

WAYNE STATE UNIVERSITY

CONSTRUCTION DESIGN STANDARDS

Wayne State University
Facilities Planning & Management
5454 Cass Avenue
Detroit, Michigan

November 16, 2018

Preface

WAYNE STATE UNIVERSITY

Construction Design Standards

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INTRODUCTION

The purpose of WSU's Construction Design Standards is to assure uniformity, quality, compatibility and ease of maintenance of construction projects. These standards are further intended to establish a measure of consistency in the delivery of professional design services to Wayne State University.

This document contains design guidelines for use in the design and construction of facilities at Wayne State University. It shall be used by all design professionals and contractors in the development of construction documents and construction. This is a continually evolving document, and users are cautioned to confirm that they are in possession of the University's current version, which may be viewed at the Design and Construction Services web page at <http://www.facilities.wayne.edu/design/index.php>.

These Standards are NOT CONTRACT SPECIFICATIONS, nor do they modify the form of agreement between the University and the Design Professional. They may, however be incorporated by reference by the University in contract documents. They are intended to address aspects of equipment, systems, or methodologies about which the University has as a preference or requirement to standardize the built environment.

Deviation from these Standards is not permitted. However, the University recognizes that deviations are inevitable due to special circumstances. THE APPROVAL OF A DEVIATION FROM THESE DESIGN GUIDELINES RESTS SOLELY WITH THE UNIVERSITY. Requests for deviation from these design guidelines must follow the process defined herein. Deviations from these standards which are made without the written approval of the University may be construed by the University as a specification error and may be addressed according to provisions of the contract.

CODES AND REGULATORY AGENCIES

The Design Professional who is contracted to execute a specific project design is wholly responsible to incorporate all prevailing code requirements into the project design. Wayne State University's Construction Design Standards is not intended to supersede any prevailing architectural, construction, life safety code, or other code or law.

The design professional is responsible to research and address all governing code requirements during the preparation of the documents and shall present a comprehensive list to the University's Project Manager for review. The Design Professional shall consider:

Codes and Jurisdictions

- NFPA (with Michigan Amendments.)
- ADA & Michigan Barrier Free Code
- City of Detroit – Elevator Code
- Michigan Building Code (complete)
- Michigan Energy Code
- NEC, National Electrical Code (with Michigan amendments)
- Michigan Rehabilitation Code for Existing Buildings
- Michigan Fire Prevention Code
- MIOSHA Standards – General Industry
- Wayne County Soil Erosion Authority
- Other codes and standards as may be applicable

The primary code for renovations to qualifying buildings shall be the Michigan Rehabilitation Code for Existing Buildings

Design Standards and References

ASHRAE 90.1 -1999 Energy Standards

ASHRAE 62-1999: Ventilation for Acceptable Air Quality

ASHRAE 55-1992, Addenda 55a-1995 – Thermal Environment Conditions for Human Occupancy,

Sheet Metal and Air Conditioning National Contractors Association (SMACNA) Indoor Air Quality Guidelines for Occupied Buildings Under Construction, 1995 Chapter 3

US DOE/EPA Energy Star Guidelines

IESNA Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99)

Forest Stewardship Council Guidelines

South Coast Air Quality Management District Rule No.1168 Adhesive Applications

Bay Area Resources Board Regulation 8, Rule 51-Adhesive and Sealant Products

Green Seal Paints and Coatings Requirements-Paints (GS-11); First Edition 5/20/1993

Carpet and Rug Institute Green Label Indoor Air Quality Test Program\

Triangle J Council of Governments, “Waste Spec” – Model Specification for Construction Waste Reduction

Enforcing Authorities

Wayne County Soil Erosion Authority

City of Detroit (Elevators; public sidewalks and curb cuts)

Michigan Department of Licensing and Regulatory Affairs (LARA)

- Bureau of Construction Codes
- Bureau of Fire Services (LARA)
- WSU Fire Inspector

The Design Professional is cautioned to determine with the University, what jurisdictional requirements exist regarding the submission of plans and specifications to the Michigan Department of Licensing and Regulatory Affairs (LARA), Office of Fire Safety, the University’s Risk Management Department, the University’s insurance carrier, or other organization or agency as applicable. Certain projects may be funded in part or in total by third parties who may reserve the right to review, comment and/or approve design.

WSU Fire Inspector

The University requires the participation of the WSU Fire inspector in all plan reviews, even those which include Michigan Department of Licensing and Regulatory Affairs and the Bureau of Fire Safety. The WSU Fire Inspector can advise the design professional on all matters of required submittal and general oversight. All communication with the WSU Fire inspector shall be initiated by the WSU Project Manager; any direct correspondence by the Design Professional to either the Bureau of Fire Services or the WSU Fire Inspector shall be copied to the WSU Project Manager.

VOLUNTARY ALTERNATIVES

The University may require that specific vendor's products be used to assure job quality through reliability, consistency, product continuity, ease of maintenance, durability, and manufacturer's proven maintenance and warranty support. No sole sourcing is permitted without written approval from WSU.

The Design Professional is encouraged to recommend alternates to either the specific project under design or these Construction Design Standards when it is believed that greater value will be realized by the University. Construction Documents shall be crafted to invite the various contractors to include voluntary alternates as addendums to their bid. However, in doing so it shall be the responsibility of the contractor and/or manufacturer to demonstrate to the University's satisfaction that equivalency of performance, quality, and reliability in fact exists.

Use of the phrase "or equal" after any specific vendor's product identification is to be avoided. Language regarding the submission of Voluntary Alternatives must be incorporated in the general conditions section of the specifications which clearly addresses the University's expectations.

The University encourages voluntary alternatives from the contractors to be addressed at bid time. Bid response forms will require that the contractor provide a base bid, in order to be considered for a voluntary alternate, which shall be included in sufficient detail in the bid response form to allow for a thorough investigation and evaluation. Voluntary alternate recommendations presented thereafter must be accompanied by improvements in schedule, reduction in cost, and/or any other compelling reason for acceptance by the WSU Design and Construction Standards Committee.

INTERPRETATION OF DRAWINGS AND ORDER OF PRECEDENCE

The Owner relies upon the Design Professional to interpret the documents developed for construction. The development of a cohesive and coordinated set of documents is expected.

To facilitate dispute resolution, the Design Professional shall incorporate a statement within the general notes or appropriate specification section applicable to the general contractor and all subcontractors that establishes the order of precedence of documents for the interpretation of design intent.

Such order shall be:

- Specifications shall have precedence over all drawings.
- Larger scale drawings shall have precedence over smaller scale drawings.
- Schedules and Tables shall have precedence over detail drawings and sections.
- Detail drawings and sections shall have precedence over smaller scale drawings.

CONSTRUCTION DOCUMENTS

Construction Document Production

The Design Professional shall create drawings using electronic media. Wayne State University (WSU) will only accept documents transmitted to WSU ready for use on the version of "AutoCAD" currently used by WSU. All CAD drawings must be in accordance with WSU Standards as outlined below.

Identification:

All documents, drawings and correspondence shall bear the WSU Project Number, Building Name and Project Title. For new buildings, WSU will be responsible for assigning a building name and number. A campus key plan and a building key plan included on the cover sheet indicating the project location. All Drawings shall bear the logo of WSU and a building key plan indicating the project location when applicable. The Wayne State University logo may be acquired through the Marketing & Communication Website at www.mac.wayne.edu.

A/E and Design Build Contractor Construction Set

1. All project CAD files shall be submitted electronically at the 100% construction/bid document stage and for each addendum or bulletin (for large projects CAD files shall be issued for each Bid Pack).
2. Electronic files using AutoCAD (WSU current version) or later. No other formats will be accepted. Contact the FP&M Project Manager for the most current version being used by Wayne State University.
3. Other software may be used in the production of CAD files for Wayne State University; however, it is the consultant's responsibility to ensure COMPLETE AutoCAD compatibility (including layers) and data integrity. CAD drawings must be identical to hard copy versions submitted.

Contractor As-Built and A/E Record Building Drawing Set

1. The Design Professional, or Design/Build Contractors are required to transmit to the WSU Project Manager a comprehensive CAD drawing set updated to As-Built accuracy, which incorporates all construction changes and modifications as provided by the Contractor's marked up As-Built document submission, which includes all Contractor's original marked up tracings., Three additional complete printed sets of the record documents shall be provided. Contractor As-Built and Record Drawings must be submitted and approved by WSU **prior to final payment to Contractor or Construction Manager**. Contract Documents shall incorporate language requiring the Contractor to provide a set of As-Built documents to WSU at the time of Substantial Completion to allow the maintenance and operating departments sufficient information to manage the newly constructed project.
2. Electronic files using WSU's current AutoCAD version. No other formats will be accepted. Contact the FP&M Project Manager for the most current version being used by Wayne State University.
3. Other software may be used in the production of CAD files for Wayne State University; however, it is the consultant's responsibility to ensure COMPLETE AutoCAD compatibility and data integrity. CAD drawings must be identical to hard copy versions submitted.
4. A list of layers for each drawing and descriptions of each layer. Hard copy and electronic. Matrix format is recommended.

5. When an A/E firm is the Design Professional of record, the modification of the construction drawings to As-Built condition shall be the responsibility of the Design Professional.

Media

Media Types

Electronic data may be submitted to Wayne State University on DVD ROM. Preliminary submittals may be sent via email to the FP&M Project Manager.

Required Documentation

The electronic data deliverable package will be submitted on accepted media and accompanied by a hardcopy description of the submittal. The package will include:

- A hard copy on bond paper, identical to the electronic file.
- An electronic file of all As-Built Drawings (* DWG) with X-REFS, LINE-TYPES, FONTS & TITLRBLOCK included

Media Labeling

All media submitted to WSU is to be labeled in the DVD case and on the DVD as follows:

WAYNE STATE UNIVERSITY

Date:

Wayne State University Proj #:

Project Title:

Consultant Proj #:

Consultant CAD Contact Person:

Building Name and Number:

Filename(s) on disk:

File Description

Each submittal is to be accompanied by a letter of transmittal that identifies the media, quantity, status and description of its contents including file names.

Required Data

File Types

The files which will be included in any submittal will fall into the following three categories.

Text Files

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Only ASCII text files will be accepted.

Drawing Files

The only types of drawing files to be included in the deliverables will be WSU current AutoCAD version and will have the DWG extension. DXF or DGN files will not be accepted.

Raster Files

The only types of raster or image files that will be accepted are TIFF, JPG.

File Information

All information included in hard copy submittals is to be included in electronic data deliverables.

File Format

All submittals shall be clearly and systematically organized and incorporate industry standard drafting practices. All submittals to Wayne State University shall have colors set by layer, not by entity. Graphic elements representing a physical component of the project (i.e., lines indicating a wall or a block indicating a light fixture) shall be shown only one time in the submittals. If additional references to the object are needed in additional drawing files they shall be shown via an external reference of the original file.

File Size and Organization

It is the responsibility of the consultant to organize drawing information coherently and maintain reasonable file sizes. Major contributors to excessive file sizes are unreferenced blocks, redundant line work and hatches. Files should be purged before submittal to remove unnecessary data and reduce file size.

Copy and Compression Format

All drawings provided electronically must open using AutoCAD. Any unreadable submissions will be replaced at the consultant's expense. If the CAD files are submitted in compressed form, the compression utility must be provided to allow for decompression. Directions must be included with the transmittal and electronically in the root directory on the electronic media.

Reference Files and Blocks

All referenced files, X-Refs, shall be located in the same directory as the dependent files and shall NOT include pathnames in the reference file attachment. This includes any raster images that may be included such as title photos, etc. If blocks are used in the documents, then they are to be consistent throughout. For example, if fixture "A" is a block, then all locations where fixture "A" is shown shall be of the same block.

Any reference files or block files pertinent to the content of the master file are required data and are to be included on the File Description.

Document File Format

There shall be one drawing file, saved in a plot-ready format, corresponding to each hard copy submittal sheet. Document files shall be formatted utilizing paper space. Plotting should take place from paper space at a scale of 1 = 1.

File Naming

All files included in the electronic data deliverable package will conform to the following file naming convention that is based on Uniform Drawing System published by CSI. Alternative file naming conventions may be utilized only with prior written approval of a detailed alternative. Approval of alternate naming conventions is solely at the discretion of the Wayne State University Facilities Planning & Management.

Similar name guidelines have been defined for both Model and Sheet file types. The first character is the discipline code designator, then a hyphen.

Model file name example: ____ - 0 1

This applies to both file types and must be one of the following:

- A Architecture
- C Civil
- E Electrical
- F Fire Protection
- G General
- H Hazardous material
- I Interiors
- K Kitchen Equipment
- L Landscape
- M Mechanical
- P Plumbing
- Q Equipment
- R Resource
- S Structure
- T Communications
- X Other disciplines
- U Utilities Infrastructure
- Z Contractor/Shop drawings

Sheet File Names

The remaining characters following the File Type will be the Sheet File Name. These are numeric and indicate the sheet sequence number. Wayne State University would prefer a system using numeric sequence by file type (i.e. A-1.0, A1.1 and so on) rather than a numeric number of the entire set (i.e. 100, 101, 102 etc.). The preferred system not only helps with electronic filing, it saves time for those who are looking for hard copy drawings.

Sheet file name example: A 1 0 1

Drawing Formats and Graphics

Sheet borders, title block and data, consultant's stamp, logos and all other components of the master drawing sheet shall be located in paper space.

AutoCAD Compatibility

CAD File deliverables must be in AutoCAD format, and work on WSU's current version of Autocad. All files delivered to Wayne State University will be thoroughly tested for compatibility and integrity. In many cases, third-party software has been used to produce CAD files and may contain predefined entities such as linetypes, symbols and blocks. Files delivered to Wayne State University must be free of any copyrighted or other material whose distribution is prohibited.

Entities

All graphic entities shall be comprised of representational and geometrically accurate entities. For example, a circle shall be represented by a circle entity and not a visually equivalent collection of line segments. Items shown in a dashed line type shall be created with the LINETYPE" feature and not by individual line elements. These characteristics are typical of files that have been converted from some other format and they will not be accepted. Likewise, files in which all blocks are exploded, or all data is on a single layer will not be accepted.

Good drawing technique goes a long way in AutoCAD drawings. It is expected that submittals to the University will be of the highest quality. The following are considered poor technique and should not be present in CAD products delivered to the University.

Redundant Lines - There should be no redundant lines. These typically are forms of multiple line segments in the same place or two segments joined to make a single segment. This also applies to text entities

Redundant Blocks - Care should be taken to ensure that only one insertion occurs for a block. Also make sure that the block itself only contains one copy of the image.

Open Intersections - One of the most important and basic tools used in CAD is object snap. By using snap, the CAD operator is sure to produce clean and closed intersections. Intersections are very important since they provide accurate snap positions and are required as part of area boundaries.

Also,

- All entities shall be colored 'BYLAYER' and not individually by entity.
- Please **avoid** the use of Yellow. It may be desirable on-screen but is nearly illegible when plotted. Colors shall NOT be used for text or symbols.
- If the drawing is to be three dimensional than it should be consistently and accurately drawn as such, otherwise it is a two-dimensional drawing and all 'Z' coordinates should be 0.0.
- All blocks shall be created from layer "0". **Nested blocks should be avoided.**
- NO information shall be stored on layer "0".
- Blocks shall not be mirrored. Mirrored blocks cannot be exploded, and their attribute cannot be edited.
- Temporary blocks used during file creation or editing shall be exploded and purged.
- Both model and **paper space** (preferred) origins shall be 0, 0.
- Drawings shall be saved with the ACAD.MNU as the current menu.

Drawing Environment

AutoCAD allows the choice between two drawing environments: model space and paper space. Model space is AutoCAD's working mode for creating the model. The model is a subset of a building's geometry and its physical components such as walls, doors, windows, columns, beams, outlets, ducts, etc. The model is **always** drawn at full scale (1:1). Paper space enables one to take the model and create a variety of views or scales for plotting. Each sheet represents one plotted drawing at full scale.

Paper Space

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General project graphic elements such as title blocks, legends, key plans, plan titles, riser and schematic diagrams, and sheet specific notes should be drawn in paper space.

Model Space

The drawing or model may be created in model space. This drawing must be drawn at full scale (1:1). Any additional items that help define the model or add model data such as details, schedules or sections must also be drawn at full scale in model space. Consistency in keeping related model elements in model space along with proper layer assignments will allow the use of x-refs and the ability to keep information dynamic and updated among disciplines.

Prototype Drawing Files

Prototype drawing files and symbols shall be utilized as provided by the University. These may include but not be limited to title sheets, formatted drawing files, drawing symbology and other blocks. When blocks contain attributes all relevant attribute fields are to be filled out.

Standard Sheet Sizes and Formats

All sheet sizes are to be limited to five standard formats. Required sheet size is specific to each project and is under the discretion of the University. They are as follows:

ANSI A Plot - 8 1/2" x 11"

ANSI B Plot- 11" x 17"

ARCH D Plot - 24" x 36" (preferred format)

ARCH EI Plot - 30" x 42"

ARCH E Sized Plot - 36" x 48"

GRAPHICS

Text

All text is to be created only with standard AutoCAD or standard Windows TrueType fonts. Exceptions will be made; however, **they must be approved by the Construction Project Manager**, in writing, and the source font file must be included in the root directory of any electronic deliverable or submittal.

All text sizes are to plot and display in accordance with the following minimum sizes:

Schedules - 1/8" Dimensions and Notes - 1/8"

Grid Numbers - 3/16"

Sheet Detail Title - 3/16"

Sheet Title - 3/16"

Sheet Number - 3/16'

The model space drawing and the paper space layout are created at a 1:1 scale, so the model space text must be scaled by a factor in relation to the paper. The scale factor is multiplied by the desired plotted text height or the AutoCAD text height. This scale factor is always reciprocal of the drawing scale. When using paper space, the zooms option 'XP' allow you to scale each viewport. The XP scale factors (1/scale factor XP) are the same factors used to convert text height in model space.

For example, if you wish to plot a drawing at a scale of 1/8" = 1', calculate the scale factor as follows.

1/8' = 1'

0.125" = 1'

$1/0.125 = 96$ (The scale factor is the reciprocal of 0.125 or 96)

Special Entity Requirements

Common symbols, doors, windows, equipment, etc. shall be inserted as blocks.

Room numbers are very important. Wayne State University's CAD drawings are used to provide real data throughout the University. A standard layer named "A-AREA-IDEN" is used and contains attribute data including not only associative data such as room number, area and perimeter but also the entity handle of the polyline with which it is associated. All As-Built submissions will contain Wayne State University's room numbers, not the construction or consultant's numbers. See the room numbering section of this document.

Dimensioning

All dimensions shown in the project submittals shall be fully associative. Dimension definition points should be located with an appropriate Object Snap (End Point, Mid-Point, etc.) or otherwise located precisely on the project geometry. Manual input of dimension text or otherwise over-riding the actual dimensions is NOT acceptable in submittals to the university.

Linetypes

It is recommended that only standard AutoCAD linetypes be used. If custom or compound linetypes are necessary, then their definition file(s) shall have a .LIN extension and shall be included in the root directory of the files with which they are associated. When linetypes are used to represent building features (i.e. Wall Ratings) a legend describing their meaning must be on every sheet.

Fill and Hatch Patterns

Vectorized fill patterns are acceptable but excessive use is discouraged as they make files unnecessarily large. In many circumstances, solids may be used instead of hatches. All consultants are responsible for keeping files sizes within manageable limits.

Polylines and Line Weights

When using polylines all segments must be joined. Where polylines are used to denote area, they must be closed. Consultants are solely responsible for the production and appearance of their hard copy submittals. Line weights should not hide any entities that are necessary for drawing clarity.

Specification Requirements

Specifications shall be provided in electronic media form acceptable to WSU. It is the Design Professionals responsibility to have the electronic media translated into the required electronic form used by WSU Design and Construction Services for bidding and archival storage.

Electronic Documents/Bid Document Distribution

The University no longer distributes printed construction documents to bidders. Specifications must be developed in Microsoft "Word" for posting to the University's Procurement and Strategic

Sourcing Department web site. Design Professionals are required to assist in the transfer of required document files as appropriate.

General

Besides the submission of the specifications in electronic media, the following is required. The general requirements (Division 1) and technical portions (Division 2 through 49) of the specifications may be included on drawings, or in book (project manual) form. Certain projects may allow the entire specification to be incorporated into the drawings. Where specifications are proposed to be included on the drawings, prior written WSU approval is required. If approval is granted, prepare as follows:

Arrange Division 1 general requirements and Division 2 through 14 technical specifications at the head of Architectural trade drawings.

Arrange Division 23 technical specifications at the head of Mechanical trade drawings.

Arrange Division 26 technical specifications at the head of Electrical trade drawings.

All projects that include Direct Digital Controls or building automation shall, provide a “point chart.” The “point chart” shall be presented in the construction plans and include all relevant descriptive information about the point type, location, device, purpose, etc. The point chart shall include all points; input, output, pseudo or virtual, analog or binary for mechanical, electrical, energy management, security, etc.

Project Manuals must contain Invitation, Instruction to Bidders, Bid Forms, Standard General Conditions and other relevant documents in addition to general requirements and technical specifications. The current ‘front end’ of the specification will be provided by the Wayne State University, Design and Construction Services Project Manager, and will be attached to the bid documents by the Procurement and Strategic Sourcing Department.

Specification Standard

WSU requires compliance with the principles and practices outlined in the CSI Manual of Practice.

Use of the 3-part Section Format, including requirements for subject matter location, is mandatory.

Use of the Page Format is encouraged but is not mandatory.

Use of the current version of CSI MASTER FORMAT Section numbers and titles for organizing Documents and Specifications within Project Manuals is mandatory. Comply with guidelines for contents of each Division and Section of the specifications.

Specification sections which represent work that is not a part of the project scope shall not appear in the Project Specification.

Language and Terminology

Compliance with the recommendations of the CSI Manual of Practice, Chapter 4 “Specification Language” is strongly encouraged. The following requirements are mandatory:

Write specifications as if addressed to the General Contractor. Do not address specifications to “This Contractor” or the “subcontractor.” Where specific parties must be referred to for clarity, use language similar to the following:

“Engage a licensed Professional Engineer to perform calculations,” or “Require Installer to examine substrate prior to installation.”

Eliminate the term “by others” from drawings and specifications. If work is not part of the Contract, say so directly using “N.I.C.” If, for example, a mechanical item is shown on an architectural sheet for clarity, use the phrase “work of Division 15” or “by mechanical trades” and reference the specific sheet number upon which the subject work can be found.

Eliminate the term “or equal” from specifications. The University requires Contractors to bid only products specified as “approved” by these standards. List at least three (3) alternative, equivalent manufacturers for each generic product specified. When the University’s Construction Design Standards, Product Standards fail to include a recommended product, or list three acceptable manufacturers; the Design Professional shall provide a product specification and recommendation. If the Design Professional specifies a product not recognized by these standards, it must be approved by WSU in writing, before the Design Professional shall provide demonstrable evidence to the University of product equivalency or superiority in advance of the university’s bid solicitation. (Refer to page 4 for a description of “Voluntary Alternatives.”)

Construction As-Builts

At the conclusion of all construction work, the Design Professional will receive marked-up drawings or CAD files from the contractor and shall update record drawings to “As-Built” status. Refer to additional “As-Built” requirements in the Construction Documents section above

The Design Professional is required to transmit to the Wayne State University Project Manager the original marked up tracings utilized to revise “Record Drawings.” The following is required to be submitted with the original tracings:

- One set of CAD vector files including all bulletin revisions, revised to “Record Drawings” condition. Provided on fully labeled CD-ROM’s
- Three complete sets of bound prints with protective Kraft paper cover sheet and back page for the University’s use.

Sepias are not acceptable.

Punch List Development

The Design Professional is responsible for the publication of a punch list of construction deficiencies. WSU prefers to begin the ‘punch out’ process with an Incomplete Work List prepared by the Contractor; which will become the basis for the punch list development. On large projects, the Contractors incomplete work list is mandatory.

Where phased occupancy is to occur, several independent punch lists may be developed. The University expects the punch list process to conclude expeditiously and the Contractor to address deficiencies immediately.

Punch List attendees shall include the Project Manager; the Design Professional; the Customer and representatives from the WSU Plant Operations and Maintenance Division.

ABATEMENT POLICY

(Asbestos/Lead Paint/PCB/Contaminated Soil)

Due to the age of most University buildings, all parties are advised to remain vigilant for the presence of hazardous materials and to bring to the attention of the WSU Project Manager the presence of any suspected materials.

WSU contracts separately with a consultant for asbestos abatement, Hazmat reports on file, bid documents, therefore the Design Professional involved with the design of a renovation project will not be required to include asbestos abatement specifications. In some cases, when hazardous materials need to be abated, large projects, especially when schedule could be impacted, the abatement work will be assigned to the general contractor. WSU will make a decision on a case by case basis. All abated materials remain the responsibility of WSU, requiring bills of lading and WSU approved disposal locations. The office of environment health safety to be involved. The University will endeavor to advise the Design Professional and the Contractor(s) of the presence of regulated hazardous materials prior to or immediately following the initiation of work.

Site demolition waste and excavation spoils which are to be removed from the project are to be considered hazardous until tested and shown otherwise; Landfill destinations are restricted to University approved landfill sites. For hazardous waste, the WSU Office of Environmental Health and Safety will coordinate the testing and manifesting.

Interim Life Safety

For projects where the magnitude of construction work will precipitate a need for the implementation of work practices and temporary separations to comply with the guidelines for interim life safety during construction, the construction documents shall reflect such requirements. This may include the placement of temporary fire rated separations, separation of HVAC and construction dust exhaust systems, etc.

During schematic design activities, the Design Professional, with the WSU Fire Inspector's Project Manager, shall evaluate the impact of the proposed construction on the maintenance of life safety, and determine if any temporary measures are required. Construction documents shall fully describe and indicate temporary measures to ensure their inclusion in the contractor's base bid proposals.

Pre-Construction Photographs

Contract documents shall require the Contractor to provide a comprehensive photographic survey of the site and building conditions prior to the initiation of construction activities. Photos shall be of high resolution and sufficiently detailed to determine existing conditions, such as cracked concrete, chipped steps, broken or cracked windows, and other general conditions in areas that will be affected by the movement of workers or materials. The photographs shall be transmitted in electronic form to the WSU Project Manager and the project Design Professional prior to the initiation of work.

STANDARD BUILDING FEATURES

Rooftop Mounted Equipment:

In situations that preclude the design of a stairway and elevator accessible penthouse enclosed roof top mechanical equipment, all roof locations shall be provided with unobstructed access for maintenance personnel. Lockable roof hatchways, intrusion alarm with three paint coats, prime paint and two finish coats of exterior grade enamel; permanent ladder access shall be provided. Hatchways shall open to safe footing and shall be designed and located in compliance with all MIOSHA requirements. Where possible, handholds or railings shall be provided to assist in the egress from and ingress to roof hatches.

Where building design features provide roofs of differing elevations that are not otherwise provided with roof access, all levels shall be provided with a MIOSHA compliant fixed roof ladder of appropriate design to allow for movement from one elevation to another without the need to utilize portable extension ladder(s). Consideration shall be given to the delivery and removal of rooftop maintenance supplies.

Rooftop equipment near roof edges must be provided with protective barriers in compliance with MIOSHA regulations. Design Professional shall avoid placement of roof hatches within 6 feet of unprotected roof edge. All roof hatches are to be mounted by Wayne State Police Department via (DSM) Door Switch Monitor per WSU PD's alarm/card access specifications (revision date 04/26/16)

Roof Fall Protection:

Rooftop equipment near roof edges shall be provided with a permanent guardrail, parapet of at least 42" in height from the surface of the roof membrane, or in the event that the architectural details do not permit, a series of permanently installed certified tie-off points for fall arrest systems.

Elevator Design Code:

WSU requires that all elevator installation designs are in accordance with requirements of the City of Detroit. Permitting and inspections are required by the city of Detroit.

Elevator Design Requirements (University):

All new elevator installations and modernization projects shall comply with University requirements. Elevator programmable controllers shall be Motion Controls products only. Elevator car walls shall be vandal resistant stainless steel. Ceilings shall be hard metallic with integrated recessed fluorescent lighting, or theft resistant LED lighting. Acoustical style ceilings are not permitted. Floors shall be heavy duty solid rubber or aluminum diamond plate for freight elevators. Use of porcelain tile or natural stone is not permitted. Elevator car and hallway call buttons shall be vandal resistant. Elevator license number shall be engraved in the control panel. Fire service key shall be provided and shall be of common design. Key switches shall allow the use of the University's BEST locking system cores. Emergency stop button shall be of the detented push-pull type.

State of the art specifications need to provide hours of operation of this elevator model.
Number of crews trained to install and maintain this model of elevator.

Elevator Emergency Telephones:

WSU employs a one button emergency telephone in all elevator cabs. The telephone is manufactured by Ramtel Corp (formerly Ramtech); 115 Railroad Ave; Johnston, RI 02919. Phone 401-231-3340; Fax 401-231-3396. Specifications shall require the phone installation by the elevator contractor. (This phone is the same as utilized for WSU's 'blue light' emergency phones.) For new installations, the vendor should be instructed to contact Ramtel for the OEM version of the phone to be integrated into the control panel trim.

Model: R833
Flush Mount Bezel: 906

Site Irrigation:

When projects include site irrigation and the irrigation water supply vacuum breaker is provided inside a structure, a floor drain shall be provided. Site irrigation water shall be separately metered. Irrigation installations shall incorporate designs that avoid excessive watering immediately adjacent to building structures. On renovation sites where irrigation systems exist, care must be taken not to damage the system. Documents shall note that the Contractor is responsible for repairs when damage is done.

Demolition Materials

The university's Haz Mat report library must be reviewed for demolition begins to verify the content of materials to be removed. Documents shall include a note related to all demolition activities that requires the Contractor to confirm with the University WSU's desire to retain salvaged materials. In general, this requirement applies to products, devices, hardware, etc; and not to materials such as conduit, wallboard, doors, ordinary signage, ceiling grid, (in some cases, intact ceiling tile may be salvaged for reuse in other building locations,) etc. Design Professional must confirm with the University interest in salvaged items and include notations on the drawing as required.

Design Investigations

The Design Profesionales must visit the site prior to the start of the design phase to determine existing conditions. Code violations and/or design deficiencies uncovered during surveys and site visits are to be brought to the attention of the WSU Project Manager. WSU will decide if corrective action is to be included in the project scope. Reference Wayne State University's Office of Environmental Health and Safety located at <http://research.wayne.edu/oehs/lab-safety/index.php> MEP engineers must visit the site before documents are completed to verify site conditions so as to confirm the accuracy of the as build documents

Designs That Require Field Verification

Certain designs may require the uncovering of elements or structures to obtain exact field verified dimensions to complete an accurate design. The Design Professional is required to notify the WSU Project Manager when such conditions are recognized or encountered. The University will review the need to uncover the elements or structures in advance of a contract for general construction to facilitate an accurate design.

Dust/Vapor/Odor and Noise Control

During construction within any of the University's buildings, it is imperative that dust/vapor/odor containment measures be implemented. Language requiring the containment of construction activities within a "negative pressure" environment must be included in the contract documents. Where perimeter containment utilizing temporary partitions is feasible, construction documents shall identify the location and construction type of the partition.

Negative pressure shall not be achieved by using the return air path of an existing or new permanent air handling unit, unless the existing ductwork is scheduled for demolition. The contract documents shall be clearly written to include, as necessary, dedicated air handling equipment (permanent or temporary) and ducting (permanent or temporary) to provide and maintain negative pressurization of the work area throughout the duration of the construction activities, or until such time as the University agrees that the work area presents no recognized hazard to surrounding environments or occupants.

Construction noise must be kept to a minimum in order not to disrupt classes, activities, or functions occurring within an occupied building. Construction activities generating sustained loud noises shall be coordinated as to acceptable times with the University Project Manager. Where penetrations or anchors can be installed without using hammer drills, such techniques shall be required through the contract documents. The Design Professional shall include notes on the construction documents in this regard.

Solid Waste Management – Construction

The Design Professional shall become conversant with the University's requirements for solid waste removal, and where appropriate, shall incorporate those requirements in the contract documents. The WSU Project Manager will coordinate the involvement of the WSU Office of Environmental Health and Safety regarding any discussions about solid waste removal to determine if there is any hazardous component of the material leaving the University; such discussions to occur prior to final approval of any Contract Documents. Waste materials shall be properly secured until testing is completed and removed promptly from the site.

Refuse Removal Considerations (normal building operations - non construction debris)

Consideration must be given to routine building refuse removal on all projects which are not served by an existing refuse removal stream, including chemical and bio-hazardous waste generation, storage and removal.

Leak Containment

The Design Professional shall provide a design for water containment specifically at incoming water service locations (domestic water and fire protection) and major mechanical systems (chillers, pump, heat exchangers). The design shall include a leak detection sensor in the contained areas to notify the Wayne State University Police Department of a water line break or abnormal situation. This notification to WSU Police shall communicate through the Campus Security System. Coordinate the method of producing the alarm signal with the University Project Manager, the University's security consultant (if any), and the University Police Department. Reference Wayne State University's Office of Environmental Health and Safety located at <http://research.wayne.edu/oehs/lab-safety/index.php>

ROOM NUMBERING

Room numbering on the contract documents shall conform to the WSU Facilities Planning and Management design conventions. Coordinate and assign room numbers early in the design through the WSU Project Manager.

Building Room Number Systems

All Wayne State University building room number systems shall be guided by space standards and criteria of the Michigan State, Department of Technology Management and Budget (DTMB), Most current Project Design Manual. The National Center for Education Statistics (NCES), Postsecondary Education Facilities Inventory and Classification Manual, November 1992 shall, also, be followed. Usable area or floor area, consisting of assignable and non-assignable (i.e. custodial/building service, circulation and mechanical) space, shall have number designations for easy identification and location, including stairways and restrooms

A majority of buildings throughout the campus, already, have established room number systems that are suitable for their intended uses. As a result of careful modifications during regular reconstruction projects, these room number systems are continuously maintained and preserved. Existing building numbering system must be maintained when modifying existing space for those facilities or additions, requiring new room number systems, the following formal assignment procedure shall be employed.

Three - Five Digit Room Number System Design and Assignment

For small relatively simple, restricted, low-rise, single wing, suite or corridor buildings, a Space Management System identification, specification and construction compatible, three - five digit, six character, room number system shall be designed and assigned as follows:

Example: Room Number 123.45

- 1st Digit: Floor, level or plane
- 2nd Digit: Main room, workstation or area off corridor
- 3rd Digit: Main room, workstation or area off corridor

Decimal point (.)

- 4th Digit: Interior room, workstation or area off main room, workstation or area.
- 5th Digit: Interior room, workstation or area off main room, workstation or area/Interior room, workstation or area off interior room, workstation or area.

The three - five digit room number system is designed and assigned to:

Allow for a potential vertical accommodation for up to 10 floors, levels or planes.

Permit a potential horizontal accommodation for up to 100 main rooms, workstations or areas per floor, level or plane.

Accommodate up to 100 interior rooms, workstations or areas off a main room, workstation or area, or up to 10 interior rooms, workstations or areas off a main room, workstation or area each with up to 10 interior rooms, workstations or areas.

Four - Seven Digit Room Number System Design and Assignment

For large relatively complex, four - seven-digit, eight-character, room number system shall be designed and assigned as follows:

Example: Room Number 12345.67

- 1st Digit: Floor, level or plane
- 2nd Digit: Floor, level or plane / Wing, suite or corridor
- 3rd Digit: Wing, suite or corridor / Main room, workstation or area off corridor
- 4th Digit: Main room, workstation or area off corridor
- 5th Digit: Main room, workstation or area off corridor

Decimal point (.)

- 6th Digit: Interior room, workstation or area off main room, workstation or area
- 7th Digit: Interior room, workstation or area off main room, workstation or area/
Interior room, workstation or area off interior room, workstation
or area

The four - seven digit room number system is designed and assigned to:

Allow for a potential vertical accommodation for up to 10 floors, levels or planes, or 10 plus floors, levels or planes.

Permit a potential horizontal accommodation for up to 10 wings, suites or corridors each with up to 1,000 main rooms, workstations or areas per floor, level or plane, or up to 100 wings, suites or corridors each with up to 100 main rooms, workstations or areas per floor, level or plane.

Room Number System Design

When using the above two systems a typically small sized main room, workstation or area shall be selected to establish the common room number module, for every similar or comparable floor, the building. This design criterion will allow sufficient reserve main room, for potential future subdivisions of larger main rooms. Every room, workstation, area, corridor, (elevator, stair) shall be numbered.

Every effort shall be made to maintain consistency by assigning similar numbers to comparably located main rooms or areas on each floor of the building. Corner main rooms custodial / building service, circulation or mechanical core main rooms shall have the same main room numbers for every floor, on which they are comparably located. Room number systems would normally begin at the primary building entrance and progress either clockwise or counter-clockwise depending on what layout is best suited for the particular floor, level or plane. Circumstances may dictate that odd numbers be assigned to outside walls with even numbers assigned to inside walls of a building.

Beginning at the primary access point of a building, an appropriate main room number value sequence designation, based on doorway with odd or even assignments to each side of the

corridor, shall be created. Larger or multiple-corridor main rooms having two or more potential numbers shall be assigned the identification designated for the primary doorway, entrance.

All main rooms or areas off corridors shall have whole number assignments for easy identification purposes. When interior rooms are located off a main room then the numeric designation shall be a decimal extension of that main room. The decimal number value sequence shall run in the same direction as that of the main rooms along the corridor.

Main room numbers for basements shall have beginning 'zeros' (Examples: 012.34 and 0123.45, respectively) for easy floor identification and location purposes. Sub-basements or lower level crawl spaces shall have room number assignments, less than whole figures and use the last two digits beyond the decimal point for designation purposes (Examples: .01 and .12, respectively).

For various space management and other purposes, room number systems shall be wholly numeric in character, so that sorting on this field can be readily made in number value sequence. Where, however, existing room number systems contain letters of the alphabet (i.e. wings, suites, corridors etc.), it may be necessary to use numeric equivalents (Examples: A = 1 or 01 and L = 12, respectively), for in-house identification or processing.

Reservation and use of room numbers 75-84 (Elevators, lifts or dumbwaiters), 87 (Cumulative residual mechanical) and 90 (Cumulative residual circulation), shall, also, be made for various space management and other purposes. Multiple cumulative residual mechanical areas (i.e. shafts, wall pockets, plenums, pipe runs, etc.) and multiple cumulative residual circulation areas (i.e. arcades, vestibules, corridors, stairwells, etc.), shall require identifications for more comprehensive specification and / or construction purposes, with numbers 87.01 plus and 90.01 plus, respectively. The latter decimal number value sequence shall run in the same direction as that of the main rooms, workstations or areas along the corridor.

Building circulation that complies with NFPA Life Safety Code requirements shall be defined by the room number system. Phantom line boundaries (line-dash-dash-line) on the floor plan drawings shall provide the appropriate definition between corridors and open areas (i.e. lobbies, atriums, reception areas, waiting areas, workstations, stack areas, study areas, etc.). Room number signage may or may not be required and provided for every room, workstation or area in a building.

Signage

The general or common procedure would be to attach whole number Americans for Disabilities Act (ADA) compliant signs or placards to each main room, workstation or area doorway or entrance off a corridor. In many instances interior rooms, workstations or areas may not necessarily require room number signage, especially when there is a decimal designation off a main room, workstation or area. Elevators, stairs, toilet rooms, janitor closets, mechanical rooms, electrical rooms, communication rooms, etc. require unique identification.

Coordinating efforts with key individuals of the various units on campus that will occupy the designated space, to determine utilization needs, is an important part of the building room number system assignment procedure. For this reason, building room number systems in preliminary draft form shall be reviewed with the user, before the final record is completed and signage ordered for installation.

When a large multi-building group is established, with, shared characteristics, every effort shall be made to create a unified room number system. Under this approach each building room number system would stand on its own, while still being connected to the group for functional and identification purposes. The Law School Complex, Gateway Complex, be likely candidates for this campus-wide system.

A draft copy of the room numbering scheme shall be reviewed with the WSU Project Manager in advance of releasing documents to bid.

Public Telephones

The routine inclusion of a public telephone has been deleted from WSU's standard design requirement. However, If provided, the installation should recognize accessibility compliance and include a provision for TDD (telephone device for the deaf). House phones, if required result in a line charge to the occupant's department and must be approved prior to inclusion in design documents.

Staging – Work Storage

The Design Professional shall include in the site design, a specific area to be used by the construction trades as a staging area, and parking during the construction process. Temporary fencing shall be indicated to protect the staging area.

These areas shall, at completion of the construction process, return to the original condition or be incorporated into the final landscape/site improvement design. These requirements shall be included in the project documentation.

Safety

The project must comply with all applicable laws, statutes, codes, ordinances and regulations as well as University insurance requirements. WSU utilizes a 'hot work' permitting process. Information can be viewed at the office of risk management website :<http://idrm.wayne.edu/risk/> Under the "FIRE SAFETY MANUAL". General notes on demolition drawings and on construction drawings shall include a cautionary warning to the contractor advising of the 'hot work' permit requirements. While the 'means and methods' of construction are the responsibility of the Contractor; all design elements shall be in compliance with MIOSHA and MDEQ requirements.

Site Restoration

Where improved sites are impacted by construction operations, the Design Professional shall include appropriate language directing the contractor to repair or replace, or otherwise make complete restoration to concrete and landscape improvements and vegetation to restore the affected area(s) to the condition prior to the start of construction. All surface water drains and catch basins which are in the construction area or that can be affected by the project, shall be scheduled for cleaning at the close of active site construction. Existing parking lots used for construction and/or material staging areas shall be included in this requirement.

PROJECT COMMISSIONING

Project commissioning is now a requirement of the Michigan Energy Code. The level of commissioning shall be determined early in the planning phase of the project.

This section specifies system commissioning requirements and activities necessary to advance the project in a systematic way from the state of static completion to a complete system in accordance with the contract documents. Including, but not limited to the following:

- Commissioning Team
- Commissioning Meetings
- Responsibilities
- Systems to be Commissioned
- Commissioning Sequence
- Project Commissioning

The determination of the Project Commissioning methodology shall be addressed in preliminary planning meetings. All decisions regarding commissioning reside with the University. The use of formal Project Commissioning does not relieve the contractor, sub-contractor, or vendor of thoroughly testing and confirming that all installations and components perform as intended.

Commissioning Team

The University Project Manager will establish a commissioning team to be assigned to this project. The team will perform construction observations during all phases of construction and monitor and document implementation of the commissioning sequence of all systems. The team will be responsible for the formal acceptance of each component of a system and the total system.

The members of the team will normally be drawn from the A/E, WSU Facilities Planning and Management Department, WSU Office of Risk Management, Construction Manager, Subcontractors, and may include an Independent Commissioning Agent. The exact membership will depend upon size, scope and complexity of the project.

Commissioning Meetings

The team meetings will be held regularly during the project. Commissioning meetings will be held separately from construction progress meetings. The Contractor and Subcontractors will be expected to attend the Owner's Commissioning Team meetings addressing system reviews.

A review of the commissioning needs of the project should be discussed at the construction kick-off meeting or an early construction meeting.

Responsibilities of the Contractor

The Contractor shall be responsible to show in the project schedule the order and timing of the commissioning sequence for each of the project's systems.

Systems to be Commissioned

The systems and equipment to be commissioned include, but are not limited to the following:

Electrical Systems

Primary Distribution
Normal Power
Life Safety Egress Lighting and Exit Illumination Systems
Emergency Power including Generator(s)
Substations
Fire Detection and Alarm System
Access Control
CCTV
Intercom
Lightning Protection Systems
Lighting/Lighting Controls
Clock
Elevators

Mechanical Systems

Air handling systems, return and exhaust air system(s)
Chilled water system(s)
Medium and low pressure steam and steam condensate systems
Condenser water system(s)
Hot water heating system(s)
Building domestic cold water system(s)
Building domestic hot water system(s)
Compressed air system
Sanitary waste and vent system
Acid and hazardous waste and vent system(s)
Natural gas system
R.O. or D.I. water systems
Medical and other gas systems (O₂, CO₂, VAC, N₂O and N₂)
Fire protection system
Sterilizers
Storm water system
Temperature control system
Building automation system
EVAC system
Variable speed drives
Fuel oil tank system

Commissioning Sequence

The Design Professional shall specify that project commissioning is the responsibility of the Contractor. However, it is to be performed in concert with the Commissioning Team which will verify the commissioning process by witnessing each commissioning activity. Verification will be performed by team members or by designated representatives.

It is important that testing of system components, subsystems and entire systems be completed in the proper order. Submit verification that testing of all systems, subsystems, or components required prior to the proposed system test have been successfully completed.

Example: Duct systems are commissioned before fans. Cleaning and flushing is done before pumps are commissioned. Pump and fan systems are commissioned before chillers and primary heating equipment. Electrical systems are commissioned before electrical components of other systems are commissioned.

The following is a general outline of the commissioning sequence, whether formal or informal. It includes, but is not limited to the following items for each system, as applicable:

- Submittal of shop drawings.
- Submittal of inspection certificates.
- Submittal of draft and final operations and training manual.
- Submittal of training plan.
- Submittal of start-up/installation materials.
- Installation and pretest.

Test the functional performance of each complete system; testing each component and item of equipment through subsystems (refer to example above). Also, include the Department of Public Safety interface for fire, security, and emergency communication systems.

Any check or test which cannot be accomplished (for seasonal or other reasons), or for which acceptable performance is not achieved, shall be rescheduled to a time when it can be accomplished.

Submittal of verification that all pressure testing, flushing, and cleaning has been completed for piping systems.

Submittal of verification of all prestart-up tests.

Submittal of verification that all pressure testing and cleaning has been completed for all air handling systems. Including, but not limited to, ductwork, terminal units, air handling units, ventilation units, and fans.

Submittal of verification that all electrical systems testing has been completed.

Submittal of verification that check, test, and start-up of variable speed drives has been completed.

Submittal of verification that check, test, and start-up by manufacturer's representatives has been completed.

Submittal of air and water balance report.

Participation in substantial completion walk-through.

Submittal of all warranties.

Submittal of "as-built" information to include all required details sufficient for the University to update the University's computerized maintenance management system

Training sessions-Participate with Contractor and Project Manager to ensure the development of clear and concise training to University maintenance and engineering staff. Training will be video-taped for future use.

Assisting the WSU's Maintenance Department in understanding control of building systems.

Conclusion of Commissioning

At the end of the commissioning process, every mode of systems operations, all system equipment, components and zones, and every item in the control sequence shall be proven operational under abnormal, emergency conditions, and all normal operational modes, including part-load and full-load conditions, where applicable.

Project documents shall require that the Contractor provide, at close of project, a spreadsheet list of filter sizes, belts, and lubrication type and frequency as required, detailed by device.

Where seasonal conditions prevent commissioning at the time of project completion and turn-over, an agreed upon schedule for commissioning when seasonal conditions allow shall be agreed upon in writing and made a part of the project close out documents.

FINISHES, FIXTURES, ACCESSORIES & NOTES by LOCATION AND ROOM TYPE

Administrative Conference Rooms

Provision shall be made for telecommunications and technology access. Storage and shelving requirements shall be met using any of the following: storage cabinets, counters, file cabinets, open or closed shelving. Provide projection screen if necessary. Floors shall be carpeted. Walls shall be painted gypsum board. Provide wall protection in the form of a chair rail. Wall covering shall be an option.

Building Engineer's Office

Locate near primary mechanical room. Provide built-in storage as required. Provide electrical/communications tie-ins for building systems as required, including appropriate ports for the connection to the University's Building Automation System, telephone, University computer network, etc.

Classrooms

Provide white porcelain enamel marker boards or chalk boards, window blinds or black out shades if projecting will be done on a regular basis. Provide built-in storage as required. Walls may be painted gypsum board or painted concrete block. Follow building program for quantity and size. Sound proofing mineral wool batts shall be installed in gypsum board walls separating classrooms.

Corridors

Provide display cases, signage, tack boards and changeable locking message boards as required by Owner. Corridors shall be designed in compliance with provisions of NFPA Standard 101.

Where fire extinguishers are required, the Design Professional shall be responsible for the proper selection, location and design. The Contractor shall be responsible for providing the cabinets, extinguishers and signage to meet the current requirements of the Owner, the coordination of which shall be the responsibility of the Design Professional.

Custodial Closet

Floor sink and tie-ins, (low profile type with minimal lip height), shelf/mop rack, wall hooks, open storage, threshold and vented door are required. Provide one Custodial Closet per floor. Corridor doors shall be self-closing. Provide backing and utility rough of ½" domestic cold water line with reduced pressure zone backflow device and accessible threaded ball valve with plugged outlet for automatic soap dispensing equipment. Floor and wall joint of room shall be water tight. Backing for future wall mounted equipment is required. One 120V. GFCI receptacle shall be provided for soap dispensing equipment. Walls shall be fully washable. Design shall consider tile, FRP board, or sealed and epoxy painted CMU's.

Custodial Room

Each building shall have one main custodial room for exclusive use by the custodial staff. It shall be located near the storage room, delivery door or dock, and service/freight elevator if one exists. Separate locker and dressing areas for men and women, toilet, sink and shower should be provided. All accessory requirements for general restroom and shower stall apply. Provide fixed benches in locker area.

Evacuation Plans

For projects that involve new construction or revisions to the floor plans of existing buildings, the work may require the addition of or revision to existing evacuation plans. For new structures, the Design Professional shall coordinate with the Owner and shall be responsible to provide such plans, including but not limited to provision of CAD files, appropriately annotated to support the printing of necessary signage. in a format acceptable to the Owner.

For new construction, the Design Professional will be responsible for the evacuation plan insert in the form acceptable to the university, and the contractor will be responsible for providing the sign frame and mounting of the evacuation plan. For renovations to existing structures, the Owner will be responsible for amending the existing evacuation plans and for the installation thereof.

Food Service Operations

The construction or renovation of food service areas, whether by the University or by a third party including tenants, shall include a preliminary plan review by WSU's Office of Environmental Health and Safety (OEHS). All designs shall comply with State and local regulations. (MCL Act 92, 2009 Michigan Food Code). OEHS involvement shall begin at the design development phase and include final plan review and approval. Upon completion of construction or renovation activities, OEHS shall inspect the work and issue an approval to occupy and operate the facility for food preparation or consumption. It should be noted that additional occupancy approvals may also be required in advance of full operation.

Lecture Halls/Auditoria

Provide carpeting at non-seating areas. Provide for appropriate public address system and audio/visual technology as required. Design for maximum acoustical quality. Provide fixed, jury or stackable seating and writing tablet arms as required. Follow building program for room capacity and size. Provide stage area as required. Rooms shall be designed in compliance with NFPA Standards 1 and 101. Room occupancy load signage shall be provided.

Libraries

Architect is to provide for any built-in fixtures as required by Owner. Consult University's program for any technology tie-ins, storage and stack space, study, lounge and administrative areas.

Lobbies

Provide building directory and tackable surfaces as required, preferably recessed. Provide seating area as required. Seating area furnishings shall bear UL or FM labels.

Maintenance/Shop

Provide sufficient space for plumbing and electrical supplies. Provide wall/corner guards and built-in storage as required. Direct exterior access may be required. Area shall be provided with a fire extinguisher, flammable/combustible storage cabinet and self-closing waste receptacle. Provide adequate electrical service and receptacles, including compressed air access of adequate pressure and volume for maintenance activities. Incorporate permanent eye wash and emergency shower if required.

Mechanical/Electrical Room

Address all safety issues and MIOSHA standards as required. See Mechanical and Electrical sections for specific equipment requirements. All louvered fresh air intakes, including convective openings for electrical substations and switch rooms shall be equipped with a filter rack and filters to minimize dirt infiltration into the room. Effect of filter resistance to air flow shall be considered in the design.

Meeting Rooms

Provision shall be made for all telecommunications and technology access. Storage and shelving requirements shall be met using any of the following: storage cabinets, counters, file cabinets, open or closed shelving. Provide projection screen if necessary. Floors shall be VCT. Walls shall be painted gypsum board. Provide wall protection in the form of a chair rail. Wall covering and carpeting shall be an option.

Monuments for Site Utilities

Certain site utilities are critical to the Owner's operations. Where new utilities, such as underground voice and data cables or fiber optic strands are installed below grade, specific monuments shall be included in site designs to indicate the location and route thereof. The design of specific monuments shall be determined in accordance with the nature of the site and may include flush or above grade products. Where the installation of monuments may be impossible due to site conditions or use, the application of durable descriptive signage on building elevations

may be required. All such monuments or signs must be coordinated with the University Project Manager in consultation with the grounds department.

Offices

Provision shall be made for all telecommunications and technology access. Built-in storage may include any of the following: storage cabinets, open or closed shelving. All offices shall be provided with tackable surfaces unless stipulated otherwise.

- a. Administrative offices and adjacent reception and common area floors shall be carpeted. Walls shall be painted gypsum board. Wall covering shall be an option.
- b. Provide resilient flooring or carpet for faculty and staff offices not inside the administrative suite.

Service Dock

Provide loading platform, lighting for night deliveries, and insulated steel overhead door. Where appropriate, provide an elevated dock and truck well with dock leveler.

Stairs & Service Stairs

Provide handrails, fire doors, safety equipment, and adequate area of refuge, signage and stair safety markings. Where applicable, signage indicating "area of refuge" shall be provided. All stairwells shall be uniquely identified with a number and shall include signage at all floors indicating the stair number. Signage shall be coordinated with and consistent with the building wide signage standard.

Storage Room/Supplies

Locate in close proximity to Custodial Room and Custodial Closet. Size is to be determined by specific needs of building. Shelving may be free standing or built-in.

Student Lounge

May or may not be required per University's program. Possible fixtures and furnishings include vending machines and built in seating. Built in seating shall bear UL or FM label.

Telephone/Communications/Data Communications

Refer to Wayne State University Telecommunications Standards for requirements regarding these spaces. The Design Professional shall provide design of telecommunications closets, raceways, cabling, connectors, punch-down blocks, etc. to facilitate the installation of the telecommunications system.

Toilet Rooms

Toilet rooms shall be provided with a toilet room sign that includes the room number consistent with the University's signage protocol.

Toilet room walls where Urinals are mounted shall have porcelain tile from floor to a minimum of 7' above finish floor. Where multiple urinals are mounted, steel reinforcement shall be included in the wall cavity to receive mounting screws for partitions. Gauge of steel shall be adequate to receive machine threads, unless otherwise determined during design development activities.

Vestibule

Do not provide recessed walk off traps or mat recesses. Provide building directory here or at Lobby. All requirements for barrier free accessibility and signage should be met.

00100 Building Design Considerations by CSI Section

00110 General

The following construction practices and design parameters are intended to provide an economical, low maintenance cost, energy efficient, and secure design in new buildings as well as renovations to existing structures.

The design of the building should include provisions for energy conservation, consideration to general maintenance and housekeeping ease, ability to access remote roof areas, ability to clean and inspect windows and exterior surfaces, site access to lawn maintenance and snow removal equipment, as well as locations to push cleared snow. Inclusion of “green” building technology is encouraged.

00200 Architectural Considerations

00201 General

The orientation of the building on the site, and its relationship to landscaping, should minimize the effect of winter winds on heating requirements and summer sun on cooling loads. Consideration shall be given to prevailing wind directions and the swing and placement of entry doors. Further consideration shall be given to the impact of architectural detail decisions on personal safety, to include issues such as hidden alcoves, obstructed views, etc.

The orientation of the building, roofs, entrances and walkways should minimize the buildup of snow and ice. The effects of northwesterly winds in winter months should be considered on entry locations and exterior door swings.

The design of the structure should consider economic use of materials, ease of construction, standard construction practices, and maintenance issues including accessibility.

The design of the building, and access to the building from the site, shall incorporate provisions for the handicapped. Exterior access to the building shall not include steps, unless a ramp conforming to the requirements for accessible design is also incorporated.

All openings into the building should be made rodent-proof and insect-proof. Windows at or below grade, and other openings which might provide access into the building, should be provided with double strength screening and hardware cloth. Provide collars, flashing and/or elastomeric sealant around all pipes that penetrate outside walls of the building, as well as pipes between rooms within the building. Consideration should be given to the design of the exterior envelope of the building to minimize areas where rodents and other creatures can nest.

Openings which could admit water during a flood or water main failure must be provided with protection to eliminate the inflow under reasonably anticipated conditions. Particular attention to this exposure must be considered for window wells, below grade entrances, below grade ramps, etc.

00202 Building Envelope

The exterior shell of the building (walls, roofs, doors and windows) shall meet the minimum insulating requirements as outlined below in “Design U Factors”.

Utilize insulated glass units at all necessary window openings, use tempered safety glass at entrance doors. Satisfy all thermal loss and heat gain objectives as defined in Section 00202.1, “Design U Factors”.

Vestibule entrances should be employed to eliminate excessive outside air infiltration. Vestibules shall be designed to accommodate handicapped access.

Avoid overhangs or “space frame” style of construction on the building or canopies which could be attractive to bird nesting or roosting.

Parapets, if used shall be a minimum of 42” above the finished roof membrane surface. If no parapets are incorporated in the building designed, life safety tie off points meeting MIOSHA requirements for strength and spacing shall be provided.

Thoroughly investigate the impact of sound transmission and equipment vibrations on the building structure. Employ vibration isolation and massing techniques to mitigate vibration transmission.

Below grade appendages of the structure are to be avoided. In the event that a portion of the building is required to be extended horizontally below grade, provide measures to prevent water infiltration into the building through the roof structure. Recognize and minimize potential vertical loads imposed upon the roof structure due to vehicular traffic above.

00202.1 Design U Factors

Where energy codes are defined, they shall be adhered to. In lieu thereof, the insulating properties of the building shall meet or exceed the following requirements:

Insulated Roofs and Ceilings:	U = 0.06	R = 16
Exposed Roof Structures (no ceiling):	U = 0.095	R = 11
Opaque Walls:	U = 0.07	R = 13
Gross Wall Area:	U = 0.13	R = 8
Windows and other transparent openings:	U = 0.33	R = 3
Floor above unconditioned space:	U = 0.04	R = 21

00203 Building Structure

Structural drawings shall indicate the soil bearing pressure used for footing design. Design loads used for floors, roofs, stairs, etc. shall be defined.

A minimum 4 foot deep frost wall foundation shall be incorporated throughout the design of the building.

Consideration should be given to fire-proofing the exposed components of the structural system. The Design Professional shall coordinate the classification of construction with local ordinances and the building codes.

00204 Wall Construction

Building exterior walls should be composed of either masonry cavity wall construction, precast concrete panels, or glass curtain wall, where durability and maintenance considerations are incorporated in the design selection. Interior building walls should be composed of either masonry or gypsum board sheets on metal studs. Refer to later sections regarding appropriate wall surface finishes.

Cavity wall insulation should be lower density extruded polystyrene, such as Dow Gray board or Foamular 150.

The building shall have a continuous and complete infiltration barrier, and a complete thermal barrier. Place structural components in a manner that will allow the thermal barrier to be unbroken. Consideration must be given to designs which will preclude the growth of mold or mildew colonies.

Construction Document sets must contain a minimum of one complete wall section showing all elements of thermal insulation, moisture waterproofing, flashing, vapor barriers and structural and finish components. Sections must show window penetrations when applicable.

Where designs call for curtain wall construction, designs shall be based upon manufacturer's standard extrusions and finishes and shall incorporate the features indicated above as applicable. Designs shall consider the method and cost of window cleaning and maintenance.

00205 Floor Construction

Design floors to accommodate the dead loads and live loads to be imposed on them. Conduits are not allowed to be laid horizontally within cast in place floors.

Floor penetrations shall be sleeved with cast-in-place steel pipe sleeves projecting not less than 1 ½ inch above finished floor and sealed against leakage. Openings shall be firestopped. Sleeves cored into existing floors shall be set with recessed steel tabs to prevent slippage downward and shall be grouted with expanding grout.

All elevated mechanical room floors to include not less than a 4" curb with an appropriate floor coating to ensure waterproof performance of the slab. (Note that all through floor penetrations require sleeves, the height of which shall not project less than the curb height.)

00206 Building Entrances and Blue Light Emergency Phones

Where possible, arrange door swings so prevailing winds will assist in closing the doors. At entrances with multiple doors, the doors shall swing in the same direction. DO NOT provide snow, mud or sand traps. Select exterior and vestibule door hardware which makes the direction of swing apparent upon approach. Multiple exterior doors shall employ a mullion on the striker side. Mullions may be required to be removable. Door hardware which employs a header or floor bolt for latching shall not employ surface mounted connecting rods. In-floor door closers are not permitted.

Provide an emergency telephone system, having one-button hands-free operation; which shall include an internal speaker and necessary electronic circuitry to provide a university wide mass notification announcement, a continuously lit blue light atop unit, and providing a direct connection to the University Public Safety Department. Exterior phones shall be provided with an internal heater provided by the manufacturer. Mount unit on galvanized steel post or acceptable architectural equivalent, near building entrance, at height to comply with barrier-free

requirements. Unit shall be Ramtel (formerly Ramtech) 115 Railroad Ave; Johnston, RI 02919; Phone 401-231-3340, FAX 401-231-3396. Model R-734, 924DX, 800-1018.

02000 Site Work and Excavations

Spoils from excavations are not acceptable as backfill. The reuse of removed materials in backfilling excavations, unless specifically examined and approved by the Owner and the Design Professional, is prohibited. Engineered fill materials shall be specified in accordance with the requirements of the installation.

Sidewalks shall be a minimum of 7' in width to allow for snow removal vehicles. Use of colored concrete is prohibited.

All exterior improvements shall be irrigated unless otherwise determined by the University.

05500 Stairs

Interior stairs shall incorporate steel channel stringers with concrete filled steel pan treads and steel risers welded on angles to the stringers. The complete stair system shall be capable of supporting a minimum design live load of 100 lbs. / sq. ft. Refer to later sections regarding appropriate stair tread finishes. Gaps between stringers and adjacent walls shall be provided with closure strips, unless incorporated as a design feature.

Where building designs can accommodate; primary access to the roof shall be by enclosed interior stairway. As an alternate, provide roof hatches that are accessible from permanent ladders located within the building. Locate ladders in areas not accessible to the general public. Provide walkway pads from the stairwell or roof hatch to roof-mounted equipment. Discharge points on the roof shall incorporate handholds or railings for ease of exiting.

06000 Wood and Plastics

The use of solid surfacing materials shall be reviewed and approved by the Owner. Products such as Corian, Surell, Zodiac, Granite, are generally acceptable. The use of Meganite is prohibited.

07500 Roofing Systems

Selected roof system shall provide a twenty (20) year warranty on materials and installation. The structure of the roof should be composed of rigid materials that are impervious to premature deterioration, such as metal form decking or concrete planks. Roof assemblies shall be of a UL design.

Insulation shall consist of extruded polyisocyanurate sheets with an integral laminated felt or glass-fiber facer. Provide tapered sheets for positive drainage (minimum ¼ inch per foot). Stagger joints between multiple layers of insulation. Total insulation thickness shall be sufficient to prevent the temperature at the vapor barrier from falling below the dew point.

Calculate the relative merits of insulation thickness and material selection using life-cycle costing methods and aged thermal conductivity (k) insulation values where appropriate. Provide this information to the Wayne State University Project Manager prior to completion of design.

A built-up asphalt or coal tar roofing system shall include a minimum of 4 plies of glass fiber felt materials. Appropriate methods to ballast roof must be included (river washed aggregate is not acceptable; graded blast furnace slag is required).

Any roofing system that will require a tar kettle shall have the additional requirement for a functional afterburner provided to control emissions from the hot kettle. This requirement must be noted in the construction documents as a general note and included in the specifications section appropriate to the details. The Design Professional shall survey the building to determine either the preferred kettle location to avoid the introduction of odors into fresh air intakes; or to indicate on the drawings, areas within which the location of a kettle is prohibited.

A modified bitumen roof membrane system shall have adequate slope and roof drainage to be completely free of ponding of water observed at four hours following a rain event.

A single-ply EPDM roofing system may be considered as an alternative to built-up systems. Selection of an appropriate roof substrate is required. Membrane thickness of 0.060" minimum is required. The Design Professional shall consider the method of fastening or adhering the EPDM to the substrate, as well as the number and location of insulation fasteners. Address wind uplift and fastener pull-out factors. Specification of a single ply roofing system requires specific written approval of the Wayne State University Design and Construction Standards Committee.

A white TPO roof system shall be incorporated in any design requiring LEED certification.

Preferred access to the roof shall be from an interior stairwell to a roof enclosure. (Refer to stair requirements above.)

Support roof mounted equipment on prefabricated insulated roof curbs. Provide cants or crickets on high side of curb to assist with roof drainage. Posts for steel framing are to be round pipe, flashed, bearing on structural steel or appropriate framing below. Skylights shall be fully fenced for fall protection.

08110 Hollow Metal Doors and Frames

Doors and frames shall meet the standards of the Steel Door Institute, "Recommended Specifications for Standard Steel Doors and Frames" (SDI-100-91) and shall meet ANSI Grade A requirements.

All interior and exterior hollow metal doors shall be minimum 18 ga. Full flush design (Grade II) with internal reinforcing of minimum 16 ga. Steel. Use thermally-insulated units with galvanized face sheets at exterior door locations. Exterior doors shall provide a minimum 5" stile.

Door frames shall be minimum 16 ga. Steel, welded construction, with required reinforcing at corners and at hardware mounting locations. For doors over 48 inches wide, use minimum 14 ga. Steel. Split-type or knock-down door frames are not acceptable. Use galvanized steel for exterior door frames.

Doors and frames shall receive minimum one (1) coat of shop primer and two (2) coats of Alkyd finish applied at the manufacturer's recommended thickness. Use rust-inhibitive primer for exterior doors. Shop painting or field painting of hollow metal doors and frames is acceptable. However, the bottom edge must be coated with specified finish.

Where glazing will be utilized in the door, use fixed integral stops on the exterior face, and removable stops on the interior face. Provide wired glass for fire-rated doors. Comply with regulatory requirements limiting glass size in fire-rated doors.

Where louvers will be utilized in an exterior door, provide weatherproof, stationary, Z-blade type (minimum 20 ga. Galvanized). Provide insect screen on interior face of louver. Where louvers will be utilized in an interior door, provide sight proof inverted V or Y louver (minimum 18 ga.), blades spaced for minimum 20 percent free area.

Where required, doors and frames shall be prepared for a concealed installation of building security system components; such work shall be coordinated with the University prior to the installation of the doors and frames. Ensure that bidding documents cover the cost of such preparation if specifics are unknown at the time of bidding.

08210 Flush Wood Doors

Doors shall meet the standards of the Architectural Woodwork Institute, "Architectural Woodwork Quality Standards", and "Architectural Flush Doors", for grade of door, core construction, and finish.

All interior wood doors shall be solid core with veneer finish as selected by Architect, rift cut, premium grade. Finish exposed edges of door with same species as door faces, with matching grain and cut. Provide book-matched veneer faces on door panels.

Where lites will be utilized in the doors, provide wood stops on each side of lite. Removable stops shall be used on the secured side of the door.

Where louvers will be utilized, comply with requirements as defined for door louvers in interior hollow metal doors.

08360 Service Doors

Exterior service doors shall be insulated rolling steel curtains, electric motor operated, factory color coated. Door slats to have flat-face profile, with required wind locking to withstand minimum 20 lb/s.f. wind loading, acting both inward and outward. Provide unit with hood to entirely enclose coiled curtain and motor assembly. Provide appropriate weather seals at jambs and door bottom.

Exterior service doors to have operators to remotely open, close, and stop door movement. A hand chain operator shall be provided for emergency use. Safety controls shall include a sensor edge at door bottom to reverse door travel when an obstruction is encountered, limit switches to automatically stop door movement at fully opened and fully closed positions, and a photoelectric eye across the door jamb to reverse door travel when an obstruction is sensed in the opening.

Interior service doors may optionally employ rapid-roll fabric type doors, electric motor operated, with minimum one (1) vision panel. Doors shall be equipped with a breakout bar along door bottom, sensor edge at door bottom to reverse door travel when an obstruction is encountered, photoelectric eye across door jamb to reverse door travel when an obstruction is sensed in the opening, and an infrared sensor at door head on each side of wall to automatically raise door when movement is sensed in front of door.

08450**Entrance Doors/Exterior and Interior Vestibule/Interior**

Entrance doors shall be extruded aluminum, monumental type, with minimum 3/16" thickness. Hinges shall be minimum 5 knuckle ball bearing type, 2 pair per door leaf. Doors that open out of the occupied space shall have two non-removable hinge pins (top and bottom). Continuous hinges shall be used on all exterior doors, including main entrance and vestibule doors.

Entrance doors shall be designed to accommodate entry by the handicapped. Limit push/pull forces and minimum door clearances to the values established by ADA guidelines. All new buildings shall be provided with an automatic door opening device at the primary entrance likely to serve mobility restricted individuals. Consult the University's Project Manager concerning the use of automatic door opening devices elsewhere.

Entrance doors and frames shall be prepared for building security systems prior to installation. Preparation prior to installation of frames and doors shall be the responsibility of the frame and door provider. Electrical conductors or raceways shall be routed in such a means as to maintain the architectural integrity of existing buildings. The Design Professional is responsible for the integration of all security installations which are a part of the project, even when the security system is designed by others. Reviews of proposed visible raceways, devices, and hardware shall be coordinated with the University's Design and Construction Standards Committee prior to any construction.

When the building does not have a readily accessible service door, front entrance frames shall be designed with a removable steel mullion feature. Hardware used shall be resistant to salt, moisture and dirt and require only common tools to remove.

08500**Windows**

Windows shall be extruded aluminum thermally isolated units, architectural grade, insulating glass with low-E coating. Units shall be low infiltration type with maximum 0.10 cfm/lf of sash opening. Vent windows, where used, shall have full weather-stripping and all required hardware.

Frames shall be thermally broken. Finish shall be either Kynar 500 or Hylar 5000, or anodized finish, color at the discretion of the Design Professional.

Spandrel panels shall have minimum R11 insulation panels on inside surface with 1" air space between insulation and exterior glass pane.

Metal infill panels shall be minimum 1" thick aluminum sandwich type with rigid insulation core, color to match surrounding aluminum frame.

Unless required by code, any windows on grade level or below grade level shall be fixed and leak proof. Avoiding windows lower than 24" above grade is discouraged.

Glazing units shall be high performance low emissivity with solar heat gain coefficient less than 0.35.

08501**Sidelights**

Where sidelights are employed, they should be designed in such a manner that they are clearly identifiable and will not be mistaken for doorways. All sidelights shall be divided with a horizontal mullion at door latch level to provide rigidity.

08710 Door Hardware

As a minimum, all doors shall have mortise type latch sets or locksets with cylinders keyed to 7 pin (SFIC) small format interchangeable core, 3 steel hinges, and hydraulic door closer with hold-open feature where appropriate. Provide "Best" removable cores for locksets. Hardware shall comply with ADA requirements, including door handle design and pull forces. Cylindrical Lock Sets are permitted only with prior University approval. All door hardware shall meet ANSI Grade One.

Specifications shall require contractor to provide construction cores at all lockable locations prior to substantial completion. The University will provide a core combination schedule and key quantity requirement to the contractor. The Contractor shall provide and install permanent cores at the time of substantial completion.

Refer to Approved Manufacturer's List for other approved miscellaneous hardware items.

Exterior locations shall be provided with anti-pick devices or covers coated to match the finish of the door.

Lock functions that are typically used on the campus are as follows:

 Storeroom function: Outside lever is always fixed. Door is opened by key only.

 Classroom function: Lever inside room is always free. Outside lever can be locked by key.

 Office (privacy) function: Outside lever is lockable either with key from outside, or with turn-button on inside lever.

 Passage function: Lever is not lockable.

 (Reference Wayne State University, Police Department's, Alarm/card Access Specifications (Revision Date 04/26/16))

09000 Finishes, General

Refer to later sections and included Schedule of Finishes for specific requirements of each room type. All finishes shall comply with the provisions of NFPA Standard 101.

A detailed Door Schedule and Room Finish Schedule shall be provided within the construction plans.

Limit exterior finish materials to those not requiring painting. Exterior finishes shall be composed of durable materials, such as masonry and metals that are not subject to rapid deterioration.

Provide non-skid floor finish materials in areas where potential for wet floor surfaces exist. Non-skid treatment shall not incorporate grooves. Install non-conductive flooring at service locations for high voltage equipment.

Provide durable, washable wall finishes in heavy traffic areas, such as lobbies, corridors, waiting areas, stairwells, and toilet rooms.

The use of Zolotone or similar multi-color coating systems requires written approval from the Wayne State University Design and Construction Standards Committee.

09300**Ceramic Tile**

Ceramic tile shall be used at all wet wall locations unless walls are constructed of concrete block units in which case paint (see paint section) may replace the use of ceramic tile. Floors in restrooms and showers shall be slip-resistant ceramic tile. Slip-resistant ceramic tile manufactured for exterior use, quarry tile or natural stone tiles shall be used at vestibule and entrance floors. Do not use ceramic tile on stair treads. First floor corridors and other heavily trafficked areas shall have slip resistant ceramic tile floors. Terrazzo shall be considered when project budget can accommodate. Installation shall be in mortar bed. Grout shall be sealed

09650**Resilient Flooring**

Generally, 1/8 inch thick vinyl composition tile (VCT) shall be used throughout buildings except at entrances, vestibules, first floor corridors, administrative offices, conference rooms, auditoria or lecture halls, study areas and libraries where carpet is the floor covering of choice. Provide rubber coved wall base when using VCT. Conductive and static dissipative VCT shall be used in those areas such as computer equipment rooms which require this special property. VCT shall not be used in wet laboratory or clean room areas; sheet vinyl floors with heat or chemically welded seams and integral coved base or other acceptable seamless flooring is required. Preferred adhesive is Henry's 430.

09680**Carpeting**

Carpeting shall be used at administrative offices, administrative conference rooms, auditoria or lecture hall aisles and common spaces, study areas and libraries. Loop, combination loop/pile or tip-sheared uneven loop construction is recommended for durability and resistance to traffic pattern wear and stains. Colors selected shall work to mask or hide soil, stains and wear; light solid colors are to be avoided. Seaming of carpets shall occur perpendicularly to long run of carpet. Avoid seaming carpet at high traffic areas such as doorways. Carpet seaming diagram submittals shall be included in the specifications and require University review and approval. For long carpet runs, patterns should consider how partial replacement of damaged sections can be accommodated.

09510**Acoustical and Hard Ceilings**

In general, exposed grid suspended ceilings are preferred over concealed systems. Spline and other non-accessible systems are unacceptable. 2 x 2 foot panels are preferred. 2 x 2 foot Tegular lay-in panels are preferred except where economy is paramount. Three-quarter inch thick panels are preferred over 5/8th inch panels. Standard 15/16th inch suspension grid is standard. Any deviation from a T-grid requires approval by the University's Design and Construction Standards Committee. Fiberglass panels are not acceptable. Use washable, soil-resistant, humidity and mold/mildew resistant, non-perforated panels for clean room applications. Use washable, soil-resistant, humidity, mold/mildew resistant panels for food prep areas which are acceptable to the authority having jurisdiction. Gypsum board ceilings shall be employed at lobbies, restrooms, showers, soffits and other areas so designated by the University or deemed desirable by Architect with University's approval. In general, do not provide acoustical or gypsum board ceilings at stairwells. Provide either concrete, gypsum board or plaster ceilings at vestibules. When gypsum board ceilings are included in design, necessary access panels shall be identified on the reflected ceiling plan. Where access panels are required for mechanical or electrical access, but not identified on the drawings, size and locations must be approved prior to proposed installation of

equipment requiring access. Design Professional must annotate drawings accordingly and show access panels on reflected ceiling drawings.

09910 **Paint**

Interior gypsum board walls shall be primed with one coat and painted with two coats of eggshell latex paint for offices, semi-gloss for corridors and classrooms. Concrete block walls shall be one coat primed with a concrete block void filler and painted with 2 coats of eggshell –Latex enamel paint. Use of a spray-applied multi-tone paint requires specific written approval from the WSU Design and Construction Standards Committee. Satin finish alkyd enamel paint shall be used on any metal door, frames and trim. Preferred application method is by spraying. Satin finish latex paint shall be used on any wood door frames and trim. Wood door, wood frames and trim shall be primed with one coat of wood primer and two coats of satin finish alkyd or latex paint. When wood is to be stained or clear finished, a minimum of two final coats of finish shall be applied. All door edges, including the top and bottom shall receive the same finish as the door faces.

Interior walls which are required smoke barrier or fire rated assemblies shall have the appropriated designation and the words “ SEAL ALL PENETRATIONS” painted in stencil form with letters not less than 1.5” in height in the color of RED on a white or existing light colored contrasting background above the finished ceiling every 10’ of continuous wall surface and not less than once in each room adjoining the wall, with a finished ceiling. Apply legend to both sides of walls.

As-built finish schedule, including room by room paint color, (product number and color formulation when applicable) and manufacturer shall be a final as-built submittal requirement.

09940 **Wall Covering**

Wall covering shall be used at Owner’s discretion and based on budgetary considerations. Recommended uses for vinyl wall covering may be considered for administrative offices and conference areas. Wall covering shall be Type II, Class A fire rated. Written approval of the WSU Design and Construction Standards Committee is required to specify wall coverings.

10100 **Visual Display Units**

Provide White Porcelain Marker boards or chalk boards in classrooms and lecture halls. Coordinate the specific product with the customer and the University’s Design and Construction Standards Committee. Marker boards are generally not suitable for use as projection screens.

Projection screens shall be manually retractable, except in a large-scale application where a stationary or motorized screen may be necessary. Follow manufacturer’s recommendations for size and surface of screen dependent upon viewing conditions.

Tack boards shall be located in corridors, offices, communal areas and meeting or conference rooms as required by Owner. Cloth or self-healing vinyl should cover a minimum ½ inch thick backing made of class A Fire Rated material. Tack boards may be framed or recessed in wall.

For accommodating built-in **Video Monitors, Slide Projectors and Rear and Front Projectors**, consult with the University’s Media Services department for equipment requirements.

Coordination of power, telecommunications, remote wiring and signal access, and equipment security is a design requirement.

10162 Toilet Compartments

Generally, ceiling hung enamel painted partitions are preferred. Where ceiling suspension is not feasible, provide floor and wall supported units. Coordinate ceiling hung units with supplemental structural steel support work. Latching hardware for barrier free stalls shall allow user to close and secure door with a single motion of one hand. Provide a non-cast metal coat/purse hook on the interior of each partition door. Provide adequate opening and turning radius to comply with State of Michigan ADA standards and for required number of ADA stalls in relation to anticipated building capacity.

Alternative partition materials may be considered when durability and vandal resistance is important. Fasteners shall be stainless steel.

Design Guidelines: Solid phenolic toilet compartments to be used in all applications.
Partition type: Floor mounted, overhead braced.

Performance Standards:

Conform to ANSI A117.1, American with Disabilities Act and State of Michigan Barrier Free Design Law for provisions for the physically handicapped.

PRODUCTS

Panel and Door Construction: ¾ inch thick, melamine face pressure and heat bonded to core. Edges shall be burnished and slightly rounded.

Pilasters: 1 inch thick, constructed same as doors and panels.

Pilaster Shoes: Formed stainless steel.

Head Rails: Heavy duty aluminum extrusion with anti-grip top edge and stainless steel wall brackets.

Attachments and Bolts: Stainless steel with heavy duty aluminum brackets.

Hinges: Stainless steel, cam operated with surface mount.

Strike and Keeper: Slide type latch, stainless steel door strike and keeper with rubber bumper.

Coat Hooks: Stainless steel with rubber bumper tip.

Grab Bars: Stainless steel, 1-1/2" in diameter.

In multi-use toilet rooms, where practical, compartment dimensions shall be as large as reasonable with design preference of doors swinging out, versus in.

10410 Display Cases

Glass-covered, self-lighted display cases shall be located in main corridors as required by the University.

10416 Building Directories

Major entrances to buildings accessed by the public shall be provided with a lockable, glass-enclosed directory, consisting of removable letters mounted on a ribbed felt-covered backboard. Directory may be partially recessed in wall.

10425 **Exterior Signage**

Provide exterior building signage to comply with ADA requirements, as well as those requirements as defined by the Wayne State University Design and Construction Standards Committee.

10426 **Interior Building Signage**

Provide interior building signage to comply with ADA requirements, as well as those requirements of the University when not in conflict therewith. Building Directories with changeable text are to be housed in locking, tempered glass-fronted cabinets. Letter size should be appropriate for viewing distance.

Emergency evacuation signage is required in all new and renovated structures. Coordinate with the University's Project Manager and the Office of Risk Management as to type and style.

10800 **Toilet Accessories**

All dispensers of soap, sanitary napkin, toilet paper and paper towel products shall conform to the current University standards at the time of design. Toilet accessories are to be Contractor Furnished and Contractor Installed. The Architect is to coordinate with the University on current models of accessories and provide coordinated placement for these items on the construction drawings. The Architect shall specify the mirrors, sanitary napkin disposal receptacles in each woman's stall, stainless steel peened grip grab bars at handicapped stall, and protective covers on cold and hot water supply at ADA sinks. Each shower shall be provided with a soap dish and two robe hooks. Barrier Free showers shall be provided with collapsible shower stall seats and stainless-steel peened grip grab bars. Confirm that ceramic tile soffit walls do not terminate at mounting heights of toilet room accessories.

Provide substantial and adequate backing within walls at all accessory mounting locations.

Toilet accessories currently used are:

9" Twin 9" Jumbo Bath Tissue Dispenser – Oceans Black SANR4009TBK

Roll Towel Dispenser – Integra, Black SANT850TBK

Foaming Soap Dispenser - Dial, Smoke, 1 Liter; CM-K-00396

Sanitary Napkin Receptacle - #1102 Wall Mount Allied Eagle is our local supplier.

11120 **Vending Machines**

Vending machines should be located in close proximity to building service entrances and storage areas for ease of servicing. They may be located in a student lounge area or lunch room or recessed in corridors so that they do not impede the flow of pedestrian traffic. All necessary utilities shall be provided including dedicated electrical circuits. Locations shall be provided with hard surface cleanable flooring. Confirm and include any requirements for data communications to vending machines.

12464 **Clocks**

Clocks shall be installed in all classrooms, lecture halls, instructional labs and reception/waiting areas and other common gathering areas as deemed necessary by the owner. The master clock controller shall be located in a locked mechanical or electrical room. Refer to preferred manufacturing listing.

12500**Window Coverings and Window Treatments**

Ensure that all wall coverings coordinate with the security systems and will not degrade the function of elements such as glass breakage detectors, etc.

Exterior appearance of window coverings should be uniform throughout the building. For horizontal or vertical blinds, use heavy duty materials and construction and operating mechanisms that eliminate overdrive (preventing damage to worm gear or control wand) at public and student occupied areas. A lighter weight blind material may be used at administrative areas and private offices. For shades, use a washable vinyl material with heavy duty clutch and chain mechanism.

Black out shades or total occlusion blinds shall be provided in rooms dedicated to, or frequently used for, visual projections of any kind.

Proper anchorage or backing material shall be incorporated in the wall design to support blinds and shades. Window coverings shall not be attached to window frames, extrusions, cover trim or other window system elements. The Design Professional shall provide a mounting detail drawing within the construction document set.

All rooms shall be provided with window coverings except those with translucent glass, such as toilet rooms.

10426 Interior Building Signage

Provide interior building signage to comply with ADA requirements, as well as those requirements of the University when not in conflict therewith. Building Directories with changeable text are to be housed in locking, tempered glass-fronted cabinets. Letter size should be appropriate for viewing distance.

Emergency evacuation signage is required in all new and renovated structures. See Facilities Planning & Management's "Campus Wide Building Emergency Signage Standards & Guidelines".

14200**Elevators**

NOTE: For projects involving the modernization of existing or the construction of new passenger or freight elevators, the Design Professional shall employ the services of a University approved elevator consultant experienced in the design and retrofit of elevators to guide and ensure the adequacy and acceptability of design.

Elevators shall be provided to accommodate the moving of passengers, furniture and equipment throughout the building. Provide a separate freight elevator where heavy equipment and materials need to be transported. The appropriate number of passenger elevators shall be based upon a transportation study. Where a mechanical penthouse is provided, freight elevator travel to penthouse level is desired, with key switch access utilizing the University's Best lock system cores.

Elevator emergency telephones are described in a previous section of this publication. The emergency telephone shall be one-button, hands-free type, with emergency override on call-in-progress to University Public Safety Department, and voice/location identification signal. Telephone shall be provided by, and testing and programming to be completed by elevator vendor.

Traveling cables shall provide spare conductors for power and telephone use. Freight elevator cars shall be provided with fire resistant protective blankets and wall mounting hooks.

Elevator cars which will include hard surface floors, whether VCT or ceramic tile, shall include an inflexible plate aluminum or steel floor to prevent floor damage when heavy equipment loads are applied to the car floor.

Two complete sets of elevator shop drawings, field wiring diagrams, block or control diagrams, software programming documentation, etc. shall be provided to the University at the time of elevator final approval.

Contract documents shall require the elevator contractor to include and provide, at no additional cost, code required full service operating and preventive maintenance for the period of the new installation warranty. Elevator Contractor shall be required to include a schedule of hourly labor, service call, and other related costs at the time of bid for repairs not covered by the warranty; warranty length to be established by the University.

15 000 MECHANICAL DESIGN AND PARAMETERS

15 010 GENERAL

This division includes WSU general requirements for Mechanical systems.

The purpose of these criteria is to provide uniformity of design based on established WSU standards and policy. All systems shall be in compliance with NFPA Standards 90A and 90B and others as applicable.

Energy conservation and maintainability shall be emphasized in all aspects of design and considerations.

Unless specific written waivers are provided by the Wayne State University Design and Construction Standards Committee, these standards are mandatory.

Air and water balancing shall be contracted directly by the University.

All direct burial mechanical piping shall include a continuous conductive tape suitably buried in the trench above the piping.

The basis of design shall incorporate products from the acceptable manufacturers listing published at the end of this standard. The Design Professional shall ensure that the 'worst case' product selection is used when dimensional differences would prevent the application of alternative products in the design; thus affecting the Owner's ability to achieve a truly competitive contractor bid response.

Construction details, components, accessories, sizes and models indicated in drawings and specifications shall indicate the minimum levels of quality and coordination requirements.

The Design Professional shall provide, within the bid document set, section drawings of all congested areas to ensure that adequate overhead space exists to route required mechanical, electrical, plumbing, and architectural components. The Design Professional shall work with the University's Project Manager to agree upon project locations that require elevation drawings.

Major items included but not necessarily limited to:

1. Basic Design Parameters
2. HVAC System
3. Pipe Hangers and Supports
4. Mechanical Vibration and Seismic Controls

5. Mechanical Insulation
6. Meters and Gages
7. Pipe and Pipe Fittings
8. Fire Protection System
9. Plumbing
10. Drinking Fountains
11. Heating, Ventilating and Air Conditioning Equipment
12. Controls-Building Automation System (B.A.S.)

15020 BASIC DESIGN PARAMETERS

Outdoor design conditions:

Summer: 95°F db / 75°F wb*

Winter: 3°F

*modifications to ASHRAE standards

Design according to the latest ASHRAE Fundamentals Handbook and Standards. Specialty occupancies, such as critical laboratory spaces may require design conditions which deviate from the ASHRAE standards. Definition of the design criterion shall be explored, discussed, and affirmed to prior to any system design activities.

Indoor design conditions:

	Summer °F db/%RH	Winter °F/%RH
General Comfort	76°/50	70°/30
Comm. Closet	78°/60	60

Mechanical and Electrical Room, including Boiler Rooms interior conditions to be specifically agreed upon in the development of each room.

Certain areas require temperature control with little deviation. In these applications, 'dead band' temperature control may be unacceptable. Areas include animal holding rooms, research laboratories, etc. The Design Professional is cautioned to determine the specific needs prior to any design work as these areas may also require modification of outdoor design conditions.

Ventilation / Indoor Air Quality: In accordance with all applicable codes and the latest ASHRAE Standards and International/BOCA Mechanical Codes.

15030 HVAC System

Central air handling units for heating and cooling system must be used whenever practical.

Carbon Dioxide sensors and automated controls shall be provided to allow control the introduction of outside air based upon air quality measurements.

Areas with differing load or occupancy characteristics must be served by separate air distribution systems to facilitate night and weekend setbacks.

All system designs shall recognize the need for routine maintainability of equipment; including access to change motors, coils, valves, dampers, etc. and shall avoid regulated spaces where MIOSHA confined space rules would apply.

Air Conditioning System

Wayne State University

Construction Design Standards - Revised, Nov 15, 2018

Air side economizer cycle (enthalpy control) shall be used in all air handling system to provide "free" cooling when outside conditions are acceptable.

As far as possible, variable air volume system design shall be used in all air systems.

System design and selection shall be made to provide the lowest life cycle system installation and operational cost. System designs which require cooling and subsequent re-heating are discouraged. Design engineers are expected to evaluate system economics prior to design and may be required to evaluate competing systems. All systems shall incorporate summer/winter controls for exterior areas and occupied/unoccupied controls for classrooms and conference rooms.

Return air fans with relief air dampers shall be furnished for air handling units with economizer controls.

Heating System

Use hot water heating for perimeter system.

Finned radiation, ceiling radiant panel and/or terminal reheat shall be used for perimeter heat. Use of plastic piping on any heating system is prohibited.

Ventilation System

Exhaust system shall meet current mechanical code requirements for new construction. Code applicability for renovations under the Michigan Rehabilitation Code for Existing Buildings shall become the subject of a preliminary design meeting with the University and authorities having jurisdiction, if any.

Heat Recovery System

Energy recovery systems shall be incorporated into designs. Closed loop energy recovery systems utilizing glycol materials shall include a permanent sign identifying the glycol material type, the system liquid volume, and the percentage of concentration of glycol that represents the basis of design.

15060 Pipe Hangers and Supports

Furnish all support and parts conforming to the latest requirements of ASME code for pressure piping B31.9 and MSS standard practice SP-58, SP-69, SP-89 and SP-90.

NFPA Compliance: Hangers and supports shall comply with NFPA standard No.13 when used as a component of a fire protection system. UL and FM Compliance: Hangers, supports, and components shall be listed and labeled by UL and FM where used for fire protection piping systems.

Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.

Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing or shall be copper plated to achieve similar metal contact.

Thermal Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation. Pipe Alignment Guides: Factory fabricated, of cast semi steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

Anchors to be specified at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

Where expansion compensators are indicated, require installation in accordance with expansion unit manufacturer's written instructions to control movement to compensators.

Provide pipe alignment guides on piping that adjoins expansion joints.

Pipe hangers shall be specified to be spaced as follows:

Pipe Size	Hanger Spacing	Rod Diameter
½" to 1-1/4"	8 feet	3/8 inch
1-1/2" to 2"	10 feet	3/8 inch
2-1/2" to 3-1/2"	12 feet	½ inch
4" to 5"	14 feet	5/8 inch
6"	14 feet	¾ inch
8" and above	16 feet	7/8 inch

Unless otherwise defined by code.

Pipe Covering Protection Saddles: Same outside diameter as the pipe insulation. The saddles shall be tack welded in place and filled with insulation equal to that of the adjacent piping.

Vertical Pipe Attachments System

Extension pipe or riser clamp.

Vibration Isolation System

Pipes subject to mechanical vibration shall be sound isolated from the structure through the use of an appropriately designed isolation strategy.

Hanger Spacing

Install hangers and supports for piping at intervals specified herein after, at locations not more than 3 feet from the ends of each runout, and not over 25% of specified interval from each change in direction of piping.

Hanger Spacing:

Pipe Size	Rod Size	<u>Maximum Hanger Spacing</u>	
		<u>Steel Pipe</u>	<u>Copper Water Tube</u>
½" & Smaller	3/8"	7'	5'
¾" – 1"	3/8"	7'	5'
1-1/4" – 1-1/2"	3/8"	9'	8'
2"	3/8"	10'	8'
2-1/2" – 3-1/2"	½"	12'	10'
4" – 5"	5/8"	14'	12'
6"	¾"	14'	--
8" – 12"	7/8"	20'	--
14" – 18"	1"	20'	--
20" and Larger	1-1/4"	20'	--

Soil Pipe Hanger Spacing:

Cast Iron Soil Pipe

All sizes

Maximum Hanger Spacing

10'-0", but not less than one Support per pipe joint

Mechanical Identification

Painted Identification Materials, Plastic Pipe Markers, Underground-Type Plastic Line Marker, Valve Tags, and Valve Schedule Frames.

Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

Require Contractor to submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space utilizing WSU's official room numbering scheme) and variations for identification (if any); Require the marking of valves which are intended for emergency shut-off and similar special uses by special flags in margin of schedule. In addition to mounted copies, require the furnishing of three extra copies for Maintenance Manuals, as well as the electronic document file in Microsoft Excel or Word.

Painted Identification Materials:

Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications.

Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

Plastic Pipe Markers:

Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI

Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide, full circle at both ends of pipe marker, tape lapped 3".
2. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
3. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by owner in cases of variance with names as shown or specified.
4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

Underground-Type Plastic Markers:

Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

Valve Tags:

Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.

1. Provide 1-1/2" diameter tags, except as otherwise indicated.
2. Provide size and shape as specified or scheduled for each piping system.
3. Fill tag engraving with black enamel. DELETE ABOVE IF PLAIN STAMPING DESIRED (LOWER COST).

Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.

Valve Schedule Flags:

For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

Lettering and Graphics:

Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

General Installation Requirements:

Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

Piping System Identification:

Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Stenciled markers, with lettering color complying with ANSI A13.1.
2. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings or enter non-accessible enclosures.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment. Include not less than one pipe identification for piping passing through any room, regardless of room size.

7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

Underground Piping Identification:

During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

Valve Identification:

Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by owner.

Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

Mechanical Equipment Identification:

Install engraved brass equipment marker on or near each major item of mechanical equipment and each operational device.

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Meters, gauges and similar units.
3. Fuel-burning units including boilers, furnaces, heaters, stills and absorption units.
4. Pumps, compressors, chillers, condensers and similar motor-driven units.
5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
6. Fans, blowers, primary balancing dampers and mixing boxes.
7. Packaged HVAC central-station and zone-type units.
8. Tanks and pressure vessels.
9. Strainers, filters, humidifiers, water treatment systems and similar equipment.

Optional Sign Types: Where lettering larger than 1" height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

Adjusting:

Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

15071 MECHANICAL VIBRATION and SEISMIC CONTROLS

All mechanical equipment, piping and ductwork shall be mounted on or suspended from vibration isolators to reduce the transmission of vibration to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

Inertia bases shall be used for equipment requiring 50 hp or larger motors. Centrifugal fans shall be mounted on spring-type vibration isolators for a minimum static deflection of 1". Pumps (including air compressors) less than 5 hp shall be designed with spring vibration isolators, 1.25" minimum static deflection; 7-1/2 hp and over, for 0.25" minimum static deflection. Reciprocating chillers shall have isolators with 1" minimum static deflection.

Piping and/or ductwork connected to this equipment shall be provided with flexible connections.

Tests and measurements should be taken upon job completion to determine effectiveness of isolators. Cost of testing and measuring procedures to be borne by the Contractor. Failure of any elements while equipment is operating shall be corrected, retested and re-measured. The Design Professional responsible for designing conforming installations that achieve designed sound pressure levels.

The first 3 pipe hangers in each mechanical equipment room shall be installed at maximum 10'-0" o.c. to and from each pump, receiver, tank, chiller, etc., shall be suspended on spring isolation hangers.

Electrical connections to motors shall be by liquid tight flexible conduit.

In addition to the 50 hp criteria for equipment requiring inertia bases, all floor mounted pumps 10 hp and larger on floors above basement level shall be required to have inertia bases.

All floor mounted equipment not required to have an inertia base shall be provided with a concrete housekeeping pad.

All piping connecting to vibration causing equipment shall have spring isolator hangers. All nuts which are exposed to vibratory motion shall be of the self-locking interference type.

15080 MECHANICAL INSULATION

Provide pipe, duct and equipment insulation to avoid condensation or to provide personnel protection if mounted in a pedestrian traffic area at an elevation less than 6'8" above finished floor. This includes mechanical rooms.

Asbestos containing insulation materials are expressly prohibited.

Piping Insulation

Piping to be insulated:

1. Domestic and process cold water piping.
2. Domestic hot water and hot water re-circulating piping.
3. Heating hot water piping.
4. Chilled water piping.
5. Steam and condensate piping, including large valves and pressure reducing valves. Valves shall employ removable jackets with snap retainers.
6. Air conditioning unit drain above suspended ceiling.
7. Horizontal sanitary and storm conductors above ceilings in occupied areas and all non-vertical sections of storm conductors.
8. Waste P-trap, hot and cold water supplies at barrier free lavatories.
9. Refrigerant suction line and fittings.

Engineer shall select economic insulation thicknesses and densities based on ASHRAE 90A-1980. Minimum thickness shall be 1 inch and minimum density of 1-1/2 lbs per cu. Ft.

Ductwork Thermal Insulation

Ductwork to be insulated:

1. Outside air intakes, ducts, and casing.
2. Mixed air plenums.
3. Supply air and return air ducts.
4. Air return ducts located in non-air conditioned space.

Duct insulation:

1. Exposed Ducts: In mechanical equipment rooms and in all other areas where it will be visible without removing ceiling or opening access panels, insulate sheet metal duct work with 1" thick, 6 lbs./cu.ft. density, rigid, high strength, insulation board made from glass fibers bonded with thermosetting resin and covered on one side with a factory applied vapor barrier facing.

2. Concealed Ducts: In ceiling spaces, building shafts, and other locations where they are not visible, insulate sheet metal ducts with 2" thick, 1.0 lb./cu. ft. density, resilient, flexible, blanket-type, thermal insulation made of glass fibers bonded with thermosetting resin and covered on one side with a factory applied vapor barrier facing with a 2" stapling and taping flange along one edge. Acoustical insulation material shall not be incorporated in any supply duct without the prior written approval of the WSU Design and Construction Standards Committee.

Equipment Thermal Insulation

Hot Equipment:

Insulate condensate receivers, hot water expansion tanks, deaerators, surge tanks, air separators, flash tanks, hot water heaters, hot water converters, and similar equipment with 2" thick, 6 lbs./cu.ft. density rigid, high strength, insulation board made from glass fibers bonded with thermosetting resin.

Cold Equipment:

Insulate water chillers, chilled water expansion tanks, air separators, chilled water pumps, and similar equipment with 2" thick, 6 PCF density flexible, closed cell, elastomeric foam insulation sheet.

15135 METERS AND GAGES

This Section includes the following types of meters and gages:

1. Temperature gages and fittings.
2. Pressure gages and fittings.
3. Flow meters.

Meters and gages furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 15 sections.

Meters and gages to comply the standards below:

1. UL Compliance: Comply with applicable UL standards pertaining to meters and gages.
2. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

THERMOMETERS-General

Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

Scale range: Temperature ranges for services listed as follows:

1. Domestic Hot Water: 30 to 240 deg with 2-degree scale divisions (0 to 115 deg C with 1-degree scale divisions).
2. Domestic Cold Water: 0 to 100 deg F with 2-degree scale divisions (minus 18 to 38 deg C with 1-degree scale divisions).
3. Hot Water: 30 to 300 deg with 2-degree scale divisions (0 to 150 deg C with 1-degree scale divisions).
4. Condensed Water: 0 to 160 deg F with 2-degree scale divisions (minus 18 to 70 deg C with 1-degree scale divisions).
5. Chilled Water: 0 to 100 deg F with 2-degree scale divisions (minus 18 to 38 deg C with 1-degree scale divisions).
6. Steam and Condensate: 50 to 400 deg F with 2-degree scale divisions (10 to 205 deg C with 1-degree scale divisions).
7. Thermometers shall be in vertical and tilted positions.

Meters and gages piping adjacent to machine to allow servicing and maintaining of machine

Thermometers are required in the following locations:

1. At inlet and outlet of each hydronic zone.
2. At inlet and outlet of each hydronic boiler and chiller.
3. At inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. At inlet and outlet of each hydronic heat exchanger.
5. At inlet and outlet of each hydronic heat recovery unit.
6. At inlet and outlet of each thermal storage tank.

BIMETAL DIAL THERMOMETERS

Type: Direct mounted, bimetal, universal angle.

Case: Stainless steel, glass lens, 5-inch diameter.

Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Element: Bimetal coil.

Scale: Satin faced, nonreflective aluminum, permanently etched marking.

Stem: Stainless steel for separable socket, length to suit installation.

THERMOMETER WELLS

Thermometer Wells: Brass or stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

Thermometer Wells: required in piping tee where thermometers are indicated, in vertical position.

PRESSURE GAGES

Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection.

Case: Drawn steel or brass, glass lens, 4-1/2-inches diameter.

Connector: Brass, 1/4-inch NPS.

Scale: White coated aluminum, with permanently etched markings.

Accuracy: Plus or minus 1 percent of range span.

Range: Conform to the following:

1. Vacuum: 30 inches Hg to 15 psi.
2. All fluids: 2 times operating pressure.

Pressure gages are required in piping tee with pressure gage valve, located on pipe at most readable position.

Pressure gage required in the following locations:

1. At suction and discharge of each pump.
2. At discharge of each pressure-reducing valve.
3. At building water service entrance.
4. At chilled water and condenser water inlets and outlets of chillers.
5. At inlets and outlets of hydronic coils.

Pressure Gage Ball Valves: Required in piping tee with snubber.

PRESSURE GAGE ACCESSORIES

Syphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

FLOW METERS, GENERAL

Flow rate of elements and meters shall be same as connected equipment or system.

Flow measuring elements and meters are required in the following locations:

1. At discharge of each pump.
2. At inlet of each hydronic coil in built-up central systems.

Meters For Use With Flow Elements: meters shall be on wall or bracket in accessible location.

VENTURI-TYPE FLOW ELEMENTS

Type: Differential-pressure venturi type, designed for installation in piping.

Construction: Bronze or cadmium-plated steel with brass fittings and attached tag with flow conversion data. Ends shall be threaded for 2 inches and smaller elements and flanged or welded for 2-1/2 inches and larger elements.

Flow Meter: Direct Reading 6" diameter meter. Scale to be in GPM appropriate for specific venturi.

15140 PIPE and PIPE FITTINGS

This standard defines acceptable underground and aboveground piping systems for building requirements. Every above ground pipe shall be labeled with a durable sign indicating the contents of the pipe and the direction of flow. Recommendation is to use a Seton or Bradley type label. Additionally, every pipe passing through any room shall include, within the room, identification as to content and direction of flow. Text size shall be sufficient to easily read from the floor below.

For all closed mechanical systems requiring domestic water, the fill line shall be provided with an appropriately sized water meter. For open systems, such as boiler feed water and cooling tower make up water; a water meter is similarly required. Other open systems to be provided with water meters shall be determined on an individual basis. All meter locations shall be installed for monitoring and reading with easy access and without the use of a ladder.

DESIGN GUIDELINES

Piping shall be run parallel or at right angel to walls in the most direct and straight manner possible. All piping shall be properly graded.

Piping shall not project beyond walls or steel lines nor shall it hang below slabs more than is absolutely necessary. Particular attention shall be paid to the required clearances.

Offset piping where required to avoid interference with other work, to provide greater headroom or clearance, or to conceal pipe more readily. Offsets shall be properly drained or trapped where necessary.

Provide swing joints and expansion bends wherever required to allow the piping to expand without undue stress to connections or equipment.

All piping in finished rooms shall be run concealed.

Exposed piping around fixtures or in other conspicuous places shall not show tool marks nor threads at fittings.

Isolate pipe from the building construction to prevent transmission of vibration to the structure and to eliminate noise.

Install piping such that any equipment connected to piping may be removed by disconnecting two (2) flanges or unions and removing only one or two pipe sections. All equipment shall have bolted or screwed flanges or unions at pipe connections.

Unions or flanges shall be used at all final connections preceded by valve; at all connections of fixtures, pumps, and equipment; and at control valves.

Unions shall be used in preference to couplings where their use will facilitate dismantling the pipe for maintenance.

Eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur due to a reduction in pipe size.

Eccentric couplings shall make the pipe flush on the bottom for steam lines and flush on the top for water lines.

Grooved pipe is acceptable in approved applications.

Weld pipe ends need to be properly beveled to permit butt-welding.

Provide dielectric unions when connecting copper pipe to different metals.

Provide strainers ahead of control valves and pressure regulating valves except for fin tube and convectors.

Provide blow down valves on strainers.

Install low point drains and high point vents in, mains, risers and branch lines. Automatic vents are not to be used except at expansion tanks. Provide a tee fitting with nipple, ¾" bell valve and capped hose connection.

Utilize steel pipe sleeves wherever pipes pass through building construction.

Below grade wells and slabs on grades need to have the space between the sleeve and pipe sealed watertight.

Pipes passing through above grade slabs and walls shall need to be sealed with non-switching, non-asbestos, non-combustible material.

Use well neck type flanges and install true and perpendicular to axis of pipe.

Use long sweep elbows whenever possible, mitered elbows not acceptable.

PERFORMANCE STANDARDS

All welding to conform to ASME welding code and standard ANSI B 31.1.

Welder certification not normally required unless working on high pressure applications (greater than 100psi).

Welders must have experience in the type of work being done and if not competent can be dismissed in opinion of design professional or owner.

Gaskets for Flanged Pipes shall be raised face for steel and full face for cast iron. Use semi metallic gaskets and replace whenever joint is broken.

Use threaded connections for steel pipe 2" and smaller; welded for 2 ½" and larger.

Install flanges in piping 2 ½" and larger when connecting to valves and equipment.

For copper tube and fitting braze joints in accordance with ANSI B 31.1 and ANSI B 9.1 as applicable.

PRODUCT DESCRIPTION

Steel Piping – Black, welded and seamless carbon steel with schedule appropriate for service ASTM A-53 for 2" and larger.

Galvanized Piping – hot dipped inside and out in accordance with ASTM B-6 using 2 ounces of zinc per square foot.

Threaded Fittings: malleable iron, black or galvanized as required for service. Malleable iron to conform to

ASTM A 197. Malleable iron fittings to conform to ANSI B 16.3, 150lb rating.

Unions: brass to iron, ground joint seat, class 150.

Wayne State University

Construction Design Standards - Revised, Nov 15, 2018

Welding Fittings: 150lb rating conforming to ASTM 234, Grade WPB forged steel with standard manufacturer trademarks, Last code, grade, etc.; dimensions to conform to ANSI B 16.9.

Welding Flanges: 150lb rating, ASTM A181, Grade 1 steel with dimensions conforming to ANSI 16.5.

Copper Pipe and Fitting: hard drawn, type cork pipe to conform to ASTM B88. Fitting to be soldered joint, wrought copper conforming to ANSI B16.22.

Solder: 985/5 tin-copper, lead free suitable for operating temp of 300 F conforming to ASTM B-32.

Gaskets: 900lb some metallic, 1/16 inch minimum thickness.

Strainers: full line size, cast iron body for threaded and flanged connections, schedule 40 steel body for welded connections, 125lb rating, threaded or bolted screen retainer, stainless steel strainer with 3/64 inch perforations.

Sleeve Seals: Interlocking synthetic rubber links connected with bolts and pressure plates to create water tight seal.

Storm, Sanitary and Waste Piping:

Underground: Standard weight hub and spigot coated cast iron with "push tight" resilient joints and fittings.

Aboveground: Service weight "no hub" cast iron pipe with drainage pattern cast iron fittings and stainless steel and retaining clamps.

Chemical waste and specialty drainage systems shall incorporate products which are manufactured to withstand expected chemicals and compounds to be drained.

Domestic Hot and Cold Water Piping:

Underground:

1. Up to 2-1/2": Type K soft temper seamless copper tube with wrought copper solder joint fittings.
2. 3 Inch and Larger: Ductile iron, class 52 with bituminous outside coating and cement mortar inside lining. Joints to be push-on type with neoprene gasket or mechanical joint.
3. Insulate as necessary.

Aboveground:

1. Up to 2 Inch: Type L hard drawn copper piping with wrought copper solder type fittings.
2. 2-1/2 Inch and Larger: Schedule 40 galvanized steel pipe with galvanized malleable iron fittings or Type L hard drawn copper piping with wrought copper type fittings.

Compressed Air Piping System:

Schedule 40 black steel pipe with 150 lb. malleable iron screwed fittings, or as required for service application exceeding #150.

Natural Gas Piping System:

Aboveground: Up to 2 inch piping shall be schedule 40 black steel with 150 lb. malleable iron screwed fittings installed with a Teflon base pipe thread compound. 2-1/2 inch and larger piping shall have welded joints.

Chilled Water and Cooling Tower Water Piping System:

Up to 2 Inch: Schedule 40 black steel pipe with 150 lb. malleable iron screwed fittings.

2-1/2 Inch and Larger: Schedule 40 black steel pipe with standard black steel butt welding fittings and 150 lb. forged steel welding neck flanges.

In lieu of welded, threaded or flanged piping system, grooved piping systems may be used at the University's option.

Heating Hot Water Piping System:

Up to 2 ½ Inch:

1. Schedule 40 black steel pipe with 125 lb cast iron screwed fittings, 250 lb malleable iron screwed unions, standard black steel screwed coupling
2. Type "L" hard drawn copper piping with wrought copper solder type fitting can be used at the mechanical contractor's option.

3 Inch and Larger: Schedule 40 black steel pipe with 125 lb welded fittings and 150 lb welded neck flanges. Grooved piping systems may be utilized at the University's option.

Steam and Condensate Piping System (up to 125 psig):

Up to 2 Inch: Schedule 40 black steel with 125 lb screwed cast iron fittings and 250 lb malleable iron screw unions.

2-1/2 Inch and Larger: Schedule 40 black with 125 lb welded fittings and 150 lb welding neck flanges.

Gravity and pumped condensate shall be as specified above except schedule 80 pipe and fittings shall be used.

Steam and Condensate Piping System (126 psig thru 250 psig):

Up to 2 Inch: Schedule 40 black steel with 300 lb forged steel screwed fittings and 300 lb forged steel screwed unions.

2-1/2 Inch and Larger: Schedule 40 black steel with 300 lb. forged steel welding neck flanges.

High pressure gravity condensate shall be as specified above except schedule 80 pipe and fittings shall be used.

Steam Trap Installations

Install steam traps in accessible locations as close as possible to connected equipment.

Install isolation valve, strainer (leg vertical), and union upstream from the trap; install union, test tee with test valve, check valve, and isolation valve downstream from trap.

Install the inlet of F & T steam traps a minimum of 12" below the outlet of the device served.

Equipment Drain Piping System:

Type "L" hard drawn copper piping with wrought copper solder type fittings. Schedule 40 galvanized steel; PVC; or CPVC piping may be utilized when design requirements will allow.

Refrigerant Piping System:

Type "L" hard drawn copper piping with wrought copper solder type fittings.

Valves – Pipe sizes of 2 ½" or smaller shall be ball valves with stainless steel balls and reinforced Teflon seats.

15300 FIRE PROTECTION SYSTEM

The entire installation shall be in accordance with NFPA Standards, and in accordance with the University's Risk Management Department requirements.

Automatic Sprinkler System

A complete and supervised automatic sprinkler system shall be installed throughout all new buildings.

Fire protection system shall be hydraulically designed and calculated in strict accordance with NFPA 13 and 14 (latest edition) and all other codes having jurisdiction. Placards detailing hydraulic design calculations shall be installed on all fire suppression systems at the base of the riser.

Standpipe and Hose System

Standpipe shall be installed in every building over two stories in height above the ground.

15400 PLUMBING

Plumbing Fixtures:

The materials used shall be non-absorptive and acid resistant.

1. Water Closets: White vitreous china, wall hung, elongated type siphon jet bowl, flush valve with water saver (3 gal./flush).
2. Urinals: White vitreous china, wall hung, siphon jet, water saver (1 gal./flush) $\frac{3}{4}$ " top spud flush valve.
3. Lavatories: White vitreous china, 20" x 18" min. wall hung complete with supply pipes and stops, strainer, cast brass P-trap and chrome plated over all brass castings faucet assembly.
4. Service Sink: Cast iron with acid resisting porcelain enamel inside, stainless rim guard bolted to rim. Recessed or low profile style. Supply fittings shall be polished chrome plated double faucet or floor mounted.
5. All faucets & flush valves in public restrooms shall utilize electronic proximity actuators.

Plumbing Equipment:

Domestic Water Heaters: Buildings with continuous steam supply: Steam to liquid heat exchanger complete with vacuum breaker, steam control valve, circulating pump, storage tank. Water heater shell and tank shall be covered with factory applied insulation and steel jacketing. Buildings with seasonal steam supply: Natural gas fired high efficiency. Capacity and tankage to be determined by projected hot water use. Consideration for small point of use heaters shall be incorporated in design development.

Domestic Water Booster Pump System: Packaged variable flow, triplex, constant pressure system, system shall be completely factory assembled. Pumps shall be automatically controlled with pressure switch. Pump packages shall be variable frequency/variable speed and shall shut down under no-flow conditions.

Sump Pump: Automatic duplex type. Pumps shall be centrifugal, self-priming complete with control package and pit cover. Not of submersible type. An audible alarm at the location of the pump shall be provided to notify of a high water condition. Consideration for connecting the pump high water alarm to the University's security or building automation system shall be discussed at design development.

15412 Drinking Fountains

Drinking fountains will be of the unit refrigeration type and to be wheelchair accessible. Locations and quantity are to be established during preliminary planning.

Drinking fountains shall be dual level barrier free, self-contained wall hung, surfaced mounted, electric air-cooled refrigerated units, self-closing valve, stainless steel top and anti-splash ridge, front press bar and stainless-steel cabinet.

15700 Heating, Ventilating and Air Conditioning Equipment

Steam and Hot Water Heating Boilers:

Boilers shall be completely pre-assembled and fire tested in the factory. Unit shall be ready for mounting on a floor and ready for attachment of water, steam, fuel, electrical, vent and stack connections. The complete packaged boiler shall be approved as a unit and shall bear the Underwriter's Laboratory label. Boiler control package shall incorporate a status point (either normally open or normally closed) to provide monitoring of operational failure by the building automation system.

1. Steam boiler trim shall be complete with water column, feed water pump control, low water cut-off safety relief valves and steam pressure controls, water treatment sample coolers, automatic boiler down and flue gas economizers. In addition to a chemical pot feeder, each boiler shall be provided with an access point for the chemical injection from a continuous feed water treatment chemical pump. Clearance for boiler tube replacement shall be reserved and indicated on the construction documents. Boiler steam discharge valves on multi boiler installations shall be of the non-return type. Water Columns on boilers shall be McDonnell-Miller float type.
2. Hot water boiler trim shall be complete with hot water connection. Low water cut-off, pressure and temperature gages, temperature controls and safety relief valve. Provisions shall be made for the collection of a boiler water sample and the direct injection of water treatment chemicals into the boiler.

Steam to Water Heat Exchangers:

Shell and tube design selected for steam in the shell and heated water in the tubes. Tubes shall be U-bend style, constructed of copper and shall be rolled into a steel tube sheet. Header shall be cast iron. Clearance for tube bundle removal shall be provided and indicated on the construction documents.

WSU prefers to utilize packaged instantaneous heat exchanger products versus component assemblies of shell and tube exchangers and controls.

Side Stream Filtration:

All closed loop circulating systems shall incorporate a side stream filtration feature sized and designed in accordance with the circulating loop size and flow.

Centrifugal Liquid Chillers:

Chillers shall be specified to use HCFC-123 or HFC-134a, and power consumption shall not exceed 0.6 kW per ton. Chiller shall be provided with OEM supplied microprocessor gateway capable of full chiller system information transfer into the building automation system. Specific design elements shall be confirmed during the evolution of project design. Provide refrigerant monitoring system and purge system as required by code.

Absorption Water Chillers:

Chiller shall be completely assembled, leak tested and evacuated in the factory. Units shall include purge system, steam control, steam demand control, economizer, strainer, etc. Chiller shall be complete with microprocessor controller to automatically control the leaving chilled water temperature.

Cooling Towers:

Cooling tower shall be induced draft, crossflow and factory assembled. Cooling tower shall be sized for 78°F WB outside ambient temperature. When fan speed is required to modulate, VFD technology shall be specified. Multi speed motors are not acceptable. Lubrication points shall be easily accessible to maintenance personnel. Fans shall be designed with direct mechanical drives. Cooling towers supporting process cooling loads shall be closed circuit fluid coolers designed for operation with a glycol cooling fluid.

Vibration sensors are to be provided by the equipment manufacturer, provisions shall be made to connect sensors to the building automation system. Where tower service work requires work above standing height; MIOSHA compliant work platforms and railings shall be provided, including ladder and access.

Circulating Pumps:

Horizontal End-Suction Pumps: Horizontal single stage, with enclosed impeller and radially split casing. Motor to pump coupling shall be keyed, flexible type grid coupling with heavy coupling guard secured to the pump base. End suction pump shall be used on system with capacities below 500 gpm.

Double Suction Pumps:

Pumps shall be single stage, split case, double suction with enclosed impeller and split casing. Upper portion of the casing shall be removable without disturbing the lower portion. Pump shall be used on system with capacities above 500 gpm.

In-Line Pumps:

Pumps shall be close coupled, single stage; bronze fitted and shall be rated for 175 psi maximum working pressure at 225°F. In-line pumps shall be limited to applications requiring 5 HP or less.

Air Handling Units:

Modular and Custom air handling unit: For system capacity of less than 30,000 CFM. All air handling units shall be in compliance with NFPA 90A and 90B.

1. Air handling unit shall consist of mixing box section, air blender section, and 85% cartridge filter section utilizing slide in filter racks, heating coil section, cooling coil section, supply fan section, all necessary plenum or spacer sections and separate return air fan unit.
2. Units shall be double wall construction. Interior wall shall be 20 ga and exterior wall shall be minimum 18 ga galvanized steel with 1-1/2 lb density insulation in all modules.
3. Supply and return fans shall be double width, double inlet air foil fan or plenum type fan. Where practical, supply air and return air fans shall be direct drive with VFD controls.
4. For variable volume system, supply and return fan motors shall be provided with variable frequency drive controls, with electrical bypass feature.
5. Air handling units shall be controlled by the building automation system (B.A.S.).
6. Filter racks shall be slide in style, requiring no supplemental clips, springs, or other hardware to maintain proper filter placement.

Custom Air Handling Units:

For system capacity of 30,000 CFM or more:

1. Unit shall consist of mixing box section, air blender section, 85% cartridge filter section, heating coil section, cooling coil section, supply fan section, plenum or spacer sections and separate return air fan unit.
2. Unit casings including walls and roof shall be double wall galvanized steel, minimum 18 ga with 2" thick 1-1/2" lb density fiberglass insulation.

3. Filter racks shall be slide in style, requiring no supplemental clips, springs, or other hardware to maintain proper filter placement.
4. Supply and return fans shall be double width, double inlet air foil fan or plenum type fan. Where practical, supply air and return air fans shall be direct drive with VFD controls.
5. For variable volume system, supply and return fan motors shall be complete with variable frequency drive controls.

Air Terminal Devices

VAV terminal boxes shall bear a sign on the exterior of the box at the service access location indicating the source air handling unit that is providing supply air and the rooms that are being served.

15950 CONTROLS-BUILDING AUTOMATION SYSTEM (B.A.S.)

Manufacturers:

Primary control equipment shall be manufactured by either Siemens, Johnson controls or Honeywell. All systems shall be BACnet/IP compatible.

Installation:

Temperature control and building automation systems shall be provided and installed by factory branch operations only. Distributors or independent contractors shall not be permitted.

Design Requirements:

1. A comprehensive points list shall be developed for all control points, including pseudo or virtual points. The list shall be incorporated within a drawing that shall be so identified and included within the mechanical drawing subgroup. The form of the comprehensive points list shall be reviewed and approved by the WSU Facilities Operations and Maintenance department. **Do we have a format of what we want? Needs to be included if we do**
2. The bidding documents shall include an overall system narrative including B.A.S. architecture.
3. All devices which make up the control system shall be energized from emergency generator powered circuits. Particular attention shall be given to supporting devices such as air compressors, controlled device power supplies, etc.
4. Contractor submittals must be provided to the University for concurrent review.
5. Wiring below 8' above finished floor shall be mechanically protected. Wiring above 8' above finished floor may share cable tray or be supported by properly spaced supporting devices
6. All systems shall be integrated into the Wayne State University campus wide network. All designs shall incorporate all hardware, software, conversion devices, etc. necessary to affect a fully functional system, including alterations required at the University's 'head end' work station. **Need to define our "head end" requirements....Siemens deisgo.....**
7. Full system graphics shall be provided at project location access equipment and the University's 'head end' work station. Full upload and download capability between local controls and University's head end shall be provided
8. Upon the completion of work, as-built documents for full B.A.S. installation, including all drawings, tables, point identifications, operating sequences, set-points, etc. shall be incorporated in the final electronic "as-built" documentation for the project.

9. For new building installations, the work station shall minimally provide an appropriate desk, chair, power, task lighting, data connection, telephone, and file drawer.
10. Work Station shall be based upon the current WSU C&IT hardware standard, which shall be acquired by the Design Professional at the time of project development. The highlighted information does not belong in this section. Need to determine where to put this.
11. Chillers, when provided, shall incorporate gateways capable of full chiller system information to the B.A.S.
12. When generator back-up is available, control system, and remotely powered controlled devices shall be powered from emergency generator fed circuits.
13. Building Automation work station graphics shall be developed in accordance with WSU standards. This needs to define our standards.

Programming Features:

1. Graphics acceptable to the University shall be provided for all mechanical and electrical systems and components which are controlled or monitored by the B.A.S. Graphics must also reside on the University's central server/control center and be fully visible at the local building's work station. All terminal device graphics should contain locations such as room numbers the device is serving. It should also notate what air handler feeds the device. It should show room set point, room temperature, discharge temperature, damper command, damper position, cfm set point, cfm the unit is putting out, valve command, valve position and mode heat or cool and occupancy or vacancy.
2. Alarms on critical points, components, and systems are an important feature and require review and concurrence by the University during the design development phase of the B.A.S.
3. Programming shall include optimized start/stop for appropriate mechanical and electrical systems.
4. Point descriptors shall include upper/lower case characters. System or point names such as AHU #1; FEEDWATER PUMP #2; etc shall be all upper case. For example, "CIRCULATING PUMP #1 - Mechanical Room 235"
5. Point descriptors including room numbers shall represent the University's assigned nomenclature instead of construction document numbers, if different.
6. Security levels and password access shall be incorporated in accordance with University requirements.
7. AHU's of greater than 5 tons of cooling capacity with fresh air/make-up air supplies shall incorporate enthalpy control strategy.
8. Lighting which shall have time of day controls shall be controlled by use of an ambient light sensor alone, or in conjunction with internal time of day algorithm.

9. In addition to required submittals and all final program information shall be provided on CD at the conclusion of the project installation.

10. The following devices, when present shall be monitored:

1. Building Alarms – (non-security)
 2. Refrigerant Leak Detectors
 3. Water and Other Fluid Leak Detectors
 4. Sump Pump High Level Alarms
 5. Sewage Ejector High Level Alarms
 6. Jockey Pump Motor Starters
 7. Fire Pump Motor Starters
 8. Emergency Generators
 9. Boiler Flame Failure
 1. Others as identified
2. Emergency Generators shall be monitored for a running condition, fuel storage tank level, ambient temperature for exterior mounted equipment, and high and low engine operating temperature.
 3. Chillers shall be prevented from short cycling when system demand is not present. (i.e. all AHU's served by the chiller are off on night set-back.)

16000 Electrical Design & Parameters

16010 General

Purpose:

The purpose of these criteria is to provide uniformity of design based on established WSU standards and policy.

Energy conservation shall be emphasized in all aspects of design and considerations.

Unless specific written waivers are provided by the Wayne State University Design and Construction Standards Committee, these standards are mandatory.

MEP/A Coordination:

The Design Professional shall provide, within the bid document set, section drawings of all congested areas to ensure that adequate overhead space exists to route required mechanical, electrical, plumbing, and architectural components. The Design Professional shall work with the University's Project Manager to agree upon project locations that require elevation drawings.

16020 Design Parameters

The design shall be in accordance with all applicable codes. Incorporate into design NFPA 70, 110.6 flash protection. FPN N01 NFP\$ 70E, FPN No2. ANSI Z535.4 - 1998

Existing code violations that are not addressed in the Program Documents but are identified in the design process, shall be brought to the attention of the Wayne State University Project Manager.

Locate equipment requiring maintenance so that it is easily accessible. Avoid installations that require the use of lifts or scaffolding, or the removal of other equipment, for routine maintenance. Provide access doors to all maintainable equipment located behind walls or above permanent ceilings. Do not create confined spaces of any regulated description.

Lockout:

All equipment must have means to lockout / isolate all potentially hazardous energy sources related to equipment that may be serviced. The lockout point(s) should be labeled and as obvious and convenient as feasible. Electrical disconnect switches shall incorporate provisions for lockout in either the On or Off position.

Electrical Safety/ Arc Flash Safety:

Electrical installations must meet or exceed NEC Article 110.16 requirement, including clearly labeling electrical switches / panels with potential electric Arc-Flash hazards. Include the Hazard Risk Category, Flash Protection Boundary, Incident Energy available, system voltage, and shock protection boundaries on labels.

Use current-limiting overcurrent protective devices to minimize Arc-Flash hazards.

Use "touch-safe" components to minimize exposure to energized components

Use fuses with blown fuse indication to minimize exposure to energized components while trouble-shooting the circuit. Provide selective coordination when designing circuit protection (only the area where the fault occurs is shut-off). Provide adequate space for maintenance, repair, and expansion in electrical rooms and closets. Provide adequate drainage and/or containment from areas with energized electrical equipment. Evaluate all areas where ground fault circuit interruption (GFI) and arc fault interruption (AFI) devices may be needed. Consider response of emergency personnel in cases of fires and natural disasters. Label all electrical control panels and circuits.

16030

Demolition

Abandoned and inactive conduits, wire, devices, equipment, etc., shall be removed in their entirety. Above new ceilings, existing lighting fixtures shall be removed. Conduit and boxes shall be removed. Conduit and wiring feeding devices, and equipment to be removed shall be also removed up to the next active pull box, junction box or panel. Hangers, messenger cable, brackets etc., supporting items to be removed shall also be unfastened and removed. Open holes in ducts, boxes, panels and knock-outs shall be closed with suitable snap plugs or blank-off steel plates.

Specifications shall require the Contractor to remove and deliver to a place designated by the University, all existing electrical equipment selected for salvage by the University. This equipment remains the property of the University. Any equipment, devices, materials, etc., that the University elects not to retain shall be legally disposed of by this Contractor.

When light fixtures are being removed and not reused, the specifications or construction drawings shall instruct the contractor to remove fluorescent lamps and ballasts (unless ballasts are confirmed to contain no PCB's); consolidate items for transportation, and coordinate with the

Project Manager to have the materials transported to the designated University location for disposal or to be manifested for hazardous waste disposal.

16040 Wiring Methods

Provide raceways for all wiring unless otherwise agreed. All power wiring shall be enclosed in concealed raceways. All raceways shall bear UL labeling for the application selected.

Do not mix wiring systems. Provide separate raceways for different systems by Voltage, type or purpose.

120/208 volt separate from 277/480 volts.

Exit and emergency lighting separate.

Fire alarm, security, tele/comm/data/audiovisual may be combined in a suitable cable tray.

16050 Electrical Service

Primary Service: 13.2 KV or 4.8 KV, 3 phase, 3 wire from utility company as directed by WSU Project Manager.

Secondary Service: 480Y/277 VAC, 3 phase, 4 wire from secondary unit substation.

Motorized Equipment Rated ½ H.P. and Larger: 480 VAC, 3 phase, 3 wire.

Fluorescent and HID Lighting: 480/277 VAC, 3 phase, 4 wire from distribution panels when appropriate.

Incandescent Lighting, LED Lighting, Receptacles and Small Power System: 208Y/120 VAC, 3 phase, 4 wire from step-down dry type transformers.

16060 Sleeves, Chases and Recesses

Provide pipe sleeves where conduits pass through concrete floors, walls, beams and ceilings. Sleeves shall be galvanized rigid steel pipe equivalent to schedule 40 wall thicknesses. Aluminum conduit shall not be used. Where specific sizes are not indicated on Drawings, sleeves shall be sized to provide one-half (1/2) inch clearance between the outside surfaces of the item for which they were installed. They shall be flush with wall surfaces, and shall extend one inch, or as directed, above finished floor levels. The space between conduit and sleeves shall be fire stopped using one of the methods detailed in the UL Fire Resistance Directory, Vol. 2, Through – Penetration Firestop Systems, latest Edition. Seal any openings between sleeves and concrete in an appropriate manner.

The filler materials and methods used shall be rated at least equal to the fire resistance of the construction material being penetrated.

16070 Concrete/Housekeeping Pads

Provide concrete envelopes for below grade conduits and housekeeping pads for motor control centers, floor mounted distribution panels, motor control centers, transformers, switchgear, etc. Concrete work shall be done by the contractor for concrete work but paid for by this contractor. Provide 4" inch high concrete housekeeping pads.

Concrete pads for primary switch units and unit substations shall have angle iron or channel nosing.

Provide 6" concrete curb across doorway of substation room where room is subjected to possibility of exterior flooding.

16080 Interruption of Services

All Contractors must obtain approval from the University Project Manager prior to interrupting existing services. All service interruptions shall be at a time suitable to the University. Include specification language covering off hours tie-ins.

In general, all shutdown of electrical services shall be performed during off hours and may include Sunday and holiday periods. This premium time cost shall be included in the Contractor's Base Bid.

16090 Conduit Installation

All work shall be concealed in finished areas unless otherwise noted. Exposed work shall be installed perpendicular or parallel to walls, ceilings, and structural members and coordinated with mechanical ducts, pipes and equipment.

For work in finished rooms without ceilings, the conduit shall be run exposed except as noted hereinbefore. Conduit drops for outlets, switches, etc., shall be run concealed in the wall construction and such conduits shall be concealed up to a point as determined by Design Professional.

Wall outlets shall not be installed back to back and shall maintain a minimum of 12" between adjacent outlets. Through-wall outlets are not permitted.

Conduit shall not be run in concrete floor or roof slabs. Conduit below slabs on grade shall be not less than 12" below the bottom of the slab above.

16100 Mounting Heights

Mounting heights shall be as follows:

Lighting Switches	4'-0"
Receptacles (General Areas)	1'-6"
Receptacles (Utility Areas)	4'-0"
Telecommunication Outlets.....	1'-6"
Wall Phone	4'-0"
Fire Alarm Stations	4'-0"
Fire Alarm Signals.....	7'-6"
Alarm Bells	1'-6" Below Fin. Ceil.
Clocks/Clock Outlets	1'-6" below Fin. Ceil.
Lighting/Receptacle Panels.....	6'-0" to Top
Distribution Panels	7'-0" to Top
Motor Starters, Safety Switches	5'-0" to Top

Basic Material Requirements

Minimum size conduit is 3/4" unless otherwise indicated.

Exterior conduit beyond ten feet from building shall be schedule 40 PVC, minimum 3/4"

Exterior conduit within ten feet from the building foundation wall shall be galvanized rigid steel, minimum 3/4".

All large (3" or larger) buried conduits containing conductors from generators shall be PVC; elbows or sweeps shall be galvanized rigid steel. Conduits projecting through concrete slabs or extending above grade shall be galvanized rigid steel.

All exterior underground conduits shall incorporate a conductive warning tape buried above the conduit.

Interior conduit under slab on grade shall be schedule 40 PVC, minimum 3/4".

No conduit shall be placed in concrete roof or floor slabs.

Conduit in wet/damp locations shall be galvanized rigid steel, minimum 3/4".

In concealed dry locations use electrical metallic tubing (EMT) thru 4" in drywall partitions and above ceiling.

In exposed dry locations use electrical metallic tubing (EMT) thru 4".

Conduits of 4" and larger shall be galvanized rigid steel with threaded fittings, provide sweeps in lieu of elbows.

Install conduit in accordance with NFPA 70 "Standard of Installation".

Flexible conduit shall be supported at intervals of 3'-0" maximum.

Support conduit using coated steel or malleable iron straps, lay-in adjustable handers, clevis hangers, and split handers with 1/4" rod minimum.

Do not attach conduit to ceiling support wires, or support of other trades, unless specifically designed.

Arrange exposed conduits to maintain headroom and present neat appearance.

Route conduit parallel and perpendicular to walls.

Route conduit installed above accessible ceiling parallel and perpendicular to walls.

Route conduit under slab from point-to-point.

Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104°F.

Install no more than the equivalent of three 90 degrees bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch size.

Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joint.

Ground and bond conduit under provisions of Section 16170.

Provide flexible connections to resiliently mounted equipment and dry transformers.

16130 **Methods**

Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

Make wiring connections using wire and cable with insulation suitable for temperature encountered in heat producing equipment.

Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.

Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

16140 **Underground Electrical Services**

Incoming underground primary electrical service duct bank shall be (2) 4" schedule 40 PVC, (1) active, (1) spare from 10' beyond building foundation to service point. Concrete encased minimum 4" envelope, 46" below finished grade with continuous conductive warning tape run above duct bank 12" below finished grade.

Incoming underground voice/data communications duct bank shall consist of 4" schedule 40 PVC from 10" beyond building foundation to service point. Direct burial 46" below finished grade with continuous conductive warning tape run above duct bank 12" below finished grade.

Any electrical conduit penetrating a building foundation wall below grade shall be made water tight at each opening to prevent the conduit's ability to conduct water from rain or flooding into the building.

16150 **Building Wire and Cable**

Service entrances: Type THWN in raceway.

Feeders: Type THHN/THWN in raceway.

Branch Circuits: Type THHN/THWN or XHHW 75°C in raceway.

Fire Alarm Circuits: Power limited, fire-protective signaling circuit cable in raceway, cable tray or conduit.

All wire/cable shall be 98% copper minimum.

Minimum size conductor for power and lighting circuits shall be 12 AWG.

Minimum size conductor for control circuits shall be 14 AWG.

Use minimum 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

Use minimum 10 AWG conductors for 20 ampere 277 volt branch circuits longer than 200 feet.

16160 Electrical Service

General

Primary service, dual underground feeds required from either utility. For new services, 13,200 volts only from PLD; either 4,800 volts or 13,200 volts from Edison. When option exists, final selection of a utility provider for each project will be made by WSU.

All primary switch units and unit substations shall be mounted on leveling channels in 4 inch concrete bases with angle iron or channel nosing. Provide a 6 inch concrete curb across doorway, and a floor drain in transformer vault if possible. No mechanical piping is permitted in transformer, switchgear, or electrical vaults, with the exception of required fire protection.

Primary Switch Units

Where lightning arrestors are required, these shall be installed in a separate cabinet completely isolated from high voltage switch cabinets and incoming primary cables.

Unit Substation

Unit substations shall be double ended, with main secondary breakers and full rated tie breaker to allow transfer of load to keep building in service in case of utility outage or maintenance on transformer, high voltage switches and fuse compartment.

Double ended substations with automatic throw over preferred for science & research buildings. Manual throw over and single ended arrangements considered and evaluated for other buildings.

If the lighting load and power load is heavy and motors are fairly large, building service should be 277/480 volts to supply 120/208 volts step down transformers to serve incandescent lights and duplex receptacles.

If the lighting load is heavy compared to the power load and no large motors are required, the building secondary service should be 120/208 volts.

When the total electrical load is 2000 KVA or more, install two double-ended substations, one for equipment at 120/208 volts and one for light and power at 277/480 volts.

Distribution is from draw out breakers in the substation to fused switch distribution panels to plug-in circuit breaker branch panels.

Unit substation and primary switchgear shall be turned over to the Owner clean (dust free) inside and outside at the completion of the job.

16170 Service and Distribution

Disconnect Switches

Fusible Switch Assemblies: NEMA KS 1; heavy-duty type HD quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in ON and OFF position. Fuse Clips: Designed to accommodate Class R fuses. Provide blown fuse indicator. Fuses: Should be of the current limiting type. Class RK-5 for 100A<, class RK-1 for 100A>, Class J, CC, T, L., Nonfusible Switch Assemblies: NEMA KS 1; heavy duty type HD; quick-make, quick-break, load interrupter enclosed knife switch with externally-operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

Enclosures: NEMA KS 1; Type 1 indoors, type 3R outdoors.

Disconnect switches shall be provided with electrical interlock with two normally open and two normally closed contacts.

Panel boards

Distribution Panel boards (DP)

Panel boards: Circuit breaker or fusible switch type.

Provide cabinet front with screw cover. Provide hinged door with flush lock and common key in finished areas. Panel fronts in finished areas shall have concealed hinges and mounting provisions. Finish in manufacturer's standard gray enamel.

Provide panel boards with copper bus. Provide copper ground bus in all panel boards.

Minimum Integrated Short Circuit Rating: 50,000 amperes rms symmetrical for 480 volt panel boards, and 35,000 amperes for 208 volt panel boards.

Molded Case Circuit Breakers: Provide plug-in circuit breakers with integral thermal and instantaneous magnetic trip in each pole, 100 percent rated.

Panel boards served by non-linear load transformers shall be equipped with 200% rated neutrals and isolated ground bus.

Branch Circuit Panel boards

Lighting (LP), Receptacle (RP) and Equipment (EP) Panel boards: Circuit breaker type.

Cabinet Size: 6 inches deep; 20 inches wide.

Provide surface or recessed cabinet having fronts with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

Provide panel boards with copper bus. Provide copper ground bus in all panel boards.

Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 120/208 volt panel boards; 14,000 amperes rms symmetrical for 277/480 volt panel boards.

Molded Case Circuit Breakers: Plug-in type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for panel switched lighting circuits. Provide UL Class A ground fault interrupter circuit breakers if required.

Circuit breakers for use in heating air conditioning, and refrigeration applications shall be HACR Type.

Panel boards served by non-linear load transformers shall be equipped with 200% rated neutrals.

All panel boards shall have an accurate panel directory completely filled out and inserted in the holder provided. All panel directories shall be provided to the Owner at the project close out in an electronic file format, such as Microsoft Word or Excel. When circuits are added to an existing panel board, the directory shall be replaced in its entirety if missing, or if more than 10% of the circuits have been re-purposed or added. Notes to this effect must be included in either the specifications or on the construction drawings.

Transformers

Provide dry type step down transformer with six (6) full capacity taps. Two (2) 2.5% above normal and four (4) 2.5 below normal.

Wiring and winding material shall be copper with a minimum of 220°C rated insulation.

Provide minimum of 2 foot flexible conduit connection to transformer.

Mount transformers on vibration isolation mat similar to Korfund Elastro-Rub.

16180 **Power Factor Correction**

Provide power factor correction on all motors 7-1/2 HP and larger.

16190 **Lighting**

General

Space Lighting

Foot candle levels in rooms shall be per latest edition of I.E.S. handbook.

In general, all lighting fixtures shall be fluorescent. Design Professionals are encouraged to review newly developed LED lighting fixtures and lamps for application on new or renovation projects. Downlighting and recessed applications shall use compact fluorescent lamps or LED lamps.

All fluorescent tubes shall be

watt rapid start T-8 lamps, low mercury content; 3500 degree Kelvin with CRI (color rendering index) no less than 80 unless special applications make this impractical. LED lamps shall be specified with similar characteristics.

Ballasts shall be high frequency electronic with maximum of 10 percent THD.

In general, commercial fluorescent or LED fixtures shall be 2' x 4' recessed lay-in grid troffers or surface mounted, metal enclosed, modular fixtures. Fixtures shall have parabolic reflectors with 3" deep cell louvers; typically, 18 cell diffuse or specular silver.

Lensed troffers and prismatic lenses are not appropriate for a computer or desktop PC environment. Fixtures with indirect lighting is preferred

Prismatic lensed troffers may be properly applied in service corridors, restrooms, stairwells and other general purpose areas.

Do not use fixtures with wrap-around lenses. Do not use fixtures requiring special tools for relamping.

Lighting designs shall prefer 3 tube dual switched applications, especially 3 and 2 tube designs for office and smaller area applications. Dimmable LED fixtures can supplant the need for multi-circuit switching designs.

High CRI lamps with parabolic reflectors, specular and semi-specular surfaces, low glare louvers and multiple switching will permit a high efficiency, low wattage per square foot lighting design utilizing moderate lumen levels.

Lighting Design Professional shall submit proposed lighting budget (watts and lumens per square foot) for University review. Alternative designs utilizing occupancy sensors or other lighting management controls may assist in meeting energy conservation objectives. Building automation system may be utilized for appropriate lighting control functions.

Stairwell lighting shall be accessible for maintenance by use of no more than an 8 foot stepladder from stair landings. Atrium lighting must also be accessible for maintenance by normal and ordinary means, submit design concepts for maintenance approval.

Exit Lights

Exit lights shall be LED.

Exterior Lights/Site Lighting

To the extent possible, LED lighting products shall be used for exterior applications. Fixtures shall be selected to avoid stray lighting impact.

Lamps

In general, fluorescent lamps shall be 32 watt rapid start, low mercury content, T-8 lamps, 4100 degree Kelvin with CRI no less than 80. Certain campus buildings utilize lamp colors which may differ. Actual color of specified lamps shall be confirmed with the University prior to the completion of construction documents. Recent projects have allowed the consideration of fixtures designed with T-5 lamps meeting the above criteria. The University encourages the inclusion of LED technology in new projects where budgets permit. Luminaire manufacturers are now offering

effective fixture designs that afford life cycle benefit to the University. Use of LED sources requires specific University design involvement.

Incandescent Lamps shall only be allowed pursuant to the approval of the Wayne State University Design Review Committee and is limited to applications where alternative sources are not available. It should be noted that dimmable LED technology is perceived as an appropriate replacement for incandescent illumination

Ballasts

Ballast for fluorescent lamps shall be rapid start high frequency (20,000 Hz) electronic with maximum 10 percent THD. Ballast make and model number selection and wiring shall be such that one fluorescent tube failure does not adversely affect light output or life of other lamps.

16200 Fire Alarm System

Furnish and install a complete point addressable type fire alarm system which complies with NFPA 70, 72, and 101, and in accordance with Office of Fire Safety codes, and the University's Office of Risk Management requirements as applicable.

The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory. The manufacturer shall provide all software and hardware required, including a programmer.

The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. At least two pair of alarm dry contacts shall be provided for connection to the University Public Safety Department and building automation system. Conduit to the appropriate communication closet or building automation system panel shall be installed, as required by fire alarm contractor.

Upon completion of all work a certificate of compliance shall be provided by the Fire Alarm Contractor attesting to the full compliance with the construction documents and current codes and standards. The Design Professional shall require the presentation of the certificate to the Design Professional and the Owner immediately following the final inspection and acceptance of the work.

An emergency voice alarm communication system shall be installed in all university assembly occupancies, in accordance with NFPA 101.

16210 Elevator Rooms

Provide a heat detector and shunt trip breaker within elevator machine rooms for hoist machine power. Heat detector will transmit a signal to the elevator controller which will then send the cab to "capture floor". Once at the capture floor, the elevator controller will send a signal to open the shunt trip breaker and interrupt elevator controller power completely. Cab lighting to remain on. Final connections to elevator controller by Elevator Contractor. Coordinate this installation with elevator specification.

16220 Distance Learning Center

Refer to WSU C&IT Standards for generic room requirements including lighting, power and communications.

16230 Telecommunications

Refer to current edition of the WSU C&IT Standards with regards to telecommunication room sizes, lighting requirements, power layout/requirements, grounding, construction standards, backboards, etc. Inclusion of design into general document set is required.

Provide 2 gang boxes with 2 gang cover plates for voice/data outlets.

Provide 1 gang box with 1 gang cover for wall mounted telephone.

Provide a minimum of 18" clearance from ladder type cable tray used for voice/data distribution, to fluorescent lighting fixtures and/or provide solid bottom cable tray if clearance cannot be maintained.

16240 Security System

The Design Professional shall coordinate security requirements with WSU FP&M. Provide all necessary power, conduit and wire per WSU Security Contractors direction. All device installation and final terminations will be by WSU Security Contractor. Verify exact requirements as early in project as possible to allow proper coordination into project.

16250 Lightning Protection

In cooperation with WSU, the Engineer shall perform a risk analysis in accordance with NFPA 780 Appendix H to determine if a lightning protection system is applicable to the building requirements.

Where lightning protection is provided, the A/E shall not use the building steel as primary down conductors. Building steel shall be bonded to the grounding system at column bases only.

16490 Devices

Receptacles

Each office shall include a minimum of one duplex receptacle on each wall elevation. Receptacles shall be spec grade. Covers shall be Stainless Steel, brushed finish. Where desk locations or computer equipment is expected to be located, receptacles shall be dual duplex (quadplex). Additional receptacles may be necessary to provide equipment support. Where counter top locations are present, above counter dual duplex receptacles shall be provided.

16720 Telephones

The number and location of public telephones shall be indicated on preliminary drawings. A public telephone shall be provided within the building and provided with an appropriate enclosure.

At least one campus telephone will be provided in a new building lobby.

Design of all telephone system components, including wiring plans, conduit and cable tray, termination closets or rooms, service entrance rooms, etc. shall be included in all basic design service proposals unless specifically excluded by the University within the request for proposal or scope definition document.

WAYNE STATE UNIVERSITY PREFERRED MANUFACTURER LIST

Preferred Manufacturers List

The Preferred Manufacturers List identifies manufacturers known to provide good quality products, meet specification and schedule requirements, provide technical support before and after the sale, and provide service after installation. This list identifies frequently specified manufacturers only. It is intended to establish a standard of quality, and it shall not be construed as limited competition.

This list shall be used by A/E's when selecting products for specification in construction documents (drawings and specifications). A/E's may specify products from manufacturers not on this list to satisfy project requirements. However, ANY DEVIATION FROM THIS LIST SHALL BE APPROVED BY THE UNIVERSITY IN ADVANCE. An A/E or Design Professional requesting a deviation shall do so through the University Design and Construction Standards Committee. This list shall not be used by contractors to justify substitutions for products specified in the construction documents. ANY SUBSTITUTION FOR A SPECIFIED PRODUCT MUST BE APPROVED BY THE UNIVERSITY IN ADVANCE. A contractor requesting approval of a substitution shall do so only at the time of bid through the University Design and Construction Standards Committee.

This list does not apply to the purchase of replacement or retrofit products needed to match or maintain existing installations.

This list is updated every six months. OBTAIN THE LATEST REVISION FROM THE UNIVERSITY PROJECT MANAGER. A manufacturer wanting to be added to this list can obtain a copy of the procedure from the University Facilities Planning and Design Department.

Note: All provided products shall have a manufacturing date within one year from date of bidding or installation.

ARCHITECTURAL

<u>Item</u>	<u>Manufacturer</u>
Unit Masonry – Face Brick	Belden Brick Co., Endicott Clay Products, Glen-Gary Corp.

Unit Masonry – Glazed, Split-Face and Burnished	Endicott Clay Products, Spectra-Glaze, Trenwyth
Unit Masonry – Sound absorbing concrete units	Trenwyth
Glass Unit Assemblies	Innovative Building Products (IBP), Pittsburgh-Corning Glass Block
Masonry and Glass Units - Mortars, Grouts and Pigments	Blue Circle Cement, Lafarge Corp., Laticrete
Masonry Accessories – Ties, truss reinforcing and anchors	Dur-O-Wall, Inc., Hohmann & Barnard, Inc. Heckman Building Products, Inc.
Mortar Additives	W. R. Grace & Co.
Plastic Laminates	Formica, Nevamar, Wilsonart, Abet, Pionite, Laminart
Solid Surface Materials	Formica, Surrell, Nevamar, Fountainhead, Corian, Wilsonart, Gibraltar
Sheet Waterproofing – Rubberized Asphalt	Carlisle Corp., Karnak Corp., W. R. Grace, W. R. Meadows
Fluid-applied Waterproofing – Single component modified polyurethane	Carlisle Corp., Mameco International Inc., Tremco
Hot Fluid-applied Waterproofing	American Hydrotech, Inc., Carlisle Corp., Miradri
Fluid-applied Dampproofing – Cold-applied asphalt emulsion	ChemRex, Inc., Euclid Chemical Co., W. R. Meadows
Fluid-applied Dampproofing – Hot-applied asphalt	Owens-Corning Fiberglas Corp., W. R. Meadows
Drainage Panels - Molded Sheets	Nicolon/Marafi, Inc., Monsanto Co., W. R. Grace & Co.
Building Insulation – Mineral fiber and glass fiber	Certain-Teed Corp., Johns-Manville Corp., Owens-Corning Fiberglas Corp.
Building Insulation – Extruded polystyrene	Diversifoam Products, Owens-Corning Fiberglas Corp.
Exterior Insulation and Finish Systems (Class PM)	Dryvit Systems, Inc., STO Industries, W. R. Bonsal Co.
Roof Insulation – Polyisocyanurate boards	Atlas Roofing Corp., GAF Building Materials Corp., Koppers Industries
Roof Insulation – Perlite boards	Johns-Manville Roofing Systems Group, Koppers Industries
Built-up Asphalt Roofing Systems	Firestone Building Products, Allied Signal Inc. Tremco, GAF – Specification PM-51PM
Built-up Coal Tar Roofing Systems	AlliedSignal, Inc. – Specification RP-51TC, Koppers Industries–Specification 420-4
Roof Flashings	AlliedSignal, Inc. – Specification G-300-C, Koppers Industries – Specification 182
Single-ply EPDM Roofing Systems	Carlisle Syntec Inc., Firestone Building Prod., Johns-Manville Roofing Systems
Roof Hatches	Babcock-Davis Hatchways, Inc., Bilco Co., Dur-Red Products, ThyCurb

ARCHITECTURAL (Cont.)

Roof Curbs and Equipment Curbs	Curbs, Inc., (The) Pate Co., Roof Products and Systems Corp., ThyCurb
Fire and Smoke Vents	Babcock-Davis Hatchways, Inc., Bilco Co., Dur-Red Products, ThyCurb
Roof Walkway Pads	24" x 24" concrete patio stone or as specified by roofing manufacturer

Joint Sealants - Polyurethane	Pecora, Sonneborn Building Products, Tremco
Metal Doors – Aluminum Entrance	Kawneer, Vistawall, Tubelite, Special-Lite
Metal Doors and Frames – Hollow metal	Ceco Door Products, Curries, Pioneer Industries, Steelcraft
Metal Doors – Sound rated	Ceco Door Prods, Industrial Acoustics Co., Overly Door Co., Steelcraft
Metal Doors – Overhead (Rolling steel curtain, Sectional, Rolling Grilles, Counter Doors, etc.)	Cornell Iron Works, Mc Keon Door Co., Overhead Door Co.
Wood Doors	Algoma Hardwoods Inc., Buell Door Co., Ideal Wood Products, Weyerhaeuser Co.
Metal Access Doors – Fire-rated	J.L. Industries, Karp Associates, Milcor, Potter Roemer
Windows – Metal	Capital Aluminum and Glass, EFCO, Kawneer, Wausau Metals
Windows – Aluminum Storefront	Kawneer, Vistawall
Windows – Aluminum Curtainwall	Kawneer, Vistawall, Wausau Metals
Door Hardware - Hinges	Hager Hinge, Mc Kinney/Parker, Stanley Hardware
Door Hardware – Locksets and latchsets	Corbin/Ruswin (2000 Series), Best – 7K
Door Hardware – Panic (exit) devices	Sargent Manufacturing, Von Duprin
Door Hardware - Closers	Corbin Ruswin Architectural Hardware, LCN, Norton Door Control
Door Hardware – ADA Powered Door Operators	LCN; Dorma, Von Duprin
Door Hardware – Cylinder Locks and Deadbolts	Best (7A / 9A Series), Corbin/Ruswin Architectural Hardware
Door Hardware – Electronic Access Control Locks	Best (Vantage Lock), keypad or magnetic stripe function
Door Hardware – Automatic and Manual Flush Bolts	Glynn-Johnson
Door Hardware – Weatherstripping and Thresholds	Pemko Manufacturing, Reese Enterprises
Door Hardware – Accessories (Stops, coordinators, kick plates, etc.)	Baldwin Hardware, Glynn-Johnson, Hager, Hiawatha, Ives, Rockwood Architectural
Glass – Insulated units	AFG Industries Inc, Ford Glass, Guardian Industries Corp.
Glass – Single pane (Float, heat-treated and tempered)	AFG Industries Inc., Ford Glass, Guardian Industries Corp, Pilkington LOF, PPG Industries
Glazing - Structural	Dow Corning Corp, General Electric Co.
Glazing – Tapes and Sealants	Bostik, Pecora, Tremco, General Electric Co.
Ceramic Tile	Dal-Tile, American Olean, Crossville, Graniti Fiandre

ARCHITECTURAL (Cont.)

Ceramic Tile - Adhesives, Mortars, Grouts, and Leveling Compounds	Bostik, Custom Building Prods, Laticrete International, Mapei
Waterproofing and Adhesive	Mapei, Bostik, Custom Building Products
Anti-Fracture Membrane	Mapei, Laticrete International, Custom Building Prods.

Metal Edge Strips	Schluter Systems
Grout Sealer	Mapei, Bostik, Custom Building Products
Leveling Compound	Ardex
Suspension Systems – Steel and Aluminum	Chicago Metallic, Armstrong World Industries, USG
Ceiling Tile – Gypsum	Armstrong World Industries, USG, Celotex Building Products
Wood Flooring	Kentucky Wood Floors, Augusta Lumber, Hartco Flooring, Bruce Hardwood Floors, Permagrain Products
Resilient Tile	Armstrong World Industries, Congoleum Tarkett, Kentile, Azrock Industries, Mannington Commercial Resilient
Resilient Base (vinyl or rubber)	Armstrong World Industries, Nora Rubber, Flexco, Roppe, Johnsonite, Mannington Commercial Resilient, Mercer Products, NAFCO, VPI Floor Products
Stair Treads	RCA Rubber, Nora Rubber, FLEXCO, Johnsonite, Musson Rubber
Rubber Flooring	Nora, Pirelli, Johnsonite, Roppe
Resilient Sheet Vinyl Flooring	Forbo, Toli, Tajima, Lonseal, Polyflor, Tarkett
Carpet Tile	Collins & Aikman, Lees, Interface
Broadloom Carpet	Atlas, Bentley, Monterey, Shaw
Fabric Wrapped Glass Fiber Panels	Whisper Wall, Capaul Corp., ESSi Acoustical Products Co., Integrated Interiors, Inc., Nelson Adams/GSI
Vinyl Manufacturer for Fiber Panels	Koroseal Wall Coverings, Lanark Vescom, VinLFab, Tower, JM Lynne, Genon, Innovations
Fabric Manufacturer for Fiber Panels	Guilford of Maine, Maharam, Knoll
Paints	Sherwin Williams, Pratt & Lambert, Benjamin Moore, ICI Paint Stores, PPG Architectural Finishes
Stains	Sherwin Williams, Olympic, PPG, Pratt & Lambert
Field Applied Decorative Paint	Scuffmaster, Zolatone
Vinyl Wallcovering	Koroseal Wall Coverings, Lanark Vescom, VinLFab, Tower, JM Lynne, Genon, Innovations
Textile Wallcovering	Knoll, Maharam, DesignTex, MDC, Wolf-Gordon

ARCHITECTURAL (Cont.)

Flexible Wood Veneer Wall Covering	Flexwood, Flexible Materials
Chalkboards and Tackboards	Claridge Products & Equipment, Greensteel, Carolina Chalkboard, Lemco, Nelson/Adams
Toilet Partitions	Knickerbocker, Sanymetal Products, Global Steel Products, Accurate Partitions, General Partition Manufacturing, American Sanitary Partition, Weis-Robart Partitions, Accurate, Flushmetal
Prefabricated Shower Stalls	Capitol Partitions, Aqua Glass
Plastic Corner Guards	Construction Specialties, Balco/Metalines, Pawling, Arden Architectural Specialties, IPC Door & Wall Protection Systems
Raised Access Flooring	Interface AR, Tate Access Floors Inc., Maxcess Technologies, Inc., Flexspace Cable Floor
Signs	Best Manufacturing, ASI Sign Systems, Mohawk Sign Systems, Innerface Architectural Signage, Allenite Architectural Sign Systems
Standard Lockers	Interior/Medart, Debourgh Manufacturing Co., Republic Storage Systems, Lyon Metal Products, List Industries, Penco Products
Fire Extinguishers	Ansul, JL Industries, Larsen's Manufacturing, Potter Roemer
Fire Cabinets and Blankets	JL Industries, Larsen's Manufacturing, Potter Roemer, Amerex
Clocks	Primex Wireless
Wire Mesh Partitions	Acme Wire, Acorn Wire & Iron Works, Kentucky Metal Products, Miller Wire Works, Jesco Industries, Standard Wire & Steel Works
Operable Partitions	Hufcor, Modernfold, Skyfold, Advanced Equipment Corp.
Toilet and Bath Accessories	American Specialties, Bobrick Washroom Equipment, Bradley, General Accessory Manufacturing (GAMCO), Brocar Products Inc., Truebro Co.
Wardrobe Specialties	Vogel Peterson, Nelson, AR (ARNCO), Raymond Engineering, EMCO Industries
Cable Hung Glass Shelving System	Jakob AG – Décor Cable
Projection Screens	Da-Lite Screen, Draper Shade and Screen, Bretford Manufacturing – Contract Division
Vertical & Horizontal Louver Blinds	Levolor Home Fashions, Graber Window Treatments, Hunter Douglas
Blackout Shades	Mecho Shade, Draper, Hunter Douglas, Kirsch, Castec, Sol-R-Veil
Auditorium Seating	Figueras International Seating, KI Furniture, JG Furniture Systems, American Seating

ARCHITECTURAL (Cont.)

Jury Seating	Figueras International Seating, Irwin Seating Co., KI Furniture, JG Furniture Systems, American Seating, Boling
Elevators – Electric traction type	Otis, Schindler, ThyssenKrupp
Elevators – Hydraulic type	Otis, Schindler, ThyssenKrupp
Elevators – Emergency Telephone System	Ramtel Model R833 Flush Mount Bezel: 906
Outdoor Emergency Telephone System	Ramtel Model R833
Drinking Fountains	Filtrine, Haws, Halsey-Taylor

MECHANICAL EQUIPMENT

<u>Equipment</u>	<u>Manufacturer</u>
Reciprocating Water Chillers (water cooled, remote air cooled condenser or package air cooled)	Trane, York, Carrier, Dunham Bush
Centrifugal Water Chillers, Absorption Water Chillers (single stage or two stage)	Trane, York, Carrier
Cooling Tower (forced draft or induced draft)	Marley, BAC, Evapco
Liquid Coolers and Evaporative Condensers	Marley, BAC, Evapco
Hydronic Pumps - In-Line	B&G, Taco, Armstrong
Hydronic Pumps - End-Suction	B&G, Taco, Armstrong, Aurora
Hydronic Pumps - Double Suction, Split Case (horizontal or vertical)	B&G, Aurora, Peerless, Ingersoll-Rand, Taco, Armstrong
Hydronic Specialties – Thermometer	Tririce, Ashcroft, Weksler, MilJOCO
Hydronic Specialties – Pressure Gauges	Tririce, Ashcroft, Weksler
Hydronic Specialties – Automatic Air Vents	Armstrong
Hydronic Specialties – Manual Air Vents	Dole, Armstrong
Hydronic Specialties – Air Eliminator and Make-Up Water Accessories	B&G, Taco, Thrush, Armstrong
Hydronic Specialties – Air Separator	B&G, Taco, Amtrol, Armstrong
Hydronic Specialties – Water Pressure Relieve Valve	B&G, Watt, M&M
Hydronic Specialties – Water Pressure Reducing Valve	B&G, Taco, Thrush
Hydronic Specialties – Expansion/Compression Tank	B&G, Taco, Thrush, Armstrong
Hydronic Specialties – Circuit Setter Balancing Valve	B&G, Taco, Armstrong
Hydronic Specialties – Suction Diffuser	B&G, Taco, Armstrong
Hydronic Specialties – Triple Duty Valve	B&G, Taco, Armstrong
Hydronic Specialties – Strainers	Mueller, Armstrong, Sarco, Spence
Hydronic Specialties – Valves, Hose Kits, and Hook-Ups	Nexus, Armstrong, B&G
Hydronic Specialties – Water Filtration	PEP Filters, Tower Flo, Vortisand
Heat Exchangers – Steam to Hot Water	B&G, Taco, Patterson-Kelly , Leslie, Armstrong, Hubbell
Heat Exchangers – Plate and Frame	B&G, Tranter
Steam Specialties – Condensate Pump and Receiver	Skidmore, Domestic , Hoffman, Aurora, Armstrong

Steam Boilers – Fire Tube	Cleaver Brooks, Peerless; Kewanee, Johnston, Miura
Steam Boilers – Water Tube	Cleaver Brooks, Bryant, Miura
Boilers, Hot Water - Heating	Cleaver Brooks, Lochinvar, Raypack,
Boilers, Domestic Hot Water	Lochinvar, Raypack,
Chimney and Exhaust Products	Metal-Fab, Ampco, Van Packer

MECHANICAL EQUIPMENT (Cont.)

Steam Specialties – Pressure Reducing Valve	Spence, Fisher, Hoffman
Steam Specialties – Safety Relief Valve	Spence, Consolidated
Dampers – Backdraft	Greenheck, Air Balance, American Warming, Perfco
Dampers – Fire and Smoke	Greenheck, Air Balance, American Warming, United Enertech
Drip Pan Elbow	Spence, Kunkle
Dehumidifiers	Dectron, Heat Pipe Technologies, Des Champs, Xetex
Fabric Duct Systems	Ductsox, Fabric Air, KE Fibertec
Spiral Duct	Semco, United McGill, RW LaPine
Pipe and Duct Labeling Products	Allen Systems, Inc. Brady (W.H.) Co.; Sign mark Div. Seton Name Plate Corp.
Flexible Connectors/ Expansion Joints	Mason Industries, Flex-Hose, Proco
Steam Traps, F&T or Bucket	Armstrong, Sarco, Hoffman
Humidifiers	Dri-Steem, Armstrong, Sarco, Nortec
Electric Humidifiers	Nortec, Armstrong, Honeywell
Heating Equipment – Cabinet Unit Heaters and Unit Heaters	Trane, McQuay, York, Sterling, Modine
Heating Equipment – Finned Tube Radiation and Convectors	Trane, Sterling, Vulcan
Heating Equipment – Booster Coils, Hot Water & Steam	Trane, McQuay, Aerofin, Greenheck, USA Coil
Heating Equipment – Unit Ventilators	Trane, McQuay, Carrier, Greenheck, USA Coil
Heating Equipment – Fan Coil Units	Trane, York, Dunham Bush, McQuay, Greenheck, USA Coil
Heating Equipment – Electric Duct Heaters	Trane, Indeeco, Brush, Markel
Heating Equipment – Radiant	Solaronics, Markel, Roberts Gordon
Computer Room Air Conditioning Units	Liebert, Data-Aire, Hiross
Energy Recovery	Greenheck, Heat Pipe Technologies, Semco, Xetex
Heat Pumps, Water Cooled or Air Cooled	McQuay, Mammoth, Trane, Climatmaster
Packaged Rooftop Heating and Air Conditioning Units	Trane, Carrier, York, Greenheck, USA Coil
Air Handling Units	Trane, York, Carrier, TMI, Air Flow Equipment
Air Handling Units – Custom	Ventrol, Pace, Buffalo, Aaon; TMI; Air Flow Equipment

Utility Fan Set	Trane, Greenheck, Penn Ventilator, Loren Cook
Centrifugal Roof Ventilators	Greenheck, ACME, Penn Ventilator, Loren Cook
Centrifugal Wall Ventilators	Greenheck, ACME, Penn Ventilator, ILG
In-Line Centrifugal Fans	Trane, Greenheck, ACME, Penn Ventilators
Propeller Fans	Greenheck, ACME, Loren Cook, Penn Ventilators

Air Terminal Units – Diffusers, Registers and Grilles	Titus Products, Price Industries, Krueter, Nailor Hart
Air Terminal Units – Variable Volume and Constant Volume Boxes	Titus Products, Price Industries, Krueter, Nailor Hart, Siemen's ZCU
Laboratory Fume Hood Controls	Siemens, Triatek, TSI, Phoenix
Airflow and Pressure Measurement	Paragon Controls, Greenheck Sure Air, Air Flow Monitoring
Vibration and Seismic Control	Mason Industries, Amber Booth, Korfund

MECHANICAL EQUIPMENT (Cont.)

Air Terminal Units – Sound Attenuator	Industrial Acoustics, Vibro-Acoustics, Semco, Rink
Temperature Controls – DDC and/or Pneumatic System	Siemens, Honeywell
Plumbing Fixtures – Water Closets, Urinal and Lavatories	Kohler, Crane, American Standard
Plumbing Fixtures – Sinks, Stainless Steel	Elkay, Just, Kohler
Plumbing Fixtures – Service Sink	American Standard, Crane and Kohler
Plumbing Fixtures – Electric Water Coolers	Elkay, Halsey Taylor, Haws, Sunroc
Plumbing Fixtures – Fixture Carriers	Josam, J.R. Smith, Wade, Zurn
Plumbing Fixtures – Floor Drains	Zurn, J.R. Smith, Wade, Josam
Plumbing Fixtures – Roof Drains	Zurn, J.R. Smith, Wade, Josam
Plumbing Fixtures – Cleanouts	Zurn, J.R. Smith, Wade, Josam
Plumbing Fixtures – Backflow Preventer	Watts, Febco, Hersey
Plumbing Fixtures – Water Pressure Reducing Valves	Watts Regulator, Cla-Val, Hoffman
Water Heaters – Steam Fired Water Heaters	PVI, Cemline, A.O. Smith, Reco
Water Heaters – Electric Water Heaters	Lochinvar, A.O. Smith, State
Water Heaters – Gas Fired Water Heaters	Lochinvar, PVI, A.O. Smith, State
Pumps – Sewage and Storm Pumps	Weil, Ebara, Weinman, Hydromatic
Pumps – Circulating Pump	Armstrong, B&G, Taco
Pumps – Domestic Pressure Booster	B&G, Peerless, Aurora, Armstrong
Reverse Osmosis Water Purification Systems	Siemens Water Technologies
Fire Protection – Sprinklers	Viking, Grinnell, Reliable Auto. Sprinkler, Central Sprinkler Corp.
Fire Protection – Water Flow Indicators & Switches	Gamewall, Grinnell, Reliable Auto. Sprinkler, Honeywell, Autocall
Fire Protection – Fire Department Connection	Elkhart, Grinnell, Guardian, Reliable Auto. Sprinkler, Potter-Roemer
Fire Protection – Alarm Check Valve	Globe Fire Sprinkler, Viking, Grinnell
Fire Protection – Fire Hose Cabinet Racks and Hose	Seco, D. Allen, Elkhart, Potter-Roemer
Fire Protection – Valves	Grinnell, Kennedy, Nibco, Stockham
Fire Protection – Electric Driven Fire Pump & Jockey Pump	ITT-AC, Syncrotlo, Aurora, Peerless

Fire Protection – Fire Pump Controller	Firetrol, Metron, Hubbell, Master Control System
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ELECTRICAL EQUIPMENT

<u>Equipment</u>	<u>Manufacturers</u>
Metal Conduit	Triangle PWC, Wheatland, Allied Steel Conduit
Liquid Tight Flexible Metal Conduit	AFC, Electri-FlexCo, O.Z. Gedney
Electrical Metallic Tubing (EMT)	Triangle PWC, Wheatland, Allied Steel Conduit
Non-Metallic Conduit	Carlson, Endot Industries, Can-Tex
Cords & Caps	Alpha Wire Corp, Woodhead Industries, Northern Wire & Cable
Ground Rods	A.B. Chance Co., GB Electrical, Wilcor Grounding Systems, Copperweld
Ground Rod Connector	Burndy, Erico, G&W
Ground Rod Exothermic Connections	Cadweld, G&W, Erico, Burndy
Generators	Onan, Kohler, —Generac
Automatic Transfer Switches	
Cabinets and Enclosures	Hoffman, B-Line, T&B
Terminal Blocks	Square D, Thomas & Betts, Ideal Industries
Plastic Raceway	Panduit Corp, Hoffman, T&B
Cable Tray	B-Line Systems, Square D, Globe Tray
Conductor	Southwire, Triangle, Rome, Cablec
Connectors – Split Bolt	IlSCO, Burndy, GB Electric
Connectors – Solderless	IlSCO, Burndy, Thomas & Betts
Connectors – Spring Wire	Ideal, 3M, Buchanan
Connectors – Compression	IlSCO, Burndy, Square D
Medium Voltage Cable	Okonite, Pirelli, Rome
Cable Terminator	RayChem, 3M, PLM
Cable Splice Kits	RayChem, 3M, PLM
Fireproofing Tape	Scotch 3M
Metal Wireways	Hoffman, Square D

Surface Raceways	Mono-Systems, Thomas & Betts, Walker Systems, Wiremold
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ELECTRICAL EQUIPMENT (Cont.)

Under Floor Raceways	Square D, Thomas & Betts, Walker Systems
Wiring Devices – Wall Switch	Pass & Seymour, Hubbell, Bryant
Wiring Devices – Receptacle	Hubbell, Bryant, Pass & Seymour
Wiring Devices – Cover Plates	Pass & Seymour, Hubbell, Bryant, Appleton
UPS	Deltec, Exide Electronics, Liebert, MGE-UPS Systems, Yuasa Exide Inc.
Floor Outlets	Steel City
Frequency Drives	Eaton Corp, Siemens, Square D, ABB
Capacitor	Aerouox, Commonwealth Sprague, Square D, Versatex Industries
Transisient Voltage Suppression	Advanced Protection Tech, Current Technology, Cutler Hammer, Inovative Technology, Siemens, Square D
Medium Voltage Switchgear	Electric Equipment, S&C Electric, Powercon, Square D, Cutler Hammer
Substation	Cutler Hammer, General Electric, Siemens, Square D
Switchgear	Culter Hammer, General Electric, Siemens, Square D
Disconnect Switch	Square D, General Electric, Cutler Hammer
Fuses	Bussmann, Littlefuse, Gould Shawmut
Buss Duct	Culter Hammer, Siemens, Square D
Dry Transformer	Square D, General Electric, Cutler Hammer
Panel boards	Square D, General Electric, Cutler Hammer
Motor Control Center	Square D, General Electric, Cutler Hammer
Variable Frequency Drives	Magnetec, General Electric, Siemens
Starters	Square D, General Electric, Cutler Hammer
Lighting Contactor and Relays	Automatic Switch Co, Cutler Hammer, Hubbell Lighting, Siemens, Square D
Time Switches	Diversified Electronics, Intermatic, Inc, Paragon Electric, Tork
Photoelectric Relays	Intermatic Inc, Fisher Pierce, Rpley PhotoControls, Paragon Electric, Tork

ELECTRICAL EQUIPMENT (Cont.)

Dimming Systems	Lithonia, Lutron
Lightning Protection	A-C Lighting Security, Thompson Lighting Protection, Independent Protection Co, Robbing Lighting, Inc.
Fire Alarm	Simplex, Honeywell, Siemens, National Time and Signal
Clocks (Proprietary)	Simplex
Security (Proprietary)	ESS
Voice/Data Technology (Proprietary)	Lucent Tech. Confirm with current C&IT Standards
Fluorescent, Incandescent & HID Lamp	Osram/Sylvania, General Electric, Phillips
Fluorescent Ballasts	Advance Electronic Mark V, Valmont, Universal
HID Ballasts	Advance, Universal, Jefferson