PART 11 - ELECTRICAL NARRATIVE

EXECUTIVE SUMMARY

The Wayne State University Hilberry Gateway project will have a multitude of programs spaces which will support three dedicated performance spaces. The facility will have the renovated Jazz Center, new proscenium and flexible theaters, and production space to support the theatrical spaces.

The overall facility shall be supported from DTE Energy. Telecommunications systems shall be supported via Wayne State campus infrastructure. The lighting systems shall accommodate the varied design requirements for the varied program spaces/needs. The power system shall originate from DTE Energy power grid and will be utilized to support multiple distribution subsystems meeting the performance requirements of each system. The telecommunications system shall originate from the campus infrastructure and shall be utilized throughout the building. Specialty systems shall be created to support theatrical and audiovisual subsystems.

The existing Hilberry Theatre systems shall be reused where possible during the renovation of existing spaces. Existing service entrance shall be back fed from new electrical service.

The electrical systems are expected to meet Wayne State University’s standards to provide an easy to interface, reliable and simple system which shall integrate with the acoustic, performance, production and visual requirements of this project. All systems shall be designed and installed with LEED certifications in mind.

GENERAL

1. The following information is provided to indicate major systems and capacities. Not all required items are indicated, referenced or identified.
2. The materials and equipment outlined in this narrative exemplify the level of quality expected and/or referenced for this project.
3. Refer to Wayne State University Construction Design Standards for Preferred Manufacturers List. Any deviation from this list shall be preapproved by the University and Design Team in advance.

The electrical systems are expected to meet Wayne State University’s standards to provide an easy to interface, reliable and simple system which shall integrate with the acoustic, performance, production and visual requirements of this project. All systems shall be designed and installed with LEED certifications in mind.

APPLICABLE CODES AND STANDARDS

1. 2015 Michigan Building Code
2. 2015 Michigan Energy Code
4. Zoning Ordinance (City of Detroit)
5. 2010 ADA Standards for Accessible Design (Department of Justice)
6. Michigan Barrier Free Code
12. DTE Energy Utility Service requirements.
The following Standards shall also be utilized for the design of this project:
1. Wayne State University Construction Design Standards
2. Wayne State University Fire Safety Manual
3. Wayne State University Office of Environmental Health and Safety

In addition to the above publications, refer to the following guidance and design narratives:
1. Theatrical Design Narrative
2. Theatrical AudioVisual Narrative
3. Theatrical Acoustic Design Criteria

**SUSTAINABILITY**
1. The project shall be pursuing a USGB LEED certification.
2. The project will likely follow LEED Version 4 for Building Design and Construction.
3. Energy Monitoring: The project will follow the disaggregation of loads to meet Title 24 Building Energy Efficiency Standards. Whole building revenue grade metering will be required at the service entrance. Sub-metering is also required at each panelboard/load type.
4. Commissioning:

**ELECTRICAL PROJECT SCOPE**
1. All electrical work associated with Wayne State University Gateway Project and the site work associated with the building, unless listed below.
2. Items currently not included in the scope of work
   a. Telephone System: Telephone hardware and electronics, cabling, faceplates, terminal blocks, termination and testing. It is presumed that the owner will perform this work under a separate contract. Pathways (conduit and cable tray), backboxes, and backboards are included as part of this project scope
   b. Data System: Data network electronics such as concentrators, Ethernet switches, servers, uninterruptible power supplies, and other electronic equipment, as well as cabling, faceplates, patch panels, network equipment racks, terminations and testing is not included. It is presumed that the owner will perform this work under a separate contract. Pathways (conduit and cable tray) and backboxes are included as part of this project.
   c. Cable TV (CATV) System: Video recorders, video signal processors, other electronics, as well as cabling, outlets, faceplates, are not included. It is presumed that the owner will provide this equipment. Video cabling pathways (conduit and cable tray), backboxes, and backboards are included as part of this project.
   d. Security Systems: Cameras, card readers, control devices, recording devices, monitors, and other electronic devices are not included. It is presumed that the owner will provide this equipment. Security system pathways (conduit and cable tray), backboxes, and backboards are included as part of this project.
   e. Overhead Paging System: Amplifiers, speakers, telephone interface and cabling are not included. The owner will perform this work under a separate contract.

**SERVICE AND DISTRIBUTION SCOPE**
1. Existing Conditions:
   a. Existing Hilberry Theater building electrical systems shall be **demolished**. All existing electrical service **infrastructure shall be reused as much as possible. Utility service entrance shall be refeed through new electrical service.** All low-voltage systems shall be removed to their source. All existing branch circuit shall be removed and conduit shall be removed where possible. All new electrical systems shall be provided during the project.
In order to support new feeder connections, an overcurrent protective device shall be installed within existing service entrance equipment. At this device a new feeder shall originate to support a new distribution panel. This distribution panel shall be sized to support all new feeder connections required for new program space within the existing Hilberry building.

b. Review any demolished equipment with Wayne State University and follow guidelines for any salvage.

c. The moving of the existing MacKenzie House is not a part of the project scope. Review and Coordinate any requirements with Wayne State University.

Temporary Power:

d. Provide temporary construction power to the site and construction services. The permanent building utility company pad-mounted transformers may be utilized for temporary power. Provide proper electrical and physical protection for pad-mounted transformer. Contractor is responsible for all distribution and metering equipment of construction power.

e. Contractor is responsible for all construction phasing of the project. If existing Hilberry Theater remains in operation during construction of addition, Contractor shall be responsible for maintaining system operation and coordination of scope pertaining to renovation of the existing Hilberry Theater and construction of the addition and new/existing systems within the existing facility.

2. Power Distribution:

a. The complex construction will require a single electrical service to serve the facility.

i. The services shall originate at the local utility power connections at the west properly line. Additional exterior equipment may be required by electrical utility to provide primary power utility service to facility.

ii. The facility shall make use of a unit substation located within main level electrical vault.

iii. The substation shall make use of 2000/2500 AA/FA kva transformer.

iv. Facility shall utilize (1)4000A, 480/277V 3-phase 4-wire switchboard shall be in the Main Electrical room located in the basement of the facility.

v. From this service multiple, smaller distributed services shall be created to serve the different requirements of the building.

1. Theatrical Dimming and Theater support equipment.

2. Theatrical AudioVisual Equipment


Ref to one-line diagram for additional requirements of system.

vi. Theatrical dimming and theater support equipment: Separate, dedicated transformer(s) shall be provided to serve the dimmers and company switches for the respective performance lighting systems. The theater dimming systems shall be in dedicated dimmer room that shall be located outside of the acoustical separation of the performance spaces. These systems shall utilize a K13 or Harmonic Mitigating Transformer (HMT). The feeders and bus for all equipment of this system shall be served with a 200% neutral. Refer to one-line diagram for additional requirements of system.

1. The project shall make use of a 500kva two HMT transformers serving an 1600Amp, 208/120V, 5W, 3-phase distribution boards which will serve theatrical relay and dimming panels within both theaters.

2. Distribution panel shall also provide radial feeder connections to (3)225Amp 208/120V panelboards and company switches for the proscenium theater. The panelboards will be located at the following locations:

a. Manager’s position on stage.

b. Control Room

c. Catwalk level.
4. The distribution shall also accommodate Relay panels for 120V and 208V receptacles serving theatrical system.

3. Refer to theatrical narrative for additional information regarding system connections for variable acoustics, rigging and other theatrical support equipment.

4.vii. Theatrical AudioVisual Equipment: Separate dedicated transformers shall be provided to serve the sound systems and company switches for the respective performance audiovisual systems. The transformers and panelboards shall be in separate rooms from the audiovisual racks. The rooms shall also be located outside of the acoustical separation of the performance spaces. These systems shall utilize a K13 iso-shielded transformer. The feeders and bus for all equipment of this system shall be served with a 200% neutral, 100% ground and 100% Isolated Ground.

1. A K13 isolation transformer shall be used to feed the AudioVisual system.

2. This transformer shall serve a distribution board that will connect to the sequencing panel, IG company switches and IG panelboards only. These panels shall not serve loads outside of the theater or the theater support spaces.

3. Theatrical AudioVisual system will be fed through a sequencing panel manufactured by Lyntec, Inc. and a panelboard using feed-thru lugs connected to the Lyntec panel.

4. Provide connections to IG company switches to service temporary connections.

5. The project shall make use of a 225kva Iso-shielded K13 rated transformer serving an 600Amp, 208/120V, 5W, 3-phase distribution board which will serve Isolated ground panelboards within both theaters. Refer to one-line diagram for additional sizing and information.

4.viii. Building loads and other teaching spaces: The remaining building shall be provided with a radial distribution system originating from a 480/277V distribution panel located in the main electrical room.

1. The building shall have electrical rooms within each wing of the facility to serve electrical connections.

2. Each workshop shall have a dedicated transformer and panelboard to serve the area. Each panelboard shall have shunt trip capability for shut down if an emergency event arises for power shut off.

3. Each mechanical room shall have a dedicated panelboard. Feeder shall originate at secondary side of substation.

4. Boiler room shall have shunting capability of all equipment located within boiler room.

5. Smaller secondary distribution transformers will be used for distributing power to auxiliary electrical rooms and work areas with heavy electrical equipment loads. These shall be 480:208/120V Volt, 3 phase, 4 wire dry type factory assemblies with Class H insulation for 150 degree C rise.

6. These transformers will serve 208/120V panels at local electrical rooms to serve power needs for non-Theatrical, non-Theatrical AudioVisual system loads.

b. General convenience duplex receptacle locations and quantities

i. The following specifications are generalizations and will be modified throughout the design development phase.

ii. Note: The floor structure is a 2-hour rated structure. All floor penetrations and floorboxes will require the proper Fire/Temperature protective ratings.

iii. Corridors: Receptacles every 25 feet throughout for housekeeping purposes.

iv. Storage, utility spaces: One receptacle at entrance door, 48” AFF

v. Mechanical spaces: GFCI Receptacles spread throughout for maintenance purposes
vi. Outdoor: One receptacle at each entrance/exit from the building, with additional perimeter outlets to reduce the spacing to 100'-0" maximum.

vii. Typical single Occupant Office
1. (1)Quad receptacle and (1)Duplex receptacle, remainder as NEC dictates.

viii. Conference rooms
1. Floorboxes mounted at opposite ends of table with duplex receptacles.
2. (4)receptacles (one on each wall)
3. (1)Ceiling mounted receptacle at projector or wall mounted display.
4. Provide (3) 120V circuits for catering connections in each large conference room.

ix. Restrooms
1. GFCI receptacle above counter tops
2. Connection for Automatic Flush Valves for toilets, urinals and lavatories.
3. Connection for electric water cooler
4. Connection for hand dryers. Provide dedicated 120V circuit for each unit.

x. Scene Shops
1. 120V receptacles mounted at 48" every 4’ for all workbenches.
2. Circuit shall be provided for every two receptacles.
3. 120V receptacles mounted at 48" every 8’ for open workspaces along wall.
4. Circuit shall be provided for every receptacle.
5. Provide power dedicated circuit connections to all equipment located within the room.
6. Provide shunt interlock of all electrical equipment connected to the industrial ventilation. If the ventilation systems are not activated, the equipment shall not operate.
7. Provide receptacles located throughout the room for electric welders.
8. Provide receptacles on ceiling with drop cords on an 8’x8’ grid.
9. Provide dedicated receptacles for shop equipment at locations to be identified by owner during future document preparation.
10. Class one Division one installation practices will be followed around paint booth.
11. Provide (4)50A 208/120V connection within metal fabrication shop.

xi. Blackbox theater
1. Provide duplex receptacles every 8’ on all walls.
2. Provide duplex receptacles every 16’ on each catwalk.
3. Additional power requirements will be indicated in AudioVisual and Theatrical reports and drawings.

xii. Classrooms
1. Provide duplex receptacles every 8’ of open wall space.
2. Provide for three duplex receptacles for ceiling mounted projectors
3. Provide (2)dedicated circuits for AV equipment within classrooms.
4. Provide receptacles every 4’ along any millwork in classrooms.
5. Provide floorbox at lectern teaching stations.
6. All Low-voltage connections for lectern shall be provided at wall.

xiii. Public Gathering Areas
1. Provide receptacles for every permanent grouping of seats.
2. Provide receptacles for every 10’ of wall space
3. Provide receptacle on every column in public areas.

xiv. Other potential power requirements
1. Site/Exterior Signage
2. Projection Screens
3. For detailed listing of mechanical system equipment, refer to Mechanical Systems Narrative.
c. Motor Controls
   i. Air Handling Units and Pumps: Where served by a VFD, VFD to be furnished by Division 23, installed by Division 23, and connected by Division 26.
   ii. Stand-alone Motor Starters: Provide a magnetic starter for all motors without integral controls. Provide a combination starter when starters are mounted within sight of the motor. Coordinate scope with Division 23 narrative.

d. Solar Ready installation
   i. Provide (3) 3” conduit from main electrical room to the following roof elevations.
      a. Theater roof
      b. Production Wing Roof
   ii. Provide future space for inverter. Maintain connection requirements in building’s main switchboard.

e. Emergency Generator
   i. A new 250 kW diesel/natural gas-powered emergency generator located on grade nearby the west-side of the building located by the loading dock.
   ii. The unit will provide emergency power for the facility. The emergency distribution will be in the building and will consist of distribution switches, two automatic transfer switches, 480/277V panelboards, transformers and 208/120V panelboards.
   iii. Life Safety:
            1. Egress lighting throughout project.
            2. Egress lighting in the theaters shall utilize house lighting.
   iv. The fire pump shall be a separate connection from the generator through the fire pump controller.
   v. Equipment branch
       1. Mechanical system sump pumps.
       2. Mechanical hot water production system
       3. Mechanical hot water distribution system.

LIGHTING SCOPE
1. Lighting Scope will be described within other parts of the Schematic Design Narratives.
   a. Emergency egress lighting will be supplied by existing generator and campus life safety system distribution.
   b. Exterior: Building-mounted exterior lighting at entrances/exits from the building will be circuited and controlled to serve as egress lights.
2. Interior Lighting Specifics: Interior spaces are described below, with design intent and maintained illumination levels.
   a. Dressing Rooms: Provide LED luminaires in the space for general illumination. Provide LED mirror luminaires with 90 plus CRI around three sides of the mirrors. The targeted light level is 50 foot-candles at work plane and 40 foot-candle vertical illumination at 4 feet above the finished floor.
   c. BOH Production Offices: Provide LED luminaires with direct/indirect lighting. The targeted light level is 40 foot-candles on the work plane.
   d. Back of House Green Room: Provide LED luminaires with indirect lighting. The targeted light level is 15 foot-candles on the work plane.
   e. Public Restrooms: Provide recessed LED downlights, one per stall and in the open areas. Provide decorative dimmable LED luminaires at the mirrors. The targeted light level is 10 foot-candles at the stall.
   f. Single Occupant Restrooms: Provide recessed LED downlights in the room. Provide decorative dimmable LED luminaires at the mirror. The targeted light level is 10 foot-candles at the stall.
g. **Classrooms:** Provide suspended direct/indirect LED luminaires for general illumination. Provide recessed LED wall washers to illuminate the marker board walls. The targeted light level is 40 foot-candles on the work plane.

h. **Scene Shop:** Provide LED industrial strips for uniform horizontal and vertical illumination. Lighting will be coordination with elevation and equipment requirements. The targeted light level is 50 foot-candles at the work plane.

i. **Workshops (Metal, Wood, Electronic, and Robotics):** Provide suspended LED linear lighting with 3:1 max/min uniformity on work surfaces. The targeted light level is 40 foot-candles on the work plane.

j. **Storage Rooms:** Provide LED luminaires for general illumination. Special design consideration beyond the basic lighting will be provided for the spaces with the doors opening to the public spaces. The targeted light level is 10 foot-candles on the work plane.

k. **Mechanical Rooms:** Provide LED luminaires for general illumination. Special design consideration beyond the basic lighting will be provided for the spaces with the doors opening to the public spaces. The targeted light level is 20 foot-candles on the work plane.

3. **Lighting Controls Requirements:**
   a. **Lighting Control System (LCS):** Will use a large-scale dimming control network to communicate between all lighting-control devices throughout the building.
   b. The LCS should have UL 924 listed devices being capable of turning controlled emergency lighting loads to full on during the power failure.
   c. System should be capable of scheduling, dimming, task tuning, occupancy control, and other controls including daylight harvesting.
   d. Control software should enable integration with a Building Automation System (BAS) via BACnet/IP with no additional hardware required.
   e. Software interface should be made available to networked computer devices via standard Web browser, without requiring additional software on computers and other access devices.
   f. All control software connections between managed systems should be via the Owner’s LAN (local area network) or WAN (wide area network), or the internet in general.

   a. The LCS should monitor the status of control devices, display alarm information, and notify select individuals, either through a web interface, or via emails, of important issues.

   b. In public spaces, preset dimming controls with manual override will be provided to create lighting scenes for special events and performances. The lighting control system shall have the capability to be integrated to the theatrical lighting control system in Performance Hall so the present scenes can be recalled from the theatrical lighting control system.

   c. Performance Hall shall have an architectural dimming system to provide multiple lighting levels and scenes to allow for full flexibility. The architectural dimming system shall be fully integrated into the theatrical lighting control system.

   d. Dimming controls will be provided in work and office areas to allow occupant selection of lighting level.

   e. Individual offices, conference rooms, classroom rooms, lounges, single occupant restrooms and other enclosed rooms less than 1000 SF will be provided with vacancy/occupancy sensors to automatically control lighting. See list below for the sensor application.

      a. Individual office, conference rooms, classroom rooms, lounge rooms, dressing rooms, greenroom: Ceiling-mounted dual technology vacancy sensor.

      b. Multi-occupant toilet rooms: Ceiling-mounted ultrasonic occupancy sensor with relay controls. The relay control shall be activated during business hours. Occupancy sensor shall be activated after business hours.

      c. Single occupant toilet rooms: Wallbox infrared occupancy sensor.

   f. Automatic daylight dimming controls will be provided in all daylit zones.
g. Exterior and facade lighting will be controlled by exterior photocell and astronomic timeclock input, through the lighting control relay panel system.

SYSTEMS SCOPE

a. Fire Alarm: An addressable fire alarm system will be provided throughout the building. System will include manual stations, smoke detectors, duct smoke detectors, heat detectors, connections to sprinkler system and HVAC equipment, audio/visual devices and visual devices. System will be designed to meet NFPA and the State of Michigan Building Code. The existing building’s fire alarm system shall not be reused. The following items will be included
   a. Manual pull stations will be installed at the following locations:
      i. Building box office
      ii. Nearby building fire alarm control panel. Mounting heights shall be no lower than 36”AFF and no higher than 48”AFF and shall be within ADA accessible reach limits at all locations and within 5' of exit doors.
   b. Heat and Smoke detection: Provide complete coverage heat and smoke detection in accordance with NFPA 72 including all local and state amendments –or- in the following locations:
      i. Mechanical rooms
      ii. Storage rooms
      iii. Electrical rooms
      iv. Dimmer Rooms
      v. AudioVisual rack rooms
   c. Audio/visual and visual notification appliances in quantities and locations required to notify occupants in accordance with NFPA 72 and the ADA. Strobes shall be minimum 15 cd rating under UL 1971. Audible devices shall be speaker based. Basis of design ceiling speakers and ceiling speaker/strobes shall be an 8” speaker equivalent to Wheelock S8.
   d. Door Holders: Provide magnetic door holders for release of designated doors upon alarm signal. Coordinate with architectural for doors to be held open. Provide all required door hardware interfaces for unlocking doors and releasing held open doors.
   e. Elevators: Smoke and heat detectors needed to perform elevator recall function.
   f. Fire Protection: Connection to tamper and flow switches in quantities and locations determined by the fire protection contractor.
   g. HVAC Interface:
      i. Interface to accomplish control of HVAC units based on duct detector input, monitoring of power used for life-safety functions (shunt trip power, etc.)
      ii. Interface to accomplish control of HVAC combination fire/smoke dampers. Dampers shall actuate upon detection of smoke by associate duct detector.
   h. An LCD remote annunciator will be provided at a location acceptable to the fire department for notification and control of the system.
   i. A DACT will be provided to transmit fire alarms to the Owner’s central monitoring location.
   j. Fire alarm system conduit and fire alarm j-box covers shall be painted red.
   k. System shall interface with Building BAS system for all controls and alarm signals.

b. Telecommunications
   a. Voice/Data Systems: The voice/data systems will be furnished and installed by the owner. The contractor will provide empty boxes, conduit and sleeves to facilitate the voice/data cabling. A typical voice/data outlet will have a two-gang box with a single gang faceplate and a 1” empty conduit routed to an accessible ceiling location.
b. Two 3” empty conduits will be stubbed out from the MPOP room, Telecom room, Server room to the campus fiber optic panels located in the tunnel.

c. Cable Tray:
   i. 4” inside depth, 24” inside width, wire-mesh type, galvanized steel, NEMA 8C supported 8’ on center.

d. Refer to drawings for locations of MPOP room and Telecom Rooms:

e. The typical layout for each Telecom room will consist of:
   i. ¾” AC grade plywood along all four walls of the room.
   ii. Three 2-post equipment racks in a single row centered in the room with 10” wide front and rear vertical cable management between each rack and 6” wide front and rear on the end of the row of racks.
   iii. 18” wide telco style ladder racking over the racks to the walls with cable drop-outs at each rack.

f. Outlet Quantities and Locations:
   i. Private Offices – Two outlets.
   ii. Cubicles – One outlet.
   iii. Small Conference rooms – Two outlets.
   iv. Large Conference rooms – Four outlets.
   v. Wireless LAN Access Points – One outlet mounted on the ceiling for each 1800 sq. ft. of floor space.
   vi. IP Security Cameras – One outlet.
   vii. Classrooms – Four outlets.
   viii. Ceiling mounted projectors

g. TV Distribution
   i. A wired television distribution system connected to an antenna system or cable utility will be provided. Cabling will consist of 0.50” trunk distribution cabling and RG6 horizontal cabling. Splitters and line amplifiers shall support 750 MHz minimum video bandwidth.
      1. Conference rooms
      2. Theater control rooms
      3. Classrooms
      4. Access Control
      5. Provide raceway and junction boxes for future access control system.
      6. Typical Card Reader locations shall include:
         7. Suite Entry doors.
         8. Mechanical room doors.
        10. Department entry doors.
        11. Classrooms
        12. Scene Shop
        13. Theater back of house entries
        14. Building entries
        15. Doors between building interconnections.
        16. Telecom rooms and Server room (refer to Telecommunications paragraph for locations).
   ii. Provide door position monitoring of all exterior doors as well as all electronically locked and access controlled doors.
iii. Provide duress buttons at reception desks and point of sale locations. Duress buttons shall be connected to the access control system.

h. Video Surveillance
i. Provide a new video surveillance system as required for the facility. The system shall be an extension of the Owner's existing Video Management System. The facility's video surveillance system will be monitored off-site at the Owner's central monitoring station. This system includes components such as power supplies, servers, storage, megapixel cameras, pan-tilt-zoom cameras, flat panel color monitors, IP network switches, other electronic equipment, and equipment racks.

ii. The video surveillance system software shall be an enterprise level solution capable of expansion beyond the initial project capacity and be compatible with IP megapixel cameras. Camera licensing shall be based on camera count, not device media access control (MAC) addresses. The system shall support multiple video formats: MJPEG, MPEG-4, H.264, etc. Functions to include photo verification of card access system, motion sensing and alarms, and selectable auto-follow with pan-tilt-zoom cameras.

iii. Cabling, outlets, faceplates, patch panels, patch cords (copper and/or fiber), transceivers, pathways (conduit and cable tray as required), standard backboxes, terminations and testing are also included as part of this project.

iv. Network System to be composed of IP network switches, cameras, and cabling. The security IP network shall be independent of other building IP networks. System to be network integrated with IP access through web server.

v. The Video Surveillance System will transmit all signals to the head end equipment located in the Server Room that serves the building.

vi. Minimum camera resolution shall be 1080p, with wide dynamic range (140dB). Exterior cameras shall be day/night cameras with IR cut filter for nighttime operation.

vii. The video storage system shall be capable of redundantly storing 30 days of video from each camera at each camera's native resolution at a minimum of 10 frames per second with light compression.

viii. Monitoring of the Video Surveillance System shall be available at viewing stations.

ix. Typical camera locations shall include:
   1. Parking lot and site cameras.
   2. Cameras for viewing exterior doors.
   3. Public corridors.
   4. Elevator landings.
   5. Stair landings.
   6. Delivery docks.

i. Audio/Video Systems
   i. All raceway and junction boxes will be provided by electrical contractor for all Audio/Visual Systems. All equipment will be provided by other project scopes.

   ii. Typical Conference Room
      1. Wall mounted TV and mount. Control thru TV remote. Audio thru TV's speakers.
      2. Laptop HDMI, VGA, and analog audio inputs in floor box with input jacks at table top.
      3. Audio and Video input for Owner furnished PC.

   iii. Typical Medium Classroom
      1. Wall mounted TV and mount. Control thru TV remote.
      2. Audio thru overhead speakers. DSP and power amplifier.
3. Wall mounted volume control.
4. Two floor boxes with laptop HDMI, VGA, and analog audio inputs and input jacks at table top or lectern.
5. Audio and Video input for Owner furnished PC.
6. Audio/Video equipment rack located in credenza.

iv. Typical Large Classrooms
1. Ceiling mounted projectors
2. Wall mounted displays.
3. One omnidirectional table microphone.
4. Control thru touchscreen controller.
5. Audio thru overhead speakers. DSP and power amplifier required. Volume control thru touchscreen controller
6. Shared power/systems floor box or poke-thru with laptop HDMI, VGA, and analog audio inputs and input jacks at table top or lectern.
7. Audio and Video input for Owner furnished PC.
8. Wireless microphone system.
9. IR/RF/Hearing Loop assistive listening system.
10. Video distribution head end equipment (media presentation switcher or matrix switcher) with auto-sensing inputs.
11. Audio/Video equipment rack located in credenza.
12. Remote system monitoring and control shall be available thru control system software, such as Creston Fusion.

j. Digital Signage System
i. Digital signage system will be used for wayfinding, interactive building directory/registration kiosks, event announcements, branding, and energy dashboard applications. Digital signage screens will include time, date, and weather information, at a minimum.

ii. The digital signage system components will be networked together and will be connected to the Internet. Content can be dynamically updated in real-time from online sources such as live news feeds (typically in the form of RSS feeds). Many organizations create a custom news feed that represents the highlights and accolades of the organization to be included as a component of digital signage. Coordinate content feeds with the Owner.

iii. Digital signage content will be created by the Owner.

iv. Provide a minimum of (2) two hour Owner training sessions. The first Owner training session will be scheduled after substantial completion and the second Owner training session shall be scheduled after approximately three months of occupancy.

k. Provide “Call for Help” Stations where indicated by owner.
i. Provide a minimum of (1) for every corridor and stair landing.

BASIC MATERIALS AND METHODS

General:

a. Shop drawings, Operation and Maintenance Manuals, and Operating instructions for the Owner are required for this project.
b. All materials shall be new, UL Listed and Approved for the purpose, and installed per code.
c. Work shall be installed per the NEC (NFPA 70) and applicable state and local codes and shall meet the requirements of nationally recognized standards. Secure and pay for all permits, licenses, utility and inspection fees, and coordinate all work with local inspection authorities.
d. All systems shall be completely functional and wiring systems shall test free of defects using megger, continuity, ground, voltage, current, and phase rotation tests. Balance system phase currents to within 5% of each other.

e. Provide all cutting and patching necessary for installation of electrical work and restore finished surfaces disturbed by this Contractor. Do not cut or drill structural members.

f. Provide general cleanup of waste and rubbish in the work area, and clean all removed and reinstalled equipment and luminaires. Clean all equipment that has become dirty during construction.

g. Equipment Support: Provide support of all electrical work through the use of hanger rods, clamps, structural framing, fastening devices, and backboards. Provide vibration isolation in all supporting hardware for vibrating electrical equipment installed by this Contractor. Provide 4” high concrete pads for floor mounted equipment.

h. Identification: Provide engraved nameplates, wire and cable markers, embossed tape, and device plate cover engraving on electrical distribution and control equipment and the loads they serve, main power and special system cabinets, motor control centers, motor starters and variable frequency drives, and disconnects.

i. Temporary Electric Services: Provide complete, adequately sized, and metered temporary electric power and lighting services for all trades. The General Contractor will pay energy charges. Provide service equipment, feeders, panel boards, panel board receptacles, and lighting as required for the trades to perform quality work in a safe environment. Energize hoists, cranes, elevators, field offices, and other large significant loads. Work shall include ground fault protection where required and comply with OSHA and the NEC. Remove facilities prior to occupancy.

j. Underground Installations: Provide all excavation, backfilling, fill, and compacting of trenches for installation of electrical work. Provide all necessary pumping and drains. Restore site surfaces such as streets, sidewalks, curbs, paved areas and lawns, to original condition. Install marking tapes and pitch conduits away from the building for draining.

k. Raceway Systems
   a. Conduits: Rigid steel, IMC, EMT, Flexible steel and Liquid tight, and PVC conduits will be used with approved fittings. Provide complete raceway systems including outlet boxes, pull boxes, and fittings. Conceal conduits in finished spaces. Group conduits on racks leaving 25% conduit space and suspend from the structure. Size conduits, boxes, and bends per the NEC. Provide expansion fittings, conduit seals, drain tees, conduit hubs, fire/smoke barriers where required. Metal conduits shall have continuous grounding integrity.
   b. PVC will be used for feeders running below the slab.
   c. IMC will be used for feeders exposed outdoors.
   d. Rigid Conduit will be used for the service entrance conduits.
   e. IMC will be used for feeders running below the slab and exposed outdoors.
   f. EMT will be used for interior feeders and branch circuits.
   g. Flexible steel or Liquid-tight will be used for connection to motors and transformers
   h. Use ¾” conduit as minimum size on all emergency circuits.
   i. Minimize conduits in structural slab and deck pours. At slab on grade, keep conduits below slab.

l. Wire And Cable: Branch circuit conductors shall be THWN/THHN solid copper through #12 and stranded copper #8 and larger. Minimum wire size is #12. Conduit fill shall conform to NEC table 3. All conductors shall be in raceways with color coded insulation and each voltage system shall be separately identified. A green ground conductor will be installed in each feeder and branch circuit conduit.
   a. Provide a separate neutral conductor for all 120/208-volt branch circuits.

m. Boxes And Cabinets
   a. Pull & Junction Boxes: Indoor boxes shall be NEMA 1, constructed of a single piece code gauge steel, with folded and welded corners, complete with flat removable screw down cover. Outdoor boxes utilizing rigid metal conduit shall be cast iron with cast iron gasketed cover held down with stainless steel screws. Outdoor boxes utilizing PVC conduit shall be plastic with screw down gasketed cover. Size all boxes per NEC article 314. Provide boxes to comply with code and to provide ease of conductor installation.
b. Outlet Boxes and Fittings: Interior outlet boxes shall be galvanized steel, non gangable, with knockouts and covers or extension rings as required. Exterior surface outlet boxes shall be cast iron alloy with threaded hubs and screw down gasketed WP covers.

c. Cabinets: Cabinets shall be constructed of code gauge steel without factory knockouts, surface or flush mounted and shall appear as a panel board with a hinged and latched door. Provide barriers to separate low voltage and power wiring as required.

n. Devices And Cover Plates
   a. Switches shall be heavy-duty specification grade, 20 amp, 120/277 volt, quiet toggle, momentary contact, pilot type or illuminated toggle. Provide single pole, double pole, 3 way, 4 way, or SPDT as required similar to Hubbell 1221 series.
   b. Receptacles shall be heavy-duty specification grade, duplex or single outlet, voltage, and NEMA configuration as required. Provide GFI receptacles as required. GFI receptacles shall have test and reset buttons and indicator lights.
   c. Interior device plate covers shall be:
   d. Unfinished areas (storage, mechanical, etc.): Galvanized steel
   e. Finished, public spaces: stainless steel
   f. Exterior device plates shall be galvanized steel WP with hinged lid.

o. Grounding And Bonding
   a. Provide grounding and bonding of the service entrance complete with grounding bushing on each conduit entering the service equipment. Connect service entrance gear to ground as listed below.
   b. Provide a service entrance ground by making a connection from the service entrance panel ground bus to the incoming water service and ground rods.
   c. Provide a 2" x ¼" x 24" copper ground bar in the main electrical room. Ground bar shall be used as the central grounding point for telecommunications and other systems in the building.
   d. Provide a 2" x ¼" x 12" copper ground bar in each MPOP room, Telecom room, Server room, and Computer room as per the TIA-607 standard.
   e. Equipment Grounding:
      i. Motor circuits shall have a ground conductor pulled with the phase conductors.
      ii. Scrape light fixture finish to assure a good ground.
   f. Provide a green grounding conductor in all branch circuit and feeder conduits sized per NEC. Provide grounding conductors in all conduit systems, flexible conduit lengths, and surface raceways.
   g. Provide grounding of all equipment comprising a permanent bonding together of all metallic, non current carrying parts of the electrical system like raceways, boxes, panels, cabinets, equipment enclosures, housings, motor frames, ducts, and luminaires.

p. Testing
   a. Provide an infrared scan of all electrical switchboards, panelboards, and transformers after equipment is energized and building has occupant load on components. Provide copies to Owner for their record.

Electrical Distribution Equipment
   a. Switchboards
      i. Buses and Connections: Three-phase, four-wire type, copper bussing, uniform capacity entire length of switchboard.
      ii. Overcurrent Protective Devices: Ratings, characteristics and settings suitable for use. Main and branch devices shall be electronic trip types with integral metering for customer’s use.
      iii. Ratings: Nominal system voltage, continuous main bus amperage, short-circuit-current rating suitable for use.
      iv. Incoming services (utility or alternative energy sources) will be metered with revenue grade power quality meter, meeting or exceeding ANSI C12.20 0.2 accuracy class.
v. Eaton Power Xpert 6000 or equivalent.

vi. Provide metering of each panelboard. Meters can be installed at the switchboard or the panelboard to obtain metering data of the load type (i.e. lighting, plug load, mechanical).

vii. Infrared Windows: Provide two IR windows on each section of switchboard.

b. Transformers: Transformers shall be dry-type with kVA ratings as shown on the drawings. Primary shall be 480 volt, 3 phase, 3 wire, delta and secondary shall be 120/208 volt, 3 phase, 4 wire wye. Transformer shall include four primary voltage adjustment taps, class H insulation for 150 degree C rise above 40 degrees C ambient, and a ventilated enclosure. Transformers shall be rated for non-linear loads and shall have k-ratings as shown on the plans.

c. Panelboards: Panelboard enclosures shall be made of code gauge steel with finished cabinet front with concealed trim clamps, concealed door hinges, and lockable trim door with flush locks all keyed alike. 120/208 volt circuit breakers shall be bolt on, minimum 10,000 AIC rating, 277/480 volt circuit breakers shall be bolt-on, minimum 14,000 AIC rating. Panel board bus ampacity shall be as indicated elsewhere in this narrative. Provide removable typewritten circuit breaker identification inside door.

d. Disconnect switches shall be heavy duty, horsepower rated, 250 volt or 600 volt, 2 pole, solid neutral, or 3 pole fused or non fused and as required. Switch shall be quick make quick break with interlock and lockable enclosure door for opening. Provide NEMA 1 enclosure indoors, NEMA 3R outdoors, and NEMA 4X in interior wet locations. Fusible switches shall use current limiting fuses with rejection type fuse clips.

viii. Fuses 600 amp and above shall be equal to Bussman Low Peak, KRP C. Fuses 600 amp and below shall be equal to Bussman Low Peak, LPN RK or LPS RK except that motor circuit fuses shall be equal to Bussman Fusetron FRN R.

e. Circuit Breaker Disconnects: Provide molded case disconnect switches, 600 volt, 3-pole in the elevator machine room. Provide one disconnect switch per elevator. Provide circuit breaker with shunt trip. Circuit breaker AIC rating shall coordinate with the circuit.

q. Devices

a. Receptacles: Provide plug load control in office spaces with the ability to schedule on/off times and override outlets on via occupancy sensors.

i. Provide contactor control of top outlet(s) of duplex and quad receptacles for all classrooms, private offices, and open offices, copy machines, coffee machines, water coolers, and display monitors.

Lighting Equipment

a. Luminaires: Luminaires will be provided complete with lamps, ballasts, drivers, and all necessary accessories and mounting hardware. Luminaires will be compatible with ceiling or wall systems.

ii. Lighting Equipment will be described within other parts of the Schematic Design Narratives.

b. Lighting Control Panels:

i. Lighting Equipment will be described within other parts of the Schematic Design Narratives.

--- End of Part 11 ---
MECHANICAL NARRATIVE

GENERAL
1. The following information is provided to indicate major systems and capacities. Not all required items are indicated, referenced, or identified.
2. The materials and equipment outlined in this narrative exemplify the level of quality expected and/or required for this project.
3. Refer to Wayne State University Construction Design Standards for Preferred Manufacturers List. Any deviation from this list shall be approved by the University and Design Team in advance.

CODES AND STANDARDS
1. The following codes will be used for the design of this project. Local Authorities Having Jurisdiction will also be consulted in their specific areas for guidance and input in the design of the systems for the building.
   a. 2015 Michigan Building Code
   b. 2015 Michigan Mechanical Code
   c. 2015 Michigan Plumbing Code
   d. 2015 Michigan Energy Code
   e. 2007 ASME Boiler and Pressure Vessel Codes with 2008 addenda
   f. 2007 National Board Inspection Code
   g. 2016 PA 407 Skilled Trades Regulation Act
   h. 2010 ASME A17.1 Safety Code for Elevators and Escalators
   i. Michigan Fire Prevention Code
   j. NFPA Standards 13, 14, 20, 25, and 90a
   k. Refer to other sections for additional code criteria
2. The following standards will be used for the design of this project.
   a. Wayne State University Construction Design Standards
   b. Wayne State University Fire Safety Manual
   c. Wayne State University Office of Environmental Health and Safety
   d. Wayne State University Risk Management Department
3. Refer also to the acoustic design criteria for the project for additional guidance on vibration isolation, room noise criteria, and required maximum duct velocities.

EXISTING CONDITIONS
1. Provide demolition of all existing mechanical systems for the existing Hilberry Theater. Review any demolished equipment with Wayne State University and follow guidelines for any salvage. Cap all utilities at mains per utility requirements.
2. The moving of the existing MacKenzie House is not a part of this scope of work. Review and coordinate any and all requirements with Wayne State University.
3. Installation and operation of new mechanical systems and any ongoing operation of the existing Hilberry Theater during construction activities shall be coordinated with Wayne State University, the renovation of the existing Hilberry Theater, the new addition/building and new systems in the existing Hilberry Theater.
HVAC SYSTEM DESIGN CONDITIONS

1. Outdoor Design Conditions
   a. Summer: 95 deg F dry-bulb / 75 deg F wet-bulb temperature
   b. Winter: 3 deg F dry-bulb
   c. Cooling Tower Selection: 95 deg F dry-bulb / 78 deg F wet-bulb temperature
   d. Basis of Data: Wayne State University Construction Design Standards Second Revision

2. Interior Design Conditions
   a. Theater and Theater Studio:
      i. Summer: 75 deg F and 50% RH
      ii. Winter: 72 deg F and no winter humidification
   b. Valade Hall
      i. Summer: 75 deg F and 50% RH
      ii. Winter: 72 deg F and 35% RH
   c. Piano Storage
      i. Summer: 75 deg F and 50% RH
      ii. Winter: 72 deg F and 35% RH
   d. General Space Design Conditions:
      i. Summer: 76 deg F and 50% RH
      ii. Winter: 70 deg F and no winter humidification
   e. Communications Closet
      i. Summer: 76 deg F and 50% RH
      ii. Winter: 60 deg F and no winter humidification
   f. Dimmer and AV Rooms:
      i. Summer: 76 deg F and 50% RH
      ii. Winter: 70 deg F and no winter humidification
   g. Vestibules, Loading Docks:
      i. Cooling: 80 deg F
      ii. Heating: 65 deg F
   h. Mechanical and Electrical Rooms:
      i. Cooling: 80 deg F
      ii. Heating: 65 deg F

3. Ventilation Air Requirements: Commercial Building Code and Per ASHRAE 62.1 Standards. Densely occupied spaces will have carbon dioxide sensors and automated control per codes to adjust outdoor air quantities based on air quality measurements.

4. Toilet Room Exhaust: Minimum of 75 CFM per Water Closet, 50 CFM per Urinal, or 1.5 CFM per SF, whichever is greater.

CHILLED WATER SYSTEM:

General: A local air-cooled chiller system will be provided to serve the new construction of the project.

Chiller System

1. The estimated cooling load for the new construction is 250-275 tons.
2. Two (2), 200 ton, energy-efficient air-cooled chillers will be provided for operation and maintenance flexibility. Each chiller will be sized at 75% of the full building load. The efficiency rating of the chiller will be evaluated in subsequent design phases. Consideration will be given to initial costs, life cycle operational costs, system flexibility and load profiles.
3. The following features shall be provided with the chillers:
   a. Minimum air-cooled chiller EER shall be 10.5 EER.
   b. Minimum air-cooled chiller IPLV shall be 17.
c. Minimum chiller turndown and associated minimum flow rate shall be 40% or less.
d. Chiller will have manufacturer’s acoustic attenuation package. Attenuation package shall include ultra-quiet fans, additional component attenuation such as enhanced insulation, and vibration isolators.
e. Refrigerant shall meet LEED enhanced refrigerant requirements.

**Chilled Water Piping and Accessories**
1. The chilled water system will be a variable primary pumping arrangement designed with a 42°F chilled water supply water temperature. The design chilled water temperature difference will be 12°F.
2. Two (2) variable speed primary chilled water pumps will circulate chilled water through the new building construction and will utilize a 500 gallon buffer tank. Pumps will be base-mounted and suction type or vertical split case type. Pumps will be selected at 100% capacity and will be operated in a lead/lag control sequence.
3. Chilled water piping:
   a. Chilled water piping 2-1/2 inches and larger will be Schedule 40 black steel pipe with welded, threaded, or flanged fittings. Piping may be copper tube with solder joint fittings for pipe sizes 2 inches and smaller.
   b. Chilled water piping systems will be 125 PSIG minimum working pressure.
   c. Valves in chilled water piping systems will be ball valves for sizes up to and including 3-inches and butterfly valves for sizes 4-inches and larger.
   d. Chilled water control valves on air handling unit cooling coils shall be pneumatic driven with digital controls.
   e. One automatic flow control valve shall be used per air cooled chiller.
   f. Connections at air handling units and other cooling equipment will have double spherical flexible connections.
   g. Chilled water piping within the mechanical room or within a minimum of 75 feet of a pump will be hung from spring and neoprene vibration isolators.
   h. Interior chilled water piping will be insulated with phenolic insulation with an all service jacket. Exposed piping in occupied areas within 8’-0” of the finished floor shall have a PVC jacket. Piping in the mechanical rooms shall have a PVC jacket. Insulation thickness will be as required to minimize thermal losses on chilled water piping and will at a minimum comply with the energy code.
4. Chilled water system accessories:
   a. Pump suction diffusers (for end suction pumps)
   b. Diaphragm compression tank
   c. Air separator
   d. Chemical feeders (per Wayne State and Eldon Water requirements)
   e. Calibrated balancing valves
   f. Strainers
   g. Flexible expansion fittings across any building structural or acoustic isolation joints.
   h. Pump inlet and discharge double spherical flexible connections.
   i. Pumps will be supported on vibration isolators with an inertia base

**HOT WATER SYSTEM**
General: A local hot water boiler system will be provided to serve the new construction of the project.

**Boiler System**
1. The estimated heating load for the building is 4,000 MBH.
2. Three (3), 2,000 MBH, energy-efficient, fully condensing natural gas firetube boilers will be provided for operation and maintenance flexibility. Each boiler will be sized at 50% of the full building load. Consideration will be given to initial costs, life cycle operational costs, system flexibility and load profiles.

Hot Water Piping and Accessories
1. The hot water system will be a variable primary pumping arrangement designed with a 120°F hot water supply water temperature. The design hot water temperature difference will be 20°F.
2. Two (2) variable speed primary hot water pumps will circulate hot water through the heating plant. Pumps will be base-mounted and suction or vertical split case type. Pumps will be selected at 100% capacity and will be operated in a lead/lag control sequence.
3. Hot water piping:
   a. Hot water piping 2 – 1/2 inches and larger will be Schedule 40 black steel pipe with welded, threaded, or flanged fittings. Piping may be copper tube with solder joint fittings for pipe sizes 2 inches and smaller.
   b. Hot water piping systems will be 125 PSIG minimum working pressure.
   c. Valves in hot water piping systems will be ball valves for sizes up to and including 3-inches and butterfly valves for sizes 4-inches and larger.
   d. Any air handling unit that has a winter mixed air temperature of 40 deg F or lower will have a local inline circulating pump for freeze protection at the unit preheat coil.
   e. Connections at air handling units will have double spherical flexible connections.
   f. Hot water piping within the mechanical room or within a minimum of 75 feet of a pump will be hung from spring and neoprene vibration isolators.
   g. Interior chilled water piping will be insulated with fiberglass insulation with a foil-scrim-kraft vapor barrier jacket. Exposed piping in occupied areas within 8’-0” of the finished floor shall have a PVC jacket. Piping in the mechanical rooms shall have a PVC jacket. Insulation thickness will be as required to minimize thermal losses on hot water piping and will at a minimum comply with the energy code.
4. Hot water system accessories:
   a. Pump suction diffusers (for end suction pumps)
   b. Diaphragm compression tank
   c. Air separator
   d. Chemical feeders (per Wayne State and Eldon Water requirements)
   e. Calibrated balancing valves
   f. Strainers
   g. Flexible expansion fittings across any building structural or acoustic isolation joints.
   h. Pump inlet and discharge double spherical flexible connections.
   i. Pumps will be supported on vibration isolators with an inertia base

VENTILATING AND SPACE CONDITIONING SYSTEMS

Air Handling Systems:
1. Air handling units shall be factory-fabricated, 2” or 4” double-wall insulated housings, custom or modular units as needed for the application. Custom units shall be required for units 30,000 cfm or greater and where application requirements (such as acoustics) dictate.

1. RTU-1 Hilberry Lobby and Support – Exterior Rooftop Unit
   15,000 cfm variable volume, variable temperature, exterior rooftop unit with 16 percent minimum outside air, full economizer and return fan.
The unit will be a 2” double-wall, exterior rooftop unit arranged (back to front) as follows:
   a. Return/Relief Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.
   b. Relief air, minimum outside air, and mixing air damper section
   c. Prefilter: MERV 8, two-inch thick pleated panel
   d. Final filter: MERV 13, 12” thick cartridge type.
   e. Hot water heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
   f. Chilled water cooling coils: 2 separate, 4- or 6-row cooling coils with intermediate access section for cleaning with design entering water temperature of 42 deg F and leaving water temperature of 54 deg F.
   g. Supply Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.

The rooftop unit shall include the following:
   - Integrated rooftop unit piping vestibules at coil connections. Vestibules shall be same construction as unit housing and have access doors, seamless roofcap and have sufficient depth for piping connections with valving.
   - Sound and vibration isolation roofcurb with spring isolation rails and acoustic panels at curb walls and curb floor.

Distribution to and from the air handling unit to spaces served will be as follows:
   a. Supply air ductwork to individual zone terminal units and distribution ductwork to diffusers downstream of terminal units.
   b. Air terminal units with hot water zone booster heating coils.
   c. Return air ductwork from zoned spaces back to mechanical room.

2. **AHU-1 Theater Stage**

13,000 cfm variable volume, variable temperature type custom unit with 20 percent minimum outside air, full economizer and return fan.

The unit will be a 4” double-wall, custom unit arranged (back to front) as follows:
   a. Return air sound attenuator.
   b. Return/Relief Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.
   c. Relief air, minimum outside air, and mixing air damper section
   d. Prefilter: MERV 8, two-inch thick pleated panel
   e. Final filter: MERV 13, 12” thick cartridge type.
   f. Hot water heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
   g. Chilled water cooling coils: 2 separate, 4- or 6-row cooling coils with intermediate access section for cleaning with design entering water temperature of 42 deg F and leaving water temperature of 54 deg F.
   h. Supply Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.
   i. Hot water re-heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
   j. Supply air sound attenuators.

Distribution to and from the air handling unit to spaces served will be as follows:
   a. Supply air acoustic housing with 4” insulated double layer construction and internal sound baffles inside the mechanical room and at the supply air penetration to Theater Stage.
b. Supply air ductwork to symmetrical, lined, low-velocity ductwork with supply air openings or diffusers. Symmetrical layout is intended to minimize or eliminate the use of balancing dampers.
c. Low-velocity, lined return air plenums shall return air to mechanical room.
d. Return air acoustic housing with 4” insulated double layer construction and internal sound baffles inside the mechanical room and at the return air penetration from Theater Stage.

3. AHU-3 Theater Seating

29,500 cfm variable volume, variable temperature type custom unit with 25 percent minimum outside air, full economizer and return fan.

The unit will be a 4” double-wall, custom unit arranged (back to front) as follows:

a. Return air sound attenuator.
b. Return/Relief Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.
c. Relief air, minimum outside air, and mixing air damper section
d. Prefilter: MERV 8, two-inch thick pleated panel
e. Final filter: MERV 13, 12” thick cartridge type.
f. Hot water heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
g. Chilled water cooling coils: 2 separate, 4- or 6-row cooling coils with intermediate access section for cleaning with design entering water temperature of 42 deg F and leaving water temperature of 54 deg F.
h. Supply Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers

i. Hot water re-heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
j. Supply air sound attenuators.

Distribution to and from the air handling unit to Theater Seating and Studio Theater will be as follows:

a. Supply air acoustic housing with 4” insulated double layer construction and internal sound baffles inside the mechanical room and at the supply air penetration to Theater Seating.
b. Supply air ductwork to symmetrical, lined, low-velocity ductwork with supply air openings, diffusers, or displacement diffusers for both Theater Seating and Studio Theater. Symmetrical layout is intended to minimize or eliminate the use of balancing dampers.
c. Low-velocity, lined return air plenums shall return air to mechanical room.
d. Return air acoustic housing with 4” insulated double layer construction and internal sound baffles inside the mechanical room and at the return air penetration from Theater Seating.

Distribution to and from the air handling unit to remaining zones / spaces served will be as follows:

a. Supply air ductwork to individual zone terminal units and distribution ductwork to diffusers downstream of terminal units.
b. Air terminal units with hot water zone booster heating coils.
c. Return air ductwork from zoned spaces back to mechanical room.

4. AHU-3 Back-of-House / Production

30,500 cfm, variable volume, variable temperature type custom unit with 20 percent minimum outside air, full economizer and return fan.

The unit will be a 2” double-wall, custom unit arranged (back to front) as follows:
a. Return/Relief Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.
b. Relief air, minimum outside air, and mixing air damper section
c. Prefilter: MERV 8, two-inch thick pleated panel
d. Final filter: MERV 13, 12” thick cartridge type.
e. Hot water heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
f. Chilled water cooling coils: 2 separate, 4- or 6-row cooling coils with intermediate access section for cleaning with design entering water temperature of 42 deg F and leaving water temperature of 54 deg F.
g. Supply Fan: Multiple, direct-drive plenum fans in fan array arrangement with integral silencers.

Distribution to and from the air handling unit to spaces served will be as follows:
d. Supply air ductwork to individual zone terminal units and distribution ductwork to diffusers downstream of terminal units.
e. Air terminal units with hot water zone booster heating coils.
f. Return air ductwork from zoned spaces back to mechanical room.

**MAU-1 Make-up Air Unit**
1. The Back-of-House / Production welding, scene shop and paint booth spaces will be served by a variable volume, 8,000 cfm four-pipe hot water and chilled water light-duty, make-up air handling unit with capability of 100% outdoor air.
2. Make-up air handling unit shall be factory-fabricated, 2” insulated housings, variable volume, modular units as needed for the application. The unit for the project will be arranged (back to front) as follows:
   a. Outside air duct
   b. Outside air/return air dampers with 100 percent outside air economizer capability
c. Filter: MERV 8, two-inch thick pleated panel type
d. Filter: MERV 13, two-inch thick pleated panel type
e. Hot water pre-heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
f. Chilled water cooling coils: 2 separate, 4-row cooling coils with intermediate access section for cleaning with design entering water temperature of 42 deg F and leaving water temperature of 54 deg F.
g. Hot water re-heating coil: 2 row coil with design entering water temperature of 120 deg F and leaving water temperature of 100 deg F.
h. Supply fan or fans: Airfoil plenum type with variable speed drives.

**Exhaust Systems:**
General: Exhaust fans will be a combination of roof mounted powered roof ventilators and inline fans located in mechanical rooms. Any inline exhaust fans will be ducted to exhaust louvers, gravity roof ventilators or louvered penthouses. Exhaust locations will be located so that re-entrainment of exhaust air is minimized. Any roof mounted equipment should be located in a screened area. An alternative to a screened area would be low profile visually appealing louvered penthouses. Fans located in mechanical rooms will be supported with spring and neoprene vibration isolation hangers. Roof mounted exhaust fans will be mounted on a curb with a neoprene pad.

The following are the anticipated exhaust systems:
1. Theater Support general exhaust fan – A mixed-flow, centrifugal tubular inline fan will serve the general exhaust needs of the area surrounding the new Theater.
2. Theater Studio Support general exhaust fan – A mixed-flow, centrifugal tubular inline fan will serve the general exhaust needs of the area surrounding the new Theater Studio.
3. Back-of-House / Production general exhaust fan - A roof mounted powered roof ventilator will serve the general exhaust needs of the back-of-house / production areas.
4. Loading dock / trash general exhaust fan - A roof mounted powered roof ventilator will serve the general exhaust needs of loading dock and trash areas.
5. Scene Shop dust collection system – A 5,000 cfm, 15 HP centralized, cartridge type dust collection system with compressed air cleaning assist will be installed for carpentry type woodworking equipment. Provide ductwork, explosion prevention system, duct connections to approximately 10 unique pieces of woodworking equipment with flexible drops and floor sweeps for general shop use.
6. Spray booth exhaust system – A 5,000 cfm high plume, constant volume, utility set exhaust fan will serve an pre-manufactured spray booth. Exhaust ductwork will be stainless steel and welded
7. Paint Shop and Scene Shop area general exhaust and relief fan – A variable volume inline exhaust fan will serve general shop exhaust needs
8. High flow, portable fume extractors for welding – Provide two (2) mobile floor fume extractor systems with flexible extractor arm to serve welding shop needs. Units shall be Portable Floor Sentry SS-400-PFS or equivalent.
9. Wall-mounted, fume extractors for welding – Provide two (2) wall mounted fume extractor systems with flexible extractor arm to serve theater scene shop needs. Units shall be Sky Sentry SS-400-SKY or equivalent.
10. Local, cabinet dust collectors for welding – Provide three (3) cabinet dust collectors to serve theater scene shop needs. Units shall be Jet JDC-501 Cabinet Dust Collector for metals or equivalent.
11. Dye Vat Exhaust – A 500 cfm dedicated, inline exhaust fan will serve the costume shop dye vat exhaust needs.
12. Dryer vent – a 6” dryer vent with 200 cfm inline exhaust fan shall be routed from dryer to outdoors. A code-approved duct lint trap box shall be provided in dryer vent duct. Exhaust fan shall be interlocked with dryer operation.

Fog Effects System:
1. The Theater Stage systems will be designed with a theatrical fog effects exhaust system. This is not a formal, code-defined smoke control system.
2. The fog effects exhaust system will include a single, mixed flow relief air fan sized at full Theater Stage airflow – 13,000 cfm.
3. The system will require a user interface with the building automation system and fire alarm system to engage the fog effect exhaust.

Split System Cooling Systems:
1. Rooms with sufficient cooling loads such as Telecom rooms, Elevator Machine rooms, AV rooms, and Dimmer rooms will be served by split-system, DX condensing units connected to local fan coil units.
2. Split systems shall be low-ambient rated to -20 deg, meet minimum energy efficiency targets, be selected at acceptable acoustic levels and shall have a BAS interface.
3. Split systems shall utilize LEED acceptable refrigerants and shall have refrigerant piping piped per manufacturer recommendations.
4. Exterior condensing units will be located on the roof in screened areas and areas outside of view.

Hydronic Terminal Units:
1. Cabinet unit heaters and unit heaters will be provided at each entry vestibule and the loading dock.
2. Hot water fin tube radiation:
   a. Hot water fin tube radiation shall be provided at all larger, exterior glazing systems.
   b. Typical fin tube radiation systems shall be pedestal type, with heavy-duty extruded aluminum linear grilles, pencil proof grilles, heavy-duty steel enclosure, with enclosure and extrusions painted to match adjacent wall surface.
   c. Select aesthetic spaces shall use fin tube radiation systems with single and double row fin tube radiation with custom enclosure by architecture.
Humidification Systems:
1. Piano Storage
   a. Piano storage rooms shall be served with dedicated electric steam humidifiers to maintain piano
      humidity levels.
   b. Two, electric steam humidifiers with direct injection steam manifolds will be used for main piano
      storage rooms.
   c. Units will be packaged unit, with electrically heated immersion heater connected to ductwork
      steam dispersion manifold, local tank, factory controls, and suitable for use with available make-
      up water.

Air Terminal Units:
1. Air terminal units shall be industry-standard variable air volume terminal units with integral airflow
   measurement, insulation, and electronic controls. Both interior and exterior zones will have hydronic
   heating coils. Acoustically sensitive spaces may require integral silencer package.
2. Terminal units will have a minimum occupied set-point and an unoccupied set-point to provide minimum
   ventilation levels to maintain indoor air quality and to meet code.
3. Interior zones with constant high internal cooling loads and low occupancy (electrical rooms, etc.):
   Variable volume air terminal units (no heating coils).
4. VAV System Zoning:
   a. All zones other than those served by other systems will be VAV with hot water reheat coils.
   b. No more than 3 office-type zones shall be combined into one VAV box.

Registers, grilles and diffusers:
1. Exposed supply ducts will use louvered face diffusers or grilles. Horizontal bar and “Flow Bar” grilles and
   registers will be used on finished walls. Square vane diffusers and egg-crate type return and exhaust
   grilles and registers will be used in all ceilings. The theaters and hall duct systems will not use standard
   diffusers. Deflection plates or other custom designed air deflection devices will be used.

Air Distribution Duct Systems:
1. System type: All systems (supply, return, and exhaust) will be ducted.
2. Supply air, return air, outside air, and exhaust air ductwork will be fabricated of galvanized sheet metal in
   rectangular and round shapes according to SMACNA Duct Construction Standards for 2” and 4” Pressure
   Classification, and for Class A duct sealing.
   a. Four-inch pressure class ductwork will be used for all supply ducts upstream of terminal units in
      variable air volume systems.
   b. Two-inch pressure class ductwork will be used for supply ducts downstream of air terminal units
      and any constant volume systems.
   c. Return ductwork will be 4” pressure class throughout.
   d. Exhaust ductwork will be 2” or 4” pressure class as appropriate for each system.
3. Insulated, *acoustical-rated* flexible ducts will be used for connections from supply air ducts to air outlets
   above ceilings.

Acoustical Attenuation Systems:
1. Flexible joints will be provided across building acoustical isolation joints.
2. Ducts and piping within mechanical rooms will be suspended from spring and neoprene vibration
   isolators.
3. Double wall acoustical housings of either 2” or 4” thickness will be used on the supply and return
   connections to each air handling unit. The design of the acoustical housings, including all internal
   baffles will be coordinated with the project Acoustician.
4. Duct silencers will be used as needed to minimize the noise levels transmitted through the ductwork.
5. Acoustical duct liner with antimicrobial coatings shall be used downstream of VAV boxes and in acoustical transfer ducts for all noise sensitive spaces including performance spaces, theaters, conference rooms, classrooms, studios, and meeting rooms.
6. Gypsum or loaded vinyl duct lagging may be used as required to minimize air flow noise radiating through the walls of ducts passing over noise critical spaces.
7. Double wall acoustic housing of either 2" or 4" thickness will be used on the supply and return connection to each air handling unit serving acoustically sensitive spaces. The design of the acoustical housings, including all internal baffles will be coordinated with the project Acoustician.
8. In noise sensitive spaces, manual volume dampers will not be located within ten diameters of an air terminal, inlet, or outlet.
9. Duct velocities will be maintained below those recommended by the project Acoustician.

Ductwork Insulation Schedule

1. All duct insulation in mechanical rooms shall be rigid board.
2. Supply air ductwork:
   a. Concealed or exposed, round or rectangular supply duct from air handling unit discharge up to air terminal unit (VAV box, heating/reheat coil) insulation shall be Mineral-Fiber Blanket at 1-1/2 inches thick and 0.75-lb/cu. ft nominal density, with an overall installed thermal resistance value of not less than R 4.2.
   b. Concealed or exposed, round or rectangular supply duct from air terminal unit (VAV box, heating/reheat coil) to space air discharge shall be insulated when ductwork is not in the space the air terminal unit serves or in the concealed ceiling plenum of the space the air terminal unit serves. Insulation in this condition shall be Mineral-Fiber Blanket at 1-1/2 inches thick and 0.75-lb/cu. ft nominal density, with an overall installed thermal resistance value of not less than R 4.2.
   c. Supply air ductwork shall not be required to be insulated where ductwork is located downstream of the air terminal unit (VAV box, heating/reheat coil) AND is exposed in the space it serves.
3. Return air ductwork:
   a. Not insulated unless noted otherwise on drawings (acoustic liner is required for any transfer air ducts and is also noted elsewhere and in details).
4. Outdoor air ductwork:
   Concealed or exposed, rectangular or round outdoor-air duct insulation shall be Mineral-Fiber Board at 2 inches thick and 3.0-lb/cu. ft nominal density.
5. Exhaust air ductwork:
   a. Concealed or exposed, rectangular or round, exhaust-air duct insulation between isolation damper and any penetration of building exterior (minimum of 15 feet) shall be Mineral-Fiber Blanket at 2 inches thick and 0.75-lb/cu. ft nominal density, with an overall installed thermal resistance value of not less than R 6.
6. Intake or relief louver plenums:
   a. Outdoor air intake plenums or relief air plenums shall be Mineral-Fiber Board at 2 inches thick and 3.0-lb/cu. ft nominal density.

EMERGENCY POWER

The following mechanical systems will be served by the life safety generator:

1. Controls/building automation system.
2. One natural gas boiler.
3. One heating hot water pump.
4. Elevator sump pumps.
AUTOMATIC CONTROL SYSTEM

Direct digital control systems will be provided for control and monitoring of mechanical equipment and systems. The control system will include direct digital control panels with electronic sensors, equipment controls, meters on all major utility services such as chilled water, hot water, domestic water, irrigation water, electricity, CO2 sensors, and electronic valve and damper operators.

1. Networked Direct Digital Control System:
   a. The building’s automatic control system will be a stand-alone direct digital control system with open-protocol programming and equipment by manufacturer approved by Wayne State University.
   b. The building automation system shall meet minimum requirements outlined in the Wayne State University Construction Design Standards.
   c. All controls will be BACNet over IP and will comply with any current owner facility management guidelines.
   d. All controls will be open protocol (BACNet) on both the IP and MSTP levels.
   e. Operator interface for programming, control and monitoring will be through a personal computer located within the building with remote ethernet connection capability from a compatible PC workstation.
   f. Operator interface to all building controllers and equipment will occur through a high level personal computer, monitor, and printer. Operator workstation will be provided with user-friendly interface with dynamic color graphics. System operating and maintenance, and energy conservation software, including trend logging capabilities that describe energy consumption and operating patterns will be provided.
   g. Off-site monitoring and secured control capability through internet connection will be provided.
   h. The control system for the building shall be connected connection to University monitoring system according to University guidelines and protocols with approved cyber-security measures.
   i. A separate compressed air system is required for air handling unit control valve actuation.

2. Energy Metering, Monitoring and Reporting:
   a. Building-Level Metering will be provided with a local data port connected to the building automation system for the following systems:
      i. Grid-provided electricity
      ii. Natural gas
      iii. Domestic water
      iv. Cooling tower make-up water

BUILDING SYSTEM STARTUP AND VERIFICATION

1. Testing and Balancing: HVAC air and water systems will be tested, adjusted, and balanced by an approved independent AABC or NEBB certified agency.
2. Equipment and Startup Testing: The Mechanical Contractor will complete equipment startup and testing. Each piece of equipment will be started and checked out according to manufacturer’s recommendation to assure proper operation before occupancy.

3. Owner’s Training: The Mechanical Contractor will demonstrate the operation and maintenance procedures of each mechanical system or equipment item for the Owner’s representative before occupancy. The project Mechanical Engineer may also participate in this session to help explain the design intent behind the system operations to the facilities staff.

4. Automatic Control System Testing: The Automatic Control System will be started and check out by the System Installer and by the Mechanical Design Engineer to assure proper operation and conformance with requirements before occupancy.

COMMISSIONING

At a minimum, the project shall be commissioned per Wayne State University Construction Design Standards requirements. In addition to the requirements outlined in the Design Standards, LEED prerequisite commissioning of this building will be performed. Note: LEED enhanced commissioning may also be a part of the project if deemed appropriate.

1. A commissioning authority will be engaged by the owner to commission the building mechanical systems.

2. The commissioning authority will have documented commissioning authority experience in at least two similar building projects.

3. At a minimum, the commissioning authority will be responsible for aiding in the development of the Owner’s Project Requirements (OPR) and Basis of Design (BOD), incorporating the commissioning requirements into the construction documents, implementing the commissioning plan, verifying the installation and performance of the commissioned mechanical systems, and completing a summary commissioning report.

4. The Mechanical Contractor, Controls Contractor and TAB Contractor shall participate in the commissioning process as defined and required by the Commissioning Agent.
PLUMBING SYSTEMS

Domestic Hot Water Systems
1. The building shall be served by multiple, gas-fired high efficiency domestic water heaters. Size and capacity of domestic water heaters shall be determined based on loads served.
2. Provide hot water recirculating pump to assure availability of hot water to fixtures and equipment.

Plumbing Fixtures
Provide plumbing fixtures for building areas as follows
1. Water Closets: Wall-hung, china, water conserving (1.28 gpf), hard-wired electronic sensor flush valve type.
2. Urinals: Wall-hung, china, water conserving 0.125 gpf, hard-wired electronic sensor flush valve type.
3. Lavatories: Wall-hung and counter-mounted, china, water conserving 0.5 gpm, with battery-powered electronic sensor faucets.
4. Sinks: Counter-mounted, stainless steel sinks with trim of various types and sizes.
5. Service Sinks: Floor-mounted, molded stone receptors with manual mixing faucets.
7. Wall Hydrants: Non-freeze, keyed type at building exterior.
8. Drinking Fountains: Drinking fountains shall be dual level, barrier free, self-contained, wall-hung and surface mounted electric air cooled refrigerated units with bottle filler, filter, self-closing valve, stainless steel top, anti-splash ridge, front press bar and stainless steel cabinet.
9. Mechanical rooms: Each mechanical room shall have service sinks where fitting and a minimum of a wall-mounted hot and cold water faucet with threaded hose connections.

Domestic Water Systems
1. Domestic water will be metered at the building entrance and at the cooling tower water feed with water consumption data sent to building automation system.
2. Domestic cold and hot water piping will be provided to building fixtures and equipment. Piping will be concealed within building shafts, walls and above ceiling spaces in finished areas. Piping will be exposed in mechanical and equipment rooms.
3. Water Softeners: A central duplex water softener located in the mechanical room will be provided.
4. Water piping will be Type L hard copper tube with copper solder-joint fittings and soldered joints. Solder will be equivalent to 95-5, having less than 0.10 percent lead content.
5. Water piping systems will be designed for a working pressure of 125 psig, unless higher pressures are warranted.
6. Valves in domestic water piping systems will be ball valves for sizes up to 3 inches.
7. Water piping will be provided with shutoff valves for isolation of piping sections for maintenance and repair. Locate isolation valves in walls to allow rapid access in the event of leaks or overflows. Means will be provided to drain piping.
8. Water piping will be insulated with fiberglass insulation with a foil-scrim-kraft vapor barrier jacket covering. Insulation thickness will be as required to prevent condensation on cold piping, and to prevent thermal losses on hot piping. Thickness will be as required by the Energy Code.
9. System pressure tests at or near the proposed utility connection point will be required in order to determine any requirements for local booster pumps.

Sanitary Waste and Vent Systems
1. Provide sanitary waste and vent piping to serve new plumbing fixtures and equipment.
2. Underground piping shall be schedule 40, solid wall PVC pipe and fittings.
3. Above ground sanitary waste piping shall be cast-iron pipe and fittings with no-hub couplings.
4. Provide cast-iron floor drains and cleanouts.
5. Floor drains shall be provided in toilet rooms, janitor’s closets and mechanical rooms.
6. Above ground sanitary vent piping shall be service class cast-iron pipe and fittings with compression joints, hubless cast-iron pipe and fittings with shielded stainless-steel couplings, or steel pipe with threaded joints.
7. Install piping systems according to state and local plumbing codes.
8. Sanitary waste piping will be routed by gravity to new sanitary sewer connection. Piping will be below grade, or concealed within building ceiling and wall cavities if possible. Sanitary vent piping will extend to the roof.

Storm Drain Systems
1. Provide multiple primary roof drains with internal rainwater leaders. Overflow drainage will be overflow scuppers as much as practical with some select areas with roof drains and internal leaders at same size and location as primary roof drains that discharge onto splashblocks at grade.
2. Average internal rainwater and overflow pipe size is 8 inches.
3. Roof drains will be cast-iron body types, with dome strainers.
4. Above grade horizontal stormwater collection piping below the roof level will be service weight cast-iron pipe and fittings with no-hub couplings.
5. Underground piping shall be schedule 40, solid wall PVC pipe and fittings.
6. Roof drain downcomers, horizontal storm water piping to the connection to main vertical piping, and 15 feet of vertical piping past the connection will be insulated with fiberglass insulation with a foil-scrim-kraft vapor barrier jacket covering. In addition, storm water piping will be insulated within 15 feet of storm water piping overflow discharge piping at grade. Insulation thickness will be as required to prevent condensation on cold piping. Roof drain bodies will be insulated.
7. Storm water piping will not be routed through noise critical spaces unless absolutely necessary. If any storm water piping must cross a noise critical space, it will be enclosed in a gypsum board soffit to minimize noise breakout.

Elevator Sump Pumps
1. All elevator shafts will be provided with a sump basin and duplex pumps.
2. The sump pump controller will have dry contacts to send a high water alarm signal to the BAS for remote monitoring.
3. Moisture sensors networked to the BAS may be added to indicate the presence of any moisture in the sump pits.

Compressed Air
1. A new compressed air system shall be provided to serve production spaces with compressed air drop needs. Drops shall be a combination of wall mounted and hose reels from above.
2. Provide a minimum of a single compressed air drop per mechanical room.

FIRE PROTECTION SYSTEMS

Fire Protection Sprinkler System
1. Provide new fire sprinkler protection for 100 percent of new building areas. Fire protection systems shall be served by a standard wet pipe system with dry type heads in areas subject to freezing.
2. The new fire service will enter into a lower level mechanical room and will include required backflow prevention, detector check valve, bypass meter etc.
3. Fire protection piping shall be Schedule 40 black steel piping with threaded or mechanical grooved-end fittings and couplings. Threadable lightwall piping will be allowed for pipe sizes NPS 3 and smaller. Thinwall or plastic piping will not be allowed. Galvanized piping will used on all dry pipe systems and connections to exterior fire department connection. Stainless steel flexible drops to sprinkler heads are acceptable, pending approval by the local Fire Marshal.
4. Provide zone valve and drain assemblies for main building areas. Coordinate required fire alarm, supervisor and water flow alarm connections.
5. Provide sidewall, pendent or upright sprinkler heads in spaces without finished ceilings and fully concealed, recessed pendent heads in finished areas.
   a. Concealed sprinklers in public areas shall have custom color cover plates to match the adjacent ceiling color.
   b. Exposed sidewall sprinklers in public area shall be a custom color to match the adjacent surface color.
   c. Upright and pendent sprinklers located in public spaces with exposed ceilings shall be a custom color that matches the color of adjacent surfaces or the color that other ceiling suspended equipment is painted.
   d. Sprinklers in non-public and unfinished areas without ceilings will be standard brass in color.
   e. Sprinklers in non-public areas with ceilings will have standard white cover plates.
6. Sprinklers will be located in a regular pattern, perpendicular and parallel with building lines, and in perfect alignment with other ceiling or building components. Sprinklers will be installed in
the center of acoustical ceiling tiles, and no closer than 4-inches from any ceiling edge or other ceiling component.

7. Elevator equipment rooms, shafts and pits will be protected in accordance with the ANSI A17 elevator code and NFPA 13.

8. System pressure and flow tests at the two fire hydrants nearest to the proposed utility connection point will be required in order to determine requirements and complete sizing for the fire pump.

9. Provide 6” remote fire department connection at south side of building.

10. Flow switch and flow alarm at each zone shall be interconnected to building fire alarm system. Electrically operated alarm shall be UL 464, as manufactured by Potter Electric Signal Company or equal. Electrically operated valve supervisory switch shall be UL 753, as manufactured by Potter Electric Signal Company or equal.

Hose Connection System

1. 2-1/2 inch fire department valves at each floor will be provided in or near each stair enclosure and at the stage as required for full coverage with 100 foot hoses.

2. Sprinkler zone valves with test valves will be provided from central locations on each floor.

Fire Pump

1. Since the fire protection system in this building must serve standpipes in the stairwells, a fire pump is required. The existing fire pump will be evaluated for re-use, but will need to be relocated if re-used. At a minimum, the pump controller and both jockey pump and controller will be replaced as part of this project. The fire pump controller will have a wye-delta closed starter configuration to limit inrush current. The fire pump and jockey pump will be on emergency power.

2. For purposes of pricing, the existing fire pump shall be relocated and reused.