/208-V distribution panel for lighting circuits.	Branch circuit panels for loads in 3rd, 4t, & 5th floors – theatre wing, including recital hall and theater	Rm 354D, under stairway S10.	Yes – new location
2PA	400-Amp, 480-V Power distribution panel for motor loads.	Transformer TS-3 and AC blower unit motor loads in Equipment Room 207.	ME Room 207	Yes
3PA	400-Amp, 480-V Power distribution panel for motor loads in Equipment Room 352.	Heating/cooling water circulation pumps in ME Room 352	ME Room 352	Yes – new location
4PA	Power distribution panel for motor loads in Equipment Room 430.	Multizone air units and roof exhauster motors	ME Room 430	Yes
4PB	Power distribution panel for motor loads in Equipment Rooms on 3rd & 4th floors of theatre wing.	AC blower unit and roof exhauster motors	ME Room 411	Yes
6P	Power distribution panel for motor loads	Multizone air units, exhaust fans, and cooling tower fans in the east side Penthouse Equipment Room.	ME Penthouse	Yes

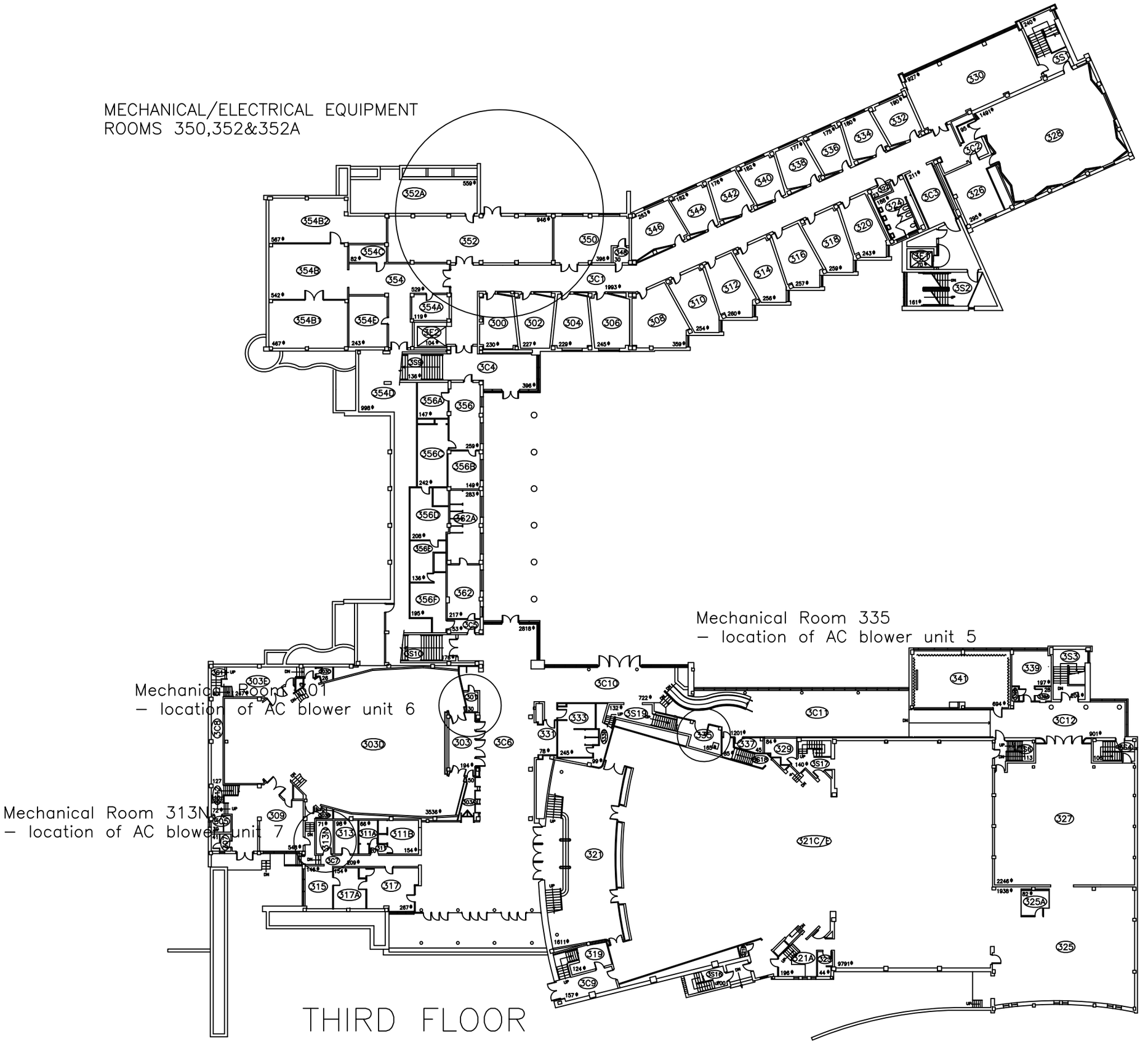
Appendix B – Diagrams and Floor Plans

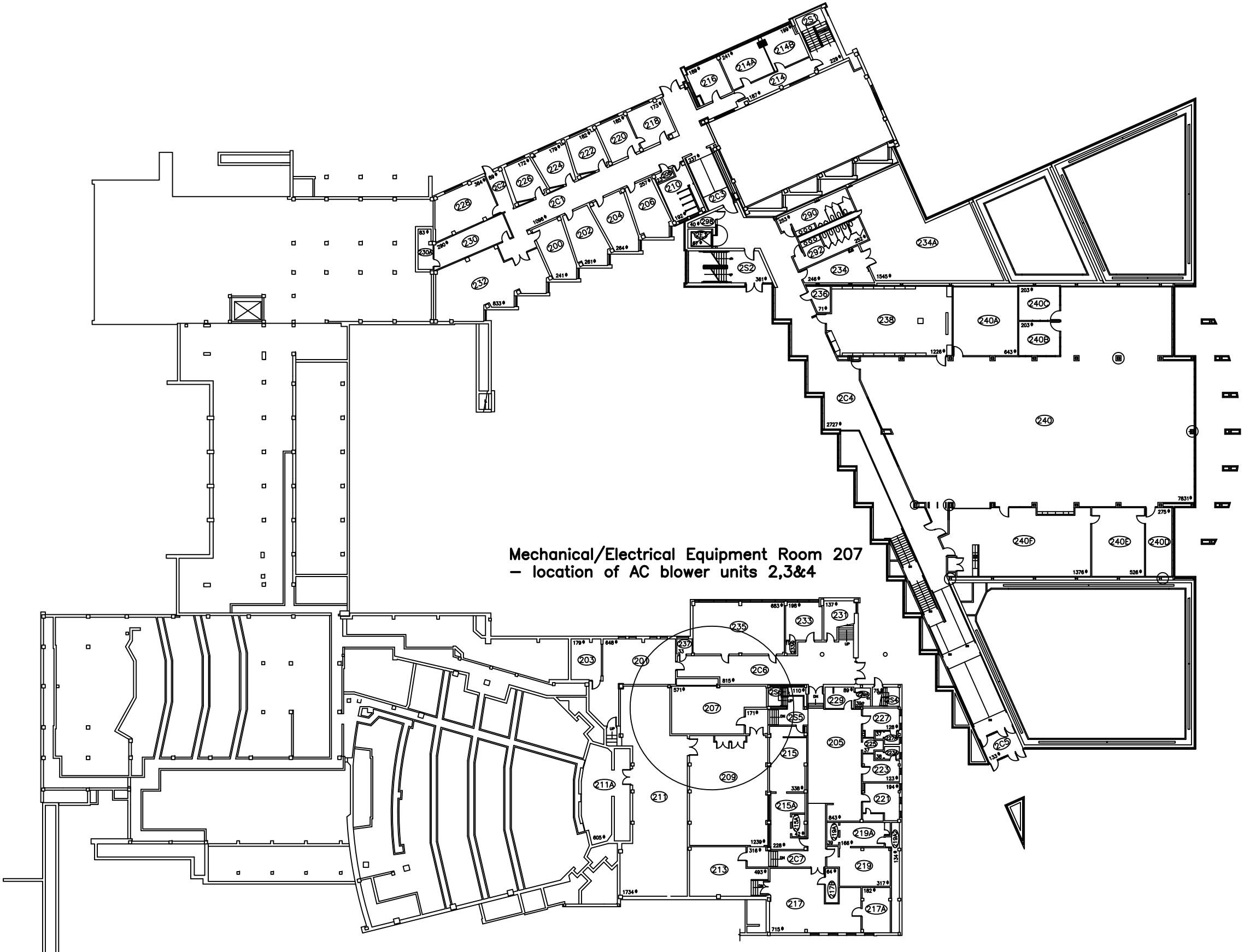


ROOFTOP PLAN

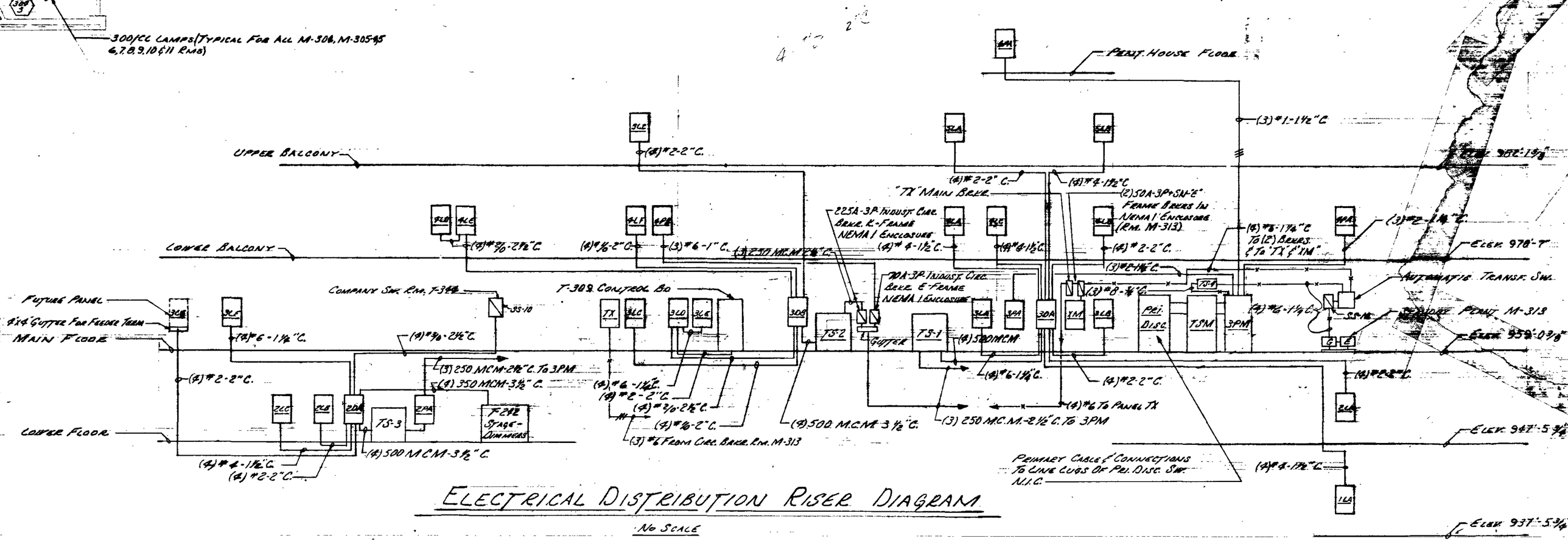


FOURTH FLOOR


MECHANICAL/ELECTRICAL EQUIPMENT
ROOMS 350,352&352A
Mechanical Room 335
– location of AC blower unit 5
Mechanical Room 301
– location of AC blower unit 6
Mechanical Room 313N
– location of AC blower unit 7
THIRD FLOOR



SECOND FLOOR



ELECTRICAL DISTRIBUTION RISER DIAGRAM

NO SCALE

- ALL FEEDERS TYPE RH-RW OR RHW EXCEPT AS NOTED BELOW.
- CONDUIT SIZES PER N.E.C. REQUIREMENTS
- DO NOT RUN ANY FEEDERS IN TUNNELS CONTAINING STEAM PIPING
- PROVIDE FRAMED RISER DIAGRAM IN RM. M-313 SIMILAR TO ABOVE SHOWING ALL FEEDER RUNS & WIRE & CONDUIT SIZES. ETC.
- ALL SECONDARY CONDUCTORS FROM TS-1, 2, 3 TO DIST. PANELS SHALL BE TYPE "XHH".

Figure 1