Legacy Collections Facility Building Systems Narrative

SUMMARY OF APPLICABLE CODES AND STANDARDS

2009 ed. Michigan Rehabilitation Code (MRC)
Michigan Compiled Laws R 29.1901-29.1934 (MCL)

2003 ICC / ANSI A117.1 & Michigan Barrier Free
Design Law of Public ACT 1 of 1966 as Amended

2009 ed. Michigan Mechanical Code (MMC)
2009 ed. Michigan Plumbing Code (MPC)
2007 ASHRAE Standard 62.1
AGIHI Industrial Ventilation Standard- latest version
ASHRAE Laboratory Design Guide – latest version
ASHRAE Standard 55, Thermal Comfort for Human Occupancy – latest version
ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality – latest version
ASHRAE Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential
Buildings – latest version
OSHA/MIOSHA Laboratory Standard- latest version
ANSI Z-9.5 Standard- latest version

Tenth ed. Illuminating Engineering Society of North America (IESNA)

2009 ed. International Fire Code (IFC)
Current ed. National Fire Codes including, but not limited to:
NFPA-10 – 1998; Portable Fire Extinguishers
NFPA-13 – 1999; Installation of Sprinkler Systems
NFPA-14 – 2000; Standpipes, Private Hydrants and Hose Systems
NFPA-30 – 2003; Flammable and Combustible Liquids Code
NFPA-72 – 1999; National Fire Alarm Code

WMU Design and Construction Standards - Latest Versions

Structural Systems

The substructure for the Legacy Collections Facility will be composed primarily of reinforced concrete.

The existing soil conditions shall be examined for geotechnical analysis prior to the design of all foundation systems. The existing soil conditions at the proposed site are unknown at this time.

Current assumed structural design includes, reinforced concrete foundations around the perimeter of the new building (extending to frost depth or bearing strata), formed walls with continuous spread footings.
Within the building footprint, shallow, formed reinforced concrete spread pad footings will provide column support for interior spaces.

The first floor will be primarily a concrete slab on grade, lightly reinforced with welded wire mesh. A continuous vapor retarder will be utilized directly below slabs on grade to limit moisture transmission into the building.

Dependent upon final grading, restrained reinforced concrete retaining walls will be employed to hold back earth where necessary. A continuous water-proofing system will be applied to said retaining walls. Perforated drain tile will be required to prevent moisture infiltration into the building and hydrostatic pressure buildup against the walls.

The superstructure for the Legacy Collections Facility will be composed primarily of steel.

Steel frame construction will support open-web steel roof joists with corrugated steel roof decking.

Braced frame construction will be used in both primary building directions to resist lateral loads imposed upon the structure due to wind pressure and/or seismic activity. Diagonal cross braced frames and/or chevron braced frames consisting of steel rods and/or tubes will be integrated with the architectural design to provide adequate lateral stability for the building.

The building’s main structural systems will be modeled and analyzed using three dimensional (3D) analysis software, which will then be linked with a “Building Information Modeling” (BIM) platform, to produce the contract documents.

**Mechanical Systems**

The purpose of the design narrative is to provide technical information related to mechanical system concepts for inclusion into the new Legacy Collections Facility at Western Michigan University. The mechanical systems will be designed to consume the lowest possible energy, while assuring comfortable, safe and maintainable service for the future. Mechanical work will include and not necessarily be limited to the following:

**Outdoor Design Conditions**

The following outdoor design conditions will be used in validating the sizing of the existing mechanical heating, ventilation and air conditioning systems. The design temperatures are based on ASHRAE 2009, Fundamentals using 0.1% cooling design and 99.6% heating design for Grand Rapids/Kalamazoo Area, Michigan area.

- **Summer**
  - 89 F DB / 73 F WB
- **Winter**
  - 0 F

Summer ambient temperature for air cooled equipment: 105 F DB

**Indoor Design Conditions**

The following indoor design conditions will be used in sizing the mechanical heating, ventilation and air conditioning systems. Relative humidity will be conditionally controlled in summer cooling mode, utilizing a high limit return will be monitored and de-humidification mode will be utilized to maintain conditions.
below the high limit. Indoor temperature and humidity conditions will be in accordance with the comfort criteria established in ASHRAE 55-2004.

<table>
<thead>
<tr>
<th></th>
<th>Summer</th>
<th>Winter</th>
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</thead>
<tbody>
<tr>
<td>Auditoriums, Library, Media, Classrooms, Reading room, Office and Administrative Areas, Common areas, Loading dock area, Storage areas, Toilet Rooms, Receiving areas</td>
<td>70-72 F DB 45% -50% RH 70-72 F DB 30-45% RH</td>
<td>70-72 F DB 30-45% RH</td>
</tr>
<tr>
<td>Archive Storage Area, Conservation workroom</td>
<td>60-65 F DB 40-45% RH</td>
<td>60-65 F DB 40-45% RH</td>
</tr>
<tr>
<td>Data, Telecommunications, Elevator equipment rooms</td>
<td>68-72 F DB 50-60% RH</td>
<td>68-72 F DB 25-30% RH</td>
</tr>
<tr>
<td>Mechanical and electrical Equipment rooms</td>
<td>90 F DB Outside air ventilation only (No mechanical cooling)</td>
<td>65 F DB No Humidification</td>
</tr>
</tbody>
</table>

**Building Internal Heat Gain Allowances**

The following values will be used in validating the sizing of the mechanical heating, ventilation and air conditioning systems.

- **Lighting:**
  - Office Open & Enclosed: 1.1 watts per square foot
  - Classroom / Lecture / Training: 1.4 watts per square foot
  - Conference Room: 1.3 watts per square foot
  - Lounge / Recreation: 1.2 watts per square foot
  - Restrooms: 0.9 watts per square foot
  - Corridor: 0.5 watts per square foot
  - Active Storage: 0.8 watts per square foot

- **People:**
  - Library: 20 people per 1000 sq.ft.
  - Offices/Support: 7 people per 1000 sq.ft.
  - Conference Rooms: 50 people per 1000 sq.ft.
  - Sensible load: 250 BTU/HR per person
  - Latent Load: 200 BTU/HR per person

- **Equipment:**
  - Mechanical/Electrical Rooms: actual loads
  - Offices/Support/Classrooms: 145 watts (500 BTU/HR) per computer per person
  - Common: 1.0 watts per sq.ft.

**Internal Heat Gain Diversity at Room Level**

- Lighting: 100%
People 100%
Equipment 100%

**Internal Heat Gain Diversity at the Air Handling Unit Level**

- Lighting 90%
- People 100%
- Equipment 80%

**Air Change Rates**

Minimum air change rates will be as follows (unless heating/cooling load, makeup air, or applicable code(s) necessitate higher value):

**Mechanical/Electrical Rooms:** 4 air changes per hour - minimum

**Office/Support Areas,**
**Common Areas:**

**Archive storage areas:** 5 air changes per hour – minimum (in order to maintain required temperature differential)

**Toilet Rooms:** 10 air changes per hour (exhausted to outdoors during occupied mode)

**Indoor Noise and Vibration Criteria**

Design sound levels listed below are based on ASHRAE 2007, Design Guidelines for HVAC Related Background Sound in Rooms.

- Private offices RC 25-35 (Neutral)
- Conference rooms RC 25-35 (Neutral)
- Classrooms RC 25-30 (Neutral)
- Large lecture rooms RC 25-30 (Neutral)
- Open-plan office areas RC 30-40 (Neutral)
- Corridors and lobbies RC 40-45 (Neutral)
- Library RC 30-40 (Neutral)

**Thermostatic Zoning**

Temperature control zones for offices will be limited to 1,000sq.ft. in open office areas or a maximum of three private enclosed offices with same occupancy and exposure. Corner offices, lobbies, reading areas, and lounge rooms will be individually controlled for temperature. Each interior and exterior zone will be separately controlled.

**Outside Air Ventilation Rates**

Outside air ventilation rates will be in accordance with latest version of ASHRAE Standard 62.1 “Ventilation for Acceptable Indoor Air Quality” and/or local mechanical code or greater if required, to provide make up for exhaust air flow. Intake openings will be located away from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots, loading docks, mainstream pedestrian walkways, and cooling towers to avoid recirculation of contaminants.
CO2 will be monitored in high occupancy spaces and outside air levels will be reduced below local mechanical codes or ASHRAE 62.1 when CO2 levels are below 1,000 PPM during partial occupant load conditions.

Additionally, mechanical ventilation systems will monitor outdoor airflow rates to keep system operating at design outdoor air conditions.

**Sustainability**

The mechanical and electrical systems will incorporate the concepts of sustainable design practices. Among the key concepts are the following; equipment and systems will be designed for maintaining desired indoor environmental control, low life cycle cost, durability and ease of maintenance. Outside air ventilation rates will exceed ASHRAE Standard 62.1 by 30%. The building energy efficiency will meet or exceed the requirements of ASHRAE 90.1 by more than 20%.

Fans and pumps will utilize premium efficiency motors, variable frequency drives, variable flow control, demand control ventilation and static pressure reset strategies, air and water temperature reset strategies. Building energy management system will employ outside air flow, temperature, carbon dioxide sensors, and energy monitoring to optimize the operation of the HVAC systems. Limited landscaping irrigation, plumbing fixtures will utilize low flow fixtures with automatic sensors to minimize water usage by at least 30%.

Mechanical and electrical systems will be commissioned by a third party to obtain the enhanced commissioning objective of LEED NC criteria. Other LEED NC criteria will be utilized in the design; flush out procedures and testing procedures will be specified prior to occupancy, indoor chemical and pollution source control, enhanced refrigerant management, measurement and verification, low emitting materials, controllability of thermal comfort systems, thermal comfort design and verification.

**Duct Sizing Criteria**

<table>
<thead>
<tr>
<th>Description</th>
<th>Criteria</th>
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</thead>
<tbody>
<tr>
<td>Supply Air Ductwork - located in Mechanical Rooms and shafts</td>
<td>1500 fpm maximum velocity, 0.25&quot;/100 ft. maximum air pressure drop</td>
</tr>
<tr>
<td>Supply Air Ductwork - Overhead in occupied spaces, upstream of air terminal unit</td>
<td>1500 fpm maximum velocity, 0.25&quot;/100 ft. maximum air pressure drop</td>
</tr>
<tr>
<td>Supply Air Ductwork - downstream of air terminal units, overhead in occupied spaces</td>
<td>1000 fpm maximum velocity, 0.10&quot;/100 ft. maximum air pressure drop</td>
</tr>
<tr>
<td>Return/Exhaust Air Ductwork - Located in Mechanical Rooms and shafts</td>
<td>1500 fpm maximum velocity, 0.25&quot;/100 ft. maximum air pressure drop</td>
</tr>
<tr>
<td>Return/Exhaust Air Ductwork - Overhead in occupied spaces</td>
<td>1000 fpm maximum velocity, 0.10&quot;/100 ft. maximum air pressure drop</td>
</tr>
<tr>
<td>Mech./Elec. Room ventilation ductwork</td>
<td>1500 fpm maximum velocity, 0.10&quot;/100 ft. maximum air pressure drop</td>
</tr>
</tbody>
</table>

**Pipe Sizing Criteria**

<table>
<thead>
<tr>
<th>Description</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC piping 2&quot; size and smaller</td>
<td>Maximum velocity: 4 fps</td>
</tr>
<tr>
<td>Maximum water pressure drop:</td>
<td>4.0 ft.hd./100 ft. equiv. length</td>
</tr>
</tbody>
</table>
HVAC piping 2-1/2" thru 10" size
Maximum velocity: 8 fps
Maximum water pressure drop: 4.0 ft.hd./100 ft. equiv. length

HVAC piping 12" and larger
Maximum velocity: 10 fps
Maximum water pressure drop: 4.0 ft.hd./100 ft. equiv. length

Domestic water branch piping
Maximum velocity: 5 fps
Maximum water pressure drop: 3.0 psi/100 ft. equiv. length

**Site Utilities**

Site utilities, such as, domestic water, storm, and natural gas will be extended from mains to the building.

**Fire Protection**

A fire main will be connected to the campus domestic water main. A detector check valve will be provided. The fire department connection will be provided outside the building in an approved location by the local authority having jurisdiction.

The building will be protected by a hydraulically calculated automatic wet sprinkler system based on ordinary hazard occupancy with each sprinkler zone having its own sprinkler control valve, flow switch and drain valve in accordance with NFPA 13.

A pre-action dry pipe system will be installed in the archive storage area.

Electrical rooms will be protected by a 3 hour wall and have no wet pipe sprinkler system.

The fire sprinkler systems provided are subject to the Fire Marshal’s approval and hydraulic calculations will be based on most recent water test reports.

**Fire Pump**

A fire pump is not required and will not be provided for this facility. The existing water service will be tested and residual flow and static/residual pressure will be confirmed in the design development phase once a final site location is determined.

**Domestic Cold and Hot Water**

A new domestic water system will be provided. Services will be extended throughout the building, as required. The incoming water service will be metered to measure building consumption.

A new domestic hot water system shall be installed, including an instantaneous gas fired water heater. An opportunity to utilize a solar collector to preheat domestic hot water will be considered during the design development phase.

A master thermostatic mixing valve will limit the building domestic hot water to 110 degrees. All barrier free lavatories will be equipped with a code rated thermostatic mixing valve.

A water softening system will be installed to pre-treat make-up water to the instantaneous gas fired water heater.
The DDC system will control the domestic hot water circulation pump operation. The pump will run between 7:00 am to 10:00 pm every day during occupied time.

Water pipes will not be routed within the archive storage area.

**Sanitary Waste and Vent**

Sanitary waste will be collected in a sump pit in the mechanical room. Waste will then be pumped to a point where it can tie into a gravity sanitary sewer line. A vent system will be installed with minimal vent-through-roof locations. Code rated individual trap primer units will be provided at each floor drain.

Floor drains will not be installed within the archive storage area. Space will be monitored for water alarm through the DDC system and the alarm will be tied into a 24 hour responder.

**Storm Drainage**

A roof drainage storm water system, consisting of roof sumps and indoor roof conductors shall be designed to flow by gravity into the external storm sewer. The size of conductors, leaders and storm drains shall be in accordance with the Michigan Plumbing Code.

An independent secondary roof drainage system shall be provided the same size as the primary roof drainage system. The secondary roof drainage piping shall be terminated to daylight above finished grade.

Horizontal rainwater leaders and overflow pipes located under roof where condensation can occur will be insulated. Roof drainage piping will not be routed through the archive storage area.

**Heating System**

Two condensing boilers (sized at 100% capacity each) in the mechanical room will be used to generate 150°F heating hot water from natural gas.

Two pumps (sized at 100% capacity each) will circulate heating water from the mechanical room throughout all building areas. All pumps shall be driven by variable frequency drives. Hot water heat transfer fluid shall be water. Base mounted pumps shall be on vibration isolated inertia bases. A bladder-type expansion tank, air and dirt eliminator, side stream hydronic cartridge filtering system, and a shot type chemical feeder will be provided for heating hot water system.

Terminal heating will generally be via perimeter heating elements and VAV box reheat coils. Finned tube convectors will be used on most perimeter walls to offset envelope heat loss. Pedestal mounted finned tube radiators will be installed in the front vestibule. Reheat coils will be provided on variable air volume terminal boxes. Hot water unit heaters will be used in the mechanical room for winter space tempering.

A separate pumped variable flow perimeter heating loop (one primary pump and one standby pump) will be provided via a bridge arrangement. This will allow the perimeter heating system supply water temperature to be reset independently of the main loop based on outside air temperature and capable of being disabled during summer cooling season.
Snowmelt System

Radiant heating will be used for snowmelt at all major public area building entrances. A plate and frame heat exchanger in the mechanical room will generate 135°F radiant heating water from the main heating hot water loop. One pump (sized at 100%) will circulate radiant heating water from the mechanical room to a manifold located in the snow melt zone. The circulating pump shall be constant flow type. The system will be integrated into the existing campus wide BMS for snow melt initiation.

Radiant water heat transfer fluid shall be 50% water – 50% propylene glycol. Tubing to be cross-linked polyethylene (PEX) embedded in the concrete slab. All embedded tube locations and manifold locations to be confirmed during the Construction Document phase. A packaged automatic glycol feed pump will be used to maintain system pressure.

Humidification System

Archive storage space humidification will be provided by an air handling unit mounted steam injection humidifier. Natural gas will be used to generate clean steam. A deionized water system will be used to generate makeup water for the clean steam humidifiers. The clean steam generator and deionized water system will be sized for future connection to two additional high-bay storage space air handling units.

Cooling System

The building will be served by two outdoor air cooled chillers, each sized for 50% of the building load. Two pumps (sized at 100% capacity each), will circulate chilled water from the mechanical room to the air handling unit cooling coils. All pumps shall be driven by variable frequency drives. Base mounted pumps shall be on vibration isolated inertia bases. A flow measuring device will be provided to monitor building chilled water cooling demand through the DDC control system. A packaged glycol fill station will be provided to maintain the system pressure of the chiller system. Pressure of the chilled water system will be monitored by the DDC system. Chiller system will run 24/7 year round. Additional opportunity to utilize a heat recovery device and/or water side economizer will be considered during the design development phase.

Future expansion considerations for two additional high-bay archive storage spaces will be included in the design. These include a third air cooled chiller, a third chilled water pump, sizing and routing of piping designed for future equipment, and valved/capped connection points.

The IDF room will be served from a dedicated package precision cooling unit that is operational 24 hour a day. Year round cooling will be provided to this area. Emergency power shall be provided to cooling equipment serving this room.

Air Handling Systems

Two indoor air handling units (one serving the office area and one serving the archive storage area) will be provided to serve the various areas throughout the building.

The office area air handling unit will be a mixed air type and it will be equipped with an integral variable flow supply and return plenum fan array, economizer section, air blender, hot water heating coils with coil freeze protection pumps, chilled water cooling coils, medium efficiency MERV 8 pre-filters, high efficiency MERV 14 bag filters, supply and return fans with a variable frequency drives, sound attenuators (where required), heat recovery wheel with bypass during economizer cycle, monitoring of outside air flow,
monitor supply and return air flow and direct digital controls. Additional UV filtration will be provided within the air handling unit.

Air distribution will be via overhead ductwork and variable air volume terminal boxes and supplied at high level via mixing type diffusers and returned at high level through plenum return in the ceiling. VAV boxes will have hot water reheat coils, electric control valves and DDC controls. VAV units will be selected to accommodate the required capacity. Sound attenuators will be provided where required.

The archive storage area air handling unit will be a mixed air type and it will be equipped with constant flow supply and return plenum fan array, hot water heating coils with coil freeze protection pumps, chilled water cooling coil, clean steam humidifier, medium efficiency MERV 8 pre-filters, high efficiency MERV 14 bag filters, active desiccant dehumidification wheel with heating hot water regeneration air preheat coil and electric regeneration air heater, supply and return fans with a variable frequency drives (to compensate for filter loading), monitoring of outside air flow, monitor supply and return air flow and direct digital controls. Space will be provided within the air handling unit to accommodate gaseous filtration.

The air handling unit supply and return air ductwork will tie into recirculating air system in a bridge arrangement. The recirculating system will cycle a large volume of air through the archive storage space to limit the supply air to return air temperature differential to a maximum of 5 degrees.

Air distribution will be via permeable fabric ductwork routed high in the truss space above the archive storage and returned at a low level with return air grilles near the floor.

Constant outside air will be used in the archive storage area- no economizer control will be utilized in order to maintain a tight environmentally controlled space. Archive air handling unit will utilize an energy efficient reheat dehumidification system to maintain low relative humidity within the space. Archive unit will run 24/7 year round. Unit will run under positive pressure with respect to adjacent spaces.

A constant volume exhaust fan will be provided for toilet room exhaust systems.

**Mechanical and Electrical Utility Rooms**

Constant volume supply and return/exhaust fans will provide ventilation of the mechanical room and electrical substation room in a “push/pull” type arrangement. Mixing dampers at each fan will modulate to maintain space temperature and provide ventilation to these spaces.

**Temperature Controls**

A micro-processor based building management system (BMS) employing direct digital controls (DDC) will be provided to monitor, control and optimize the operation of the HVAC systems. Stand-alone DDC panels will be networked together within the building and connected to central operator workstation for monitoring and control. The building control system will be connected to the campus central control system.

Graphical based operator interface will be provided at the existing BMS operator workstations. Control of the central HVAC equipment, as well as individual room controls where indicated, will be DDC type, networked and fully integrated into the building-wide BMS system. Off-hours scheduling of individual areas will be programmable through the BMS system.

Electric type valve and damper actuators will be used on the central HVAC equipment automatic valve and dampers. Actuators for individual room controls will be electronic type for supply air terminal boxes and terminal unit hot water coils, with DDC room temperature sensors and carbon dioxide sensors in high occupancy spaces.
Electrical Systems

Typical Building Load Densities

For preliminary design purposes, the load densities outlined below shall be used. Note that listed lighting densities are the maximum allowable per ASHRAE 90.1-2007 under the Space-by-Space Method.

- Stacks: 1.7 watts per square foot
- Reading Area: 1.2 watts per square foot
- Office Lighting: 1.1 watts per square foot
- Conference Room Lighting: 1.3 watts per square foot
- Restroom Lighting: 0.9 watts per square foot
- Corridor Lighting: 0.5 watts per square foot
- Active Storage Lighting: 0.8 watts per square foot
- General Power: 2.0 to 3.0 watts per square foot
- Mechanical Equipment: 3.0 to 5.0 watts per square foot
- Future Loads: 1.0 watts per square foot

Service Entrance

The new Legacy Collections Facility will be fed from the 13.8 KV loop at the Health & Human Services Building. The loop will be extended from the HHSB via a new underground duct bank. The duct bank will come from the loop switches at the HHSB, run out the back of the building towards the west and then south along the back road. Once the duct bank gets beyond the mental health facility, the duct bank will cut back to the east and follow Cass Road to the proposed archive building site. Manholes will be provided at a maximum of 1000 feet apart or after 3-90 degree turns. A manhole will be provided where the duct bank cuts back to the east towards Cass, for a future possible building. The duct bank will consist of six 4 inch PVC conduits concrete encased with a minimum 3 inch cover. The duct bank will end in the main electrical room of the Legacy Collections Facility.

The 15 KV service entrance conductors will terminate at a primary switch section consisting of a pair of loop switches and a fused transformer switch. The primary switch section, substation transformer, and secondary voltage switchgear shall be on flush-mounted leveling channels in a 4” high concrete pad. The transformer shall be sized in order to support the new Legacy Collections Facility and one additional bay to the storage area. The transformer will be a dry type with fan cooling (300KVA AA/400KVA FA). Lightning arrestors shall be provided at the incoming primary switches.

The substation grounding mat will be installed beneath the substation room and will meet the 5-ohm requirement as stated in the WMU Electrical Guidelines.

Power Distribution

The low voltage section of the new substation will consist of one 300KVA AA/400KVA FA single-ended secondary transformer with 208Y/120V draw-out air power circuit breakers. The substation main and secondary draw-out breakers shall be equipped with integral metering capabilities within the breakers trip unit.

Besides the main electrical room, dedicated electrical closets (approximately 100 gsf each) will be provided as appropriate for the building. Electrical closets will include space for future growth. It is estimated that the building will require approximately four lighting/receptacle panelboards. It is estimated that at least one electrical closet will be required beyond the main substation room.
The project team will pursue the LEED credit for “Measurement & Verification”. As such, electrical metering will be placed on the low voltage switchgear, lighting panels, and receptacle panels. Major mechanical motor loads will also be metering. There shall be a separate revenue grade meter ahead of the main and in addition to the main breaker metering capabilities. All electrical metering will report load data to the Building Management System for monthly and yearly load comparison. All electronic meters shall be per WMU standards.

Branch and feeder conductors shall be Type THHN/THWN stranded copper in conduit with a minimum size of #12 AWG for power and lighting. Compression or mechanical type connectors shall be used for conductors larger than #10 AWG. The minimum conduit size shall be 3/4”. Rigid, galvanized, threaded conduit shall be used in hazardous locations or where subject to physical damage. Electrical Metallic Tubing (EMT) may be used in interior partitions and above suspended ceilings. MC cable or flexible conduit may only be used for lighting fixture or vibrating equipment connections.

All equipment and non-current carrying metal parts of the electrical system shall be grounded in accordance with the NEC. Each branch circuit and feeder shall contain a separate grounding conductor. Equipment grounds and neutral conductors shall not be electrically interconnected on the load side of the service entrance.

In general, receptacles shall be 20 ampere, 125 volt, NEMA 5-20R configuration, specification-grade type. A maximum of six receptacles shall be connected per circuit. Ground Fault Circuit Interrupter (GFCI) receptacles shall be used in custodial rooms, toilet rooms, and other locations as required by the NEC.

A surge suppression device shall be included at the new substation distribution section as well as appropriate 208Y/120V panelboards downstream.

**Emergency Distribution**

A 150 kW (preliminary estimate), 208Y/120V emergency natural gas generator will be provided for emergency and standby loads. Emergency loads will consist of lighting loads and fire alarm panels. The standby loads will consist of the environmental equipment for the archive storage area, telecommunications rooms, associated telecommunication cooling, and security panels. The generator will feed separate automatic transfer switches for emergency and standby loads which in turn will sub-feed their respective loads. The generator will be located at the exterior of the building. The generator and associated ATS’s shall be as manufactured by Onan. A dedicated room will be required to house the emergency system distribution panels and automatic transfer switches (ATS’s). The main electrical room shall include lighting from the generator and a 120v outlet from the generator source.

The generator shall have a sound-rated enclosure, Critical Level 2. The radiator-side of the generator shall face opposite the building.

**Lighting Systems**

Interior lighting levels shall comply with the latest recommendations of the Illuminating Engineering Society of North America (IESNA). Work plane illumination for typical spaces is outlined below:

- Conference/Meeting Rooms: 30 foot-candles
- Private Office: 50 foot-candles
- Open Office with Intensive VDT Use: 30 foot-candles
- Open Office with Intermittent VDT Use: 50 foot-candles
- Toilets and Washrooms: 10 foot-candles
- Stairways and Corridors: 10 foot-candles
- Storage, Active, Bulky Items: 10 foot-candles
- Storage, Active, Small Items: 30 foot-candles
- Mechanical/Electrical Rooms: 30 foot-candles
- Collection Storage: 20-30 foot-candles (Wilsted Consulting recommendation)

With the pursuit of LEED-modified wattage densities on this project, the IESNA illumination levels will be specifically targeted for defined task surfaces.

The lighting systems will generally be based on T8, 4100 degree K fluorescent lamps. To limit ultraviolet damage to the collections, lighting fixtures will have a maximum of 10 microwatts per lumen of ultraviolet light, achieved either by lamp type or by filters.

The storage lighting will consist of continuous rows of linear fluorescent fixtures that run perpendicular to the high-density shelving system. Switching strategies will be developed to coordinate with the shelving system and to minimize the amount of fixture usage (i.e. low fixture usage will minimize ultraviolet damage). One strategy may be to have the high-density shelving system inform the lighting system the location of the aisle such that only a select number of fixtures need to be energized.

Typical private office lighting will consist of two components. Low-level ambient lighting will be provided by pendant-mounted direct/indirect fluorescent fixtures. These lights will be controlled by occupancy sensors. Task specific lighting will be provided by table-top or furniture-mounted task lighting, with long-life, low-wattage L.E.D. lamping. Tasks lights shall have an integral power switch.

Conference room lighting will consist of pendant-mounted direct/indirect fluorescent fixtures. The locations of these fixtures will be coordinated with any ceiling-mounted LCD projectors. Approximately two to four switching zones are anticipated with occupancy sensors.

Storage and utility room lighting shall consist of chain hung fluorescent fixtures.

In corridors, open public spaces, offices, conference rooms, toilet rooms, storage rooms, and the high bay storage collection, occupancy sensors shall be used to automatically turn off lighting. Occupancy sensors shall not be used in IDF Rooms or potentially hazardous spaces, such as electrical or mechanical rooms. Local switches shall be provided in all spaces in accordance with ASHRAE 90.1-1999 and LEED credit “Controllability of Systems”.

Daylight harvesting sensors will be provided in appropriate spaces.

Night lighting systems, defined as 24-hour and 7-day unswitched operation, shall be minimally utilized. Night lighting may be used at vestibule areas and areas that require security cameras.

Exterior lighting will be provided for the new building. Lighting will consist of wall-mounted fixtures, parking lot poles and fixtures, downlight fixtures and pedestrian walkway fixtures. Primary goals of exterior lighting systems will be to enhance campus security and to illuminate life-safety egress paths away from the facility.

The preferred walkway lighting fixtures are “Spectra” utilizing 32-watt fluorescent, cold-weather lamps and ballasts. During design, alternative types of fixtures will be explored.
**Fire Alarm System**

The fire alarm system for this facility shall be based on Simplex 4100U. The FACP shall be located at the loading dock. A remote annunciator panel will be located at the main lobby front door.

Throughout the building, addressable pull stations, detectors, strobes and speakers shall be provided to comply with the latest version of NFPA 72. Speakers will allow voice evacuation and emergency paging functions. Dual-action strobes will have a white lens for fire alarm and an amber lens for mass notification.

Duct smoke detectors will be installed in mechanical air handling units and in all ducts with smoke dampers. Smoke detectors shall be provided in the main substation room. Fire alarm wiring shall be plenum-rated where allowable and within conduits for all exposed areas below 10 feet or above hard ceilings.

A Very Early Smoke Detecting Alert (VESDA) system will be used in all collection storage areas. A VESDA system would provide the earliest possible warning of a potential fire and allow the Owner to investigate the potential problem well before fire spread or sprinkler discharge. This system will be tied into the Simplex 4100U control panel.

The fire alarm tie-in to campus police will be via a local fiber optic loop.

**Lightning Protection System**

The building shall be equipped with a lightning protection system. This system shall be specified as an Underwriter’s Laboratory Master Label System. Lightning strike energy shall be dissipated to ground to minimize structural failures and maximize personnel safety.

**Auxiliary Systems**

Cable trays and conduit raceways shall be provided for voice, data, audio/visual, intrusion detection, surveillance camera, and access control systems. Sleeves shall be provided from rooms to corridor cable trays. As the design of the facility continues, the requirements and locations of these raceway systems shall be coordinated with the IT department of Western Michigan University.

A dedicated MDF room will be required. A telecommunications concrete-enclosed duct bank (four 4 inch conduits) will be provided between the new Archives building and the HHSB following the same route as the electrical primary service. It is not anticipated to have any IDF rooms due to the size of the facility.

The new building will utilize Category 6 cables. Final determination will be made by the WMU. Routing for data cables shall be 300'-0” maximum from MDF/IDF to the data jack. All data jacks shall be based on a Panduit solution. Each rack in the MDF / IDF shall be provided with one 208 volt, single phase, 30 amp service and one 120 volt, 20 amp service both off the standby generator system.

A wireless data system will be provided throughout occupied portions of the building utilizing “Oberon” ceiling boxes to conceal data antennas.

Desktop computers shall be hard-wired data, while wireless connectivity will be available to laptops in interior occupied spaces.

Card access, motion detectors, and CCTV will be utilized to protect collection storage areas, MDF/IDFs and exterior doors. Campus standards for card access and surveillance CCTV are based on “Open
Options. Building entrances will have security surveillance cameras as well as “look ahead” wall-mounted monitors.

The building automation system shall be connected back to the campus system.

The building will be provided with coaxial cables for cable TV as directed by the Owner.

**Miscellaneous**

A clock system will not be included in this building.

Hard wired handicap pushbuttons will be utilized for all door operators.

The design will include an emergency duress box at the front entrance which connects to a local blue light and automatically notifies the campus police.