Williams College Design Standards

April 7, 2021

WILLIAMS COLLEGE FACILITIES

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SECTION 00 01 02
INTRODUCTION

WILLIAMS COLLEGE DESIGN STANDARDS

Williams College Facilities publishes and updates the Williams College Design Standards. Facilities is committed to prompt, professional service to students, faculty and staff. Our talented staff proudly strives to meet the current and future needs of Williams College.

Facilities manages and maintains Williams' 100+ buildings as well as 450 acres of gardens, lawns and athletic fields. In addition, it supports and maintains 100+ faculty and staff housing units as well as commercial properties that house such businesses as a coffee shop, pharmacy, market, and the College bookstore. We also manage our own Heating Plant and Chiller Plant. In total, the department cares for more than three million square feet of structures on campus.

PRIMARY USE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim into specifications or into notes on drawings. Refer questions and comments regarding the content and use of this document to the Williams College Project Manager.

Compliance with the Williams College Design Standards is mandatory for new projects, renovations, and ongoing maintenance. Variances, clarifications or exceptions to these Standards may be requested in writing by the designer or contractor requesting the variance, using Section 00 90 10 – Design Standards Variance Request Form included in the Design Standards, and addressed to the applicable Williams College Project Manager.

These design standards in no way relieve the designer of full programming, scoping, and engineering/design services, and review that would normally be required should these standards not exist. All standards contained herein should be thoroughly and iteratively reviewed and vetted with the appropriate Williams College Facilities Operations and other end-users groups.

UPDATES

The Williams College Design Standards will be updated quarterly. Proposed updates to the Design Standards are welcome, using Section 00 90 20 – Design Standards Update Request Form included in the Construction Standards. This form is available using the following link:

DISCLAIMER

Williams College anticipates the information in the Williams College Design Standards will be very helpful. It is based upon data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with the requirements of our projects. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright.

END OF SECTION

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SECTION 00 22 00
SUPPLEMENTARY INSTRUCTIONS - WORKING AT WILLIAMS

Refer questions and comments regarding the content and use of this document to the Williams College Project Manager. Without limitation, items in red are particularly project-specific.

A. Summary

1. This section contains requirements for design and construction professionals working with Williams College.
2. The “Work Rules” must be included in Section 00 22 of the project specifications.

B. Work Rules: Compliance with the following Work Rules is mandatory.

AA/EOE - MINORITY AND WOMEN-OWNED BUSINESS ENTERPRISES

It is the policy of Williams College to pursue any and all appropriate action to ensure that Minority and Women-Owned Business Enterprises, (i.e., independent business concerns which are at least 51 percent owned and controlled by minority group members (citizens of the United States or permanent residents who are Black, Hispanic, Asian or Pacific Islander, or American Indian or Alaskan Native), or women, whose ownerships in the concerns are real, substantial and continuing and who have and exercise the authority to independently control the decisions of the concerns), are given the opportunity to participate in the Williams College construction program. Accordingly, Williams College seeks the cooperation of all bidders in carrying out this policy and the bidder to whom the Contract for the Project is awarded shall exercise its best efforts in soliciting and obtaining the participation of Minority and Women-Owned Business Enterprises as subcontractors and suppliers thereon. For contracts of $1,000,000 or more, the Contractor shall provide a report to the attention of the Director of Planning and Construction, on its efforts and on the percentage of the project budget(s) being carried out by such Enterprises. Periodically Williams College and the Contractor will seek availability data on Minority and Women-Owned Business Enterprises in the local and regional areas, through appropriate agencies such as chambers of commerce or boards of trade, offices of state employment or economic affairs, etc.

MINORITIES AND WOMEN PARTICIPATION

It is the policy of Williams College to affirmatively seek the participation of minorities and women within the various categories of employment at the College. Consequently, Williams College seeks the cooperation of all bidders in carrying out this policy and the contractors to whom projects are awarded shall exercise their best efforts in soliciting and obtaining the participation of minority and women in their work force. For contracts of $1,000,000 or more, the Contractor shall submit quarterly reports to Williams College showing minority and women work force participation including trainees for each occupation utilized in the work on an occupation-by-occupation basis including trainees. The minority and women work force participation for each occupation is to be expressed as a percentage equal to the person-hours of training and employment of minority and women employees used by the Contractor and any sub-contractor in that occupation divided by the total person-hours of training and employment of all workers (including supervisory personnel) used by the Contractor and any sub-contractor in that occupation.

Periodically Williams College and the Contractor will seek availability data on minority and women in the local and regional population and as available, in the workforce.

CLEANING

The contractor shall maintain a clean, orderly site at all times. Keep all roads and walks clear of debris and dirt caused by the Work during the entire term of the Contract. Repair or replace all public and private streets, roads, drives, walks, curbs, plantings, trees, lawns and other improvements damaged during the course of the Project.

CLOTHING

Follow OSHA guidelines and all applicable regulations, standards, rules and requirements that are in effect from the Federal, State and local authorities related to this work are incorporated into this work by reference. All policies, programs, procedures and documentation required by the above referenced regulations, standards and rules shall be submitted to Williams College for review upon request.

COMPRESSED GAS CYLINDERS

All propane cylinders must be stored outside of buildings - no exceptions. Compressed gas cylinders shall always be restrained securely with a chain, belt, or stand at all times to prevent them from falling over. Secure the cylinder above its center of gravity (~2/3 up the cylinder). Whenever the gas cylinder is not in use or is being moved, the valve cap must be securely attached and at all other times unless a regulator is attached to the cylinder. Flammable gases must be stored separately from oxygen and combustible materials by at least 20 feet. Propane storage shall be reviewed and permitted with the local fire chief.

CONFINED SPACE ENTRY, SUPERVISION AND TRAINING

Any work involving the need to enter a confined space must only be done by someone who has completed the Williams College Confined Space Awareness Training within the past year and must be performed in full compliance with all policies and procedures. The policies and procedures covering confined space entry are available and can be accessed in the Facilities Office of Safety & Environmental Compliance.

DELIVERIES

Deliveries to the jobsite shall enter and leave the campus through a route to provide the least negative impact on campus and town roads. Loading and unloading shall be done in such a way that campus and town traffic is not impeded. Coordinate delivery of large items with the Construction Manager, Williams College, and local authorities. No deliveries will be accepted by the College's Receiving Department. All deliveries must be made to the jobsite or other drop-off points as arranged with and approved by the Construction Manager and the College.

DRONES or UNMANNED AIRCRAFT (USE OF)

There are public safety concerns that must be addressed in the operation of unmanned aircraft (UA).. The following operational restrictions apply to all UA'S used on or in the vicinity of College owned or controlled property.

1. UA's shall be operated so as not to create an undue hazard to College owned or controlled property, the College community or the public at any time. UA's may not be operated in a way which unduly affects the environment of, or invades the privacy of, those working within College buildings, or those entering, exiting, or walking in the vicinity of College facilities.
2. UA's may not be operated above public open-air events, inside public venues or above thoroughfares, including both public and campus streets.
3. UA's must be under line-of-sight control of the operator at all times and may not be operated at altitudes above 400 feet.
4. If a College department wishes to arrange for a contractor or other third party to use a UA for purposes associated with a College facility or event, the department shall contact the Associate Vice President for Finance and Administration for prior permission to do so. The Associate Vice President for Finance and Administration shall ensure that the UA owner and operator has adequate liability insurance and takes the risk mitigation arrangements deemed appropriate. The department must schedule the drone flight with Campus Safety and Security and must maintain a spotter in addition to the operator for safety purposes.
5. Under FAA guidelines, UAs may be operated within 5 miles of an airport only after giving notice to the airport's air traffic control tower. This requirement

applies to all UA operations on the College campus, which is within 5 miles of the North Adams Regional Airport.

6. Any UA not conforming to this Policy on College property should be reported immediately to Campus Safety and Security or other appropriate public safety officials. Campus Safety and Security may take appropriate action to enforce this Policy, including but not limited to banning operation of a UA on College property.5.

DUST

Dust created during demolition and construction must be contolled and isolated using, without limitation, covers, barriers, partitions, fans, air-scrubbers, and negative air machines. When removing debris from the building, dust must be controlled by utilizing chutes and enclosed dumpsters, and watering as necessary. when removing debris from the building. Watering and other methods shall be used as required to minimize and control dust during demoltion, construction, street sweeping, etc.

ELECTRICAL WORK

All Electrical work at Williams College will be performed in accordance with 29 CFR 1910.333, 29 CFR 1926.416, 29 CFR 1910 Subpart S, 29 CFR 1910.269 (where applicable), 29 CFR 1926 Subpart K, NFPA 70 and NFPA 70E (the latest revision of each in effect) and all applicable regulations, standards, rules and requirements that are in effect from the Federal, State and local authorities related to this work are incorporated into this work by reference. All policies, programs, procedures and documentation required by the above referenced regulations, standards and rules shall be submitted to Williams College for review upon request.

Permit-required energized electrical work will not be allowed. Non-permit required energized electrical work shall not be performed without prior notification and approval from the WCEST (Williams College Electrical Safety Team). Contracted employers shall maintain all required documentation as required by the Williams College ESP and other safety requirements.

EMERGENCY RESPONSE

In the event of a construction accident that may involve injuries and transport to the hospital, the following process is to be followed:

1. Call 911. Provide name of caller and company, address of accident and any pertinent information such as number hurt, location to best access the site, etc. If there are sufficient people to manage the incident, stay on the line with the 911 dispatcher until a police cruiser responds. The dispatcher is located in the Williamstown Police Department but will also dispatch fire and ambulance vehicles as needed. You must notify the 911 dispatcher for injuries within an asbestos containment or lead abatement area.
2. Call Security at 413-597-4444.
3. Call Williams College Project Manager
4. Call the Office of Safety and Environmental Compliance at 413-597-2406.

EXCAVATION/TRENCHING

Excavation and trenching work must be protected to meet or exceed 520 CMR 14.00.

HARDHATS

Hardhats are required at all times when within the boundaries of the construction site. All on-site personnel shall at all times wear an approved hard hat clearly indicating their name and the name of their company or organization. Visitors to the site must wear hardhats at all times but are not required to display their name and the name of their company or organization.

HAZARDOUS MATERIALS NOTIFICATION

Prior to performing any scope of Work involving demolition, the Contractor must request a hazardous materials assessment report of the work site for hazardous materials. Any removal of hazardous materials must be performed by individuals licensed in such procedures.

If, at any time, materials that are suspected to be hazardous are encountered, work must cease immediately and the Project Superintendent and the College's Project Manager notified. Such materials include but are not limited to asbestos, PCB's, oils, refrigerants, and bio-hazardous waste.

HOT WORKS PERMITTING

All contractors performing hot work on Williams College property are expected to abide by the Williams College Hot Works Program created in accordance with the Massachusetts Department of Fire Services regulations. This program applies whenever any work is done on campus that generates heat, sparks, or open flame (including, but not limited to, using a heat gun, torch, welder, or grinding wheel in such a way that sparks or heat are created).

A. Only personnel who have received a Hot Work Certification # through a training course approved by the Massachusetts State Fire Marshal shall be allowed to do any hot work at Williams College.

   1. Personnel required to have a Hot Works Certification # include:

      a. Anyone who performs hot work
      b. Anyone who serves as a "Permit Authorizing Individual" to perform, supervise, or delegate hot work
      c. Anyone who performs as a fire watch, except for fire department fire details
      d. Anyone who needs a permit from the local fire department to conduct such work.

   2. A copy of the current certification card shall be provided to the Facilities Office of Safety & Environmental Compliance (S&EC) when personnel initially obtain a Hot Works Permit, prior to the commencement of any hot work.

      a. If the Facilities Office of Safety & Environmental Compliance confirms that there is already a copy of this certification card on file, then a copy does not have to be provided for that individual again.

B. A hot works permit must be obtained from the Williamstown Fire Department (located at 34 Water Street) for each project that has been issued a building permit, prior to the commencement of hot work. Consult with the Williamstown Fire Chief for details on the duration of their Permit, and the associated Fee.

   1. The Facilities Office of Safety & Environmental Compliance must be given a copy of the permit from the Williamstown Fire Department.

2. Hot Works permits will not be issued from the Facilities S&EC office, until a copy of the Hot Works Permit from the Fire Department is on file in the Facilities S&EC office.

C. Anyone doing hot work must first obtain a Williams College hot works permit, for each day that the hot work is done. Each permit is only good for one day, and for one specific location.

1. If the location of the work changes, even within the same building, then a new permit must be obtained for the new location.

2. Fill out the permit and do the pre-work checklist part, and call Campus Safety & Security (CSS) at 597-4444 to tell them that Hot Work will be occurring.

3. Prior to beginning the work, e-mail S&EC a scanned copy of the Permit, so that S&EC personnel know the who/what/where/when of the work that is going on.

4. Complete the permit once the Fire Watch is complete (fire watch is 1-hour duration after the work is complete, except for torch applied roofing which has a 2-hour requirement).

5. Call CSS to let them know that the Hot Work is completed.

6. E-mail S&EC a scanned copy of the completed permit upon the completion of the fire watch, before the end of the 24-hour permit period.

D. Contractors working directly for Williams College employees, shall have an appropriately-trained and certified supervisor, foreman, or manager from Williams College serve as the “Permit Authorizing Individual.”

1. The top (white) sheet of the completed hot works permit shall be kept at the work site in a safe location where it cannot catch fire, and shall be returned to the Facilities Office of Safety & Environmental Compliance once the fire watch is complete.

2. A fire watch must be maintained for a minimum of 60-minutes after completion of work (120-minute minimum after the completion of any torch-applied roof work).

E. The general contractor, construction manager, or OPM on construction sites shall administer the hot works program on their site, and will be responsible for obtaining all permits, designating someone to verify the safety of the jobsite for hot work as the “Permit Authorizing Individual” prior to the commencement of any hot work on-site, and for coordinating the fire watch.

1. (C.1 and C.2 apply).

F. The worksite must be made safe per all requirements specifically listed on the hot works permit.

1. See “Appendix A” of this Policy, to view a copy of the hot works permit.

G. Any work done outside using a heat source for paint removal, roof repairs, etc. requires a hot work permit from the Williamstown Fire Department, in conjunction with the College hot works permit.

1. The Facilities Office of Safety and Environmental Compliance will assist with securing any such hot work permits, provided sufficient prior notification from the contractor(s) involved.

HOURS OF WORK

Hours of work shall be 8:00am until 5:00pm, Monday through Friday. Weekend and off-hours work will be allowed only by special arrangement with and at the sole discretion of the College, and requested 72 hours in advance.

Construction and/or maintenance activities outside or in close proximity to College-owned student residences typically may not begin before 8am.

Construction and/or maintenance inside College-owned student residences typically may not begin before 9am.

Construction will usually end by 5pm. Occasionally, a project may need to continue after 5pm. In these cases, residents of housing that is likely to be affected will be notified.

Occasionally a project may need to continue through the weekend. Should this be the case, the project will not start until 9:00am and will typically end by 4:00pm

IDLING EQUIPMENT

It is a violation of MGL Chapter 90, Section 16A for any motor vehicle to idle longer than five minutes unless the vehicle is being serviced, is a delivery vehicle for which engine power is necessary for the delivery, or the vehicle is in operation for which associate power need is required. Therefore, unnecessary idling of equipment is prohibited.

KEY ISSUANCE

All key requests must be submitted by the Williams College Project Manager. Building campus Master Keys will only be issued when access cannot be obtained through the occupants, and when practical, access will be provided by the Project Manager rather than issuing a key to the Contractor. Keys must be returned on the day of issuance unless otherwise authorized by the Project Manager. Allow 24 hours for processing requests. Keys may be picked up at the front office in Facilities between the hours of 7 AM and 4 PM, unless alternative arrangements are made with the Project Manager.

LEAD PAINT NOTIFICATION

Bidders are hereby notified that lead paint is present at the job site. Such lead-containing paint is required to be removed under this Contract. Monitoring, abatement and legal disposal shall be part of the Work. Disturbance of existing lead-based paint by the Contractor by sanding, sawing, grinding or scraping and removal and disposal of materials containing lead based paint must be in full compliance with OSHA Regulation 29 CFR 1926.62; “Lead exposure in Construction; Interim Final Rule”.

LOCKOUT / TAGOUT

Any work involving the servicing and maintenance of machines and equipment in which the unexpected start up or energization of the machines or equipment, or release of stored energy could cause injury or harm to employees can proceed only under the supervision of a Williams College employee trained in Lockout/Tagout procedures, and in full compliance with such policies and procedures.

NOISE

No unnecessary noise or disruption will be tolerated or permitted. College activities continue year round on the campus, and adjacent neighborhoods consist of private residences. Music, shouting and unnecessary running or idling of equipment will not be allowed.

OIL CONTAINING EQUIPMENT

Any time a new piece of equipment that contains oil is installed, the Contractor must submit the following information to the Project Manager:

1. Location of new equipment
2. The amount of oil in the equipment
3. Location of floor drains in proximity to the equipment
4. Necessity of secondary containment

When an existing piece of equipment is removed, the Contractor must submit the following information to the Project Manager:

1. The location of the old equipment
2. The quantity of oil
3. The name of the contractor who will be removing the oil.

OWNER'S SCHEDULE

Coordinate construction activities with the Williams College Calendar available on the website. Unscheduled events may occur on campus which will impact the Contractor's use of the project area or the Work of the Contract.

1. College Commencement Weekend: No work allowed.
2. Alumni Reunion Weekend: Quiet work only on Thursday and Friday. No work allowed on Saturday and Sunday.
3. Reading and exam periods: The College reserves the right to limit work to quiet work only during these periods.
4. Other Scheduled and Unscheduled Events: Coordinate with the Owner's Project Manager.

PARKING

It should not be assumed that parking for this project will be adjacent to or convenient to the project. Parking of construction personnel vehicles will be at a remote location up to one half-mile mile from the site. The College will not provide shuttle service. Parking of construction personnel vehicles on any other land or property will be subject to ticketing, fines, booting and/or towing at the vehicle owner's expense.

RADIOS AND MUSIC

No radios or other musical devices will be allowed on site. This includes personal listening devices such as iPods, cell phones, etc. Such devices are considered a hazard on the construction site.

REFRIGERANT CONTAINING EQUIPMENT

The Contractor shall be responsible and accountable for compliance with the EPA Clean Air Act (CAA) Section 608, 40 CFR Part 82 and any state and local codes for all refrigerant- related work. Contractor shall ensure that all contractor employees and subcontractors are made aware of these practices prior to beginning work on refrigerant containing equipment.

Contractor shall provide only proper level EPA certified technicians using EPA certified and registered recovery/recycling units to perform work on new and existing Williams College refrigerant equipment.

Refer to Williams College Regulatory Contractor Guidelines for Refrigerant Containing Equipment (found at www.facilities.williams.edu/policies) for additional requirements. A copy of this document can also be obtained from the Project Manager or from the Williams College Office of Safety and Environmental Compliance.

RUNOFF

Runoff of water from the site must be controlled to prevent contaminated water from entering the stormwater collection system or onto other areas or property.

SAFETY AND ENVIRONMENTAL COMPLIANCE

The Contractor must comply with all Safety and Environmental Compliance Contractor Regulatory Guidelines for the following: hot work permits, refrigerant containing equipment, oil containing equipment, fluorescent bulbs, confined space entry, asbestos and lead assessment, spills, compressed gas cylinders, on-site accidents. These guidelines can be found at www.facilities.williams.edu/policies or can be obtained from the Project Manager or from the Williams College Office of Safety and Environmental Compliance.

SCAFFOLDING

All scaffolding, staging, ladders, etc. and their use must fully comply with all OSHA requirements and standards.

SECURITY

The Contractor is solely responsible for security within the construction fence or site, and for all of its equipment, materials, vehicles and work on or off site.

SERVICE INTERRUPTIONS

Interruption of utility services which will affect other College facilities or functions must be coordinated a minimum of ten days in advance with the College's Project Manager. Frequently this work may have to be performed during off hours (early morning, late night or weekend) timeslots.

SEXUAL HARASSMENT

The Contractor and Subcontractors shall be responsible and accountable for their employees, suppliers, subcontractors, and their employees, with regard to their conduct during the performance of the Work. Specifically, persons involved in the performance of the work shall not physically or verbally abuse or harass the students, staff, visitors to the College, or other workers. Such conduct shall be grounds for immediate dismissal from the project. Sexual harassment is illegal under both State and federal Law. In some cases it may lead to prosecution under the Criminal Sexual Conduct Law.

SMOKING AND TOBACCO PRODUCTS

No tobacco products of any kind may be used inside or within 25' of any College building.

SPILLS

All spills (petroleum, chemical, sewer breaks, etc.), regardless of quantity, must be reported immediately to the Project Manager, the Office of Safety and Environmental Compliance (597- 2406), and Campus Safety & Security (597-4444). Any fines incurred as a result of failure to notify the College immediately will be the responsibility of the Contractor.

Upon a Spill or Release of Petroleum based Products or Chemicals the Contractor must:

1. Take measures to stop the release if safe to do so (e.g., shut valves, stop transfer operations).
2. Immediately confine leaked material with absorbents, sand or by other means if such actions can be done so safely.
3. Identify the product/material involved in the spill using the SDS (formerly known as MSDS) obtained from the Contractor's on-site file.

All sewer releases and backups must be reported to the project manager and the office of safety and environmental compliance.

NOTE: For a release during non-working hours contact Campus Safety & Security and they will contact someone from the Safety and Environmental Compliance office to complete notifications. If, for some reason, they are unable to contact someone from SEC, contact the MA DEP and follow up with notification to the Office of Safety and Environmental Compliance at the earliest possible opportunity.

Department of Environmental Protection 24 hour emergency response number is 1-888-304-1133. Western Regional Office Fax (413) 784-1149

436 Dwight Street
Springfield, MA 01103
Phone (413)784-1100

STREET CLEANING

Construction debris and soil materials tracked by construction traffic onto campus streets and walks shall be removed immediately by the contractor using means acceptable to the College such as street sweeping trucks.

TRASH REMOVAL/RECYCLING

All waste removal is the responsibility of the Contractor unless specifically excluded in the Contract Documents. Unauthorized use of Williams College receptacles (including dumpsters and compactors) will result in a reduction of contract payment equal to the estimated cost to remove the refuse.

All building material shall be screened for recyclable materials and any recyclable material shall be removed to the appropriate recycling facility.

All fluorescent bulbs that are removed during work must be boxed and labeled as uiversal waste and recycled in compliance with Williams College policies.

All waste disposal practices shall be in accordance with Massachusetts Departmnet of Environmental Protection Regulations: 310 CMR 19.017: Waste Disposal Ban Regulation

USE OR ENTRY INTO RESIDENCE HALLS

No access to dormitories will be permitted without the presence and supervision of a Williams College employee. Access to student bedrooms shall be coordinated ahead of time with the students occupying the room. All Contractors shall wear a College-issued ID card as well as company uniform when working in occupied buildings.

USE OR ENTRY INTO COLLEGE BUILDINGS (EDUCATIONAL BUILDINGS)

There shall be no entry into other College buildings without the permission and supervision of the Project Manager or other College personnel. All Contractors shall wear a College- issued ID card as well as company uniform when working in occupied buildings.

USE OR ENTRY INTO OTHER COLLEGE BUILDINGS

There shall be no entry into other College buildings without the permission and supervision of the Construction Manager or College personnel.

VEHICULAR TRAFFIC ON CAMPUS

Construction vehicles and equipment shall obey all posted speed limits and other traffic restrictions. Construction vehicles and equipment shall stop for all pedestrians. Pedestrians always have the right of way.

USE OF COLLEGE SEAL

The use of the College Seal is restricted to the Office of the President and the Board of Trustees.

END OF SECTION

SECTION 00 90 10
DESIGN STANDARDS VARIANCE REQUEST FORM

VARIANCES, CLARIFICATIONS OR EXCEPTIONS TO THE CONSTRUCTION GUIDELINES

Proposed variances, clarifications or exceptions to these Standards must be requested with this form.

This form must be submitted to the Williams College Project Manager, who will direct the inquiry to the appropriate department for review and disposition.

Request:

Date of request: ____

Response date requested: ____

Project: ____

Williams project manager: ____

Requestor: ____

Requestor email: ____

Standards section number: ____

Standards section title: ____

Request and Reason: Include benefit to Williams College, impact on project cost, impact on project quality, impact on project schedule, impact on sustainable design as applicable. Attach supporting documentation sufficient for evaluation and review.

Response:

Reviewed w/ Ops: ____

Accepted: ____

Accepted with modification: ____

Not accepted: ____

Response completed by:

Name: ____

Signed: ____

Date signed: ____

END OF FORM

SECTION 00 09 20
DESIGN STANDARDS UPDATE REQUEST FORM

UPDATE REQUEST

Proposed updates to these Standards must be requested with this form.

This form must be submitted to the Williams College Project Manager, who will direct the inquiry to the appropriate department for review and disposition.

Request:

Date of Request: ____

Response Date Requested: ____

Project: ____

Williams Project Manager: ____

Requestor: ____

Requestor Email: ____

Standards Section Number: ____

Standards Section Title: ____

Request and Reason: Include benefit to Williams College, impact on project cost, impact on project quality, impact on project schedule, impact on sustainable design as applicable. Attach supporting documentation sufficient for evaluation and review.

Response:

Accepted: ____

Accepted with Modification: ____

Not Accepted: ____

Response Completed By:

Name: ____

Signed: ____

Date Signed: ____

END OF FORM

SECTION 01 24 00
VALUE ANALYSIS

PART 1 - GENERAL

A. This section contains administrative requirements for design and construction professionals working with Williams College.

B. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

C. Value analysis, value management, or value engineering

   1. There shall be no variance from these design standards without explicit and written approval from Williams College.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 35 29
HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES

CONTACTS

Emergency:

From Cell Phones: 413-458-5646

From Campus Phones: 9-911 or 911.

Williams College Campus Safety and Security Department:

Phone (24 hours a day): 413-597-4444 or from campus phones x4444

Email: security@williams.edu

END OF SECTION

SECTION 01 57 23
TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

A. This section contains administrative requirements for design and construction professionals working with Williams College.

B. Temporary Storm Water Pollution Control documents are attached as Appendix VIII.

C. The Williams College Temporary Storm Water Pollution Control documents and requirements shall be reviewed, and fully integrated and implemented during the initial design phase of the project.

PART 2 - PRODUCT

PART 3 - EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all cleaning and final delivery of project.

END OF SECTION

SECTION 01 74 23
FINAL CLEANING

PART 1 - GENERAL

A. At completion of work, remove all waste, debris, rubbish, tools, equipment, machinery and surplus materials. Clean all sight-exposed surfaces; leave work clean and ready for occupancy.

PART 2 - PRODUCT

PART 3 - EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all cleaning and final delivery of project.

B. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

C. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

D. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

E. Sweep concrete floors broom clean in unoccupied spaces.

F. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

G. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

H. Remove labels that are not permanent.

I. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

J. Remove grease, dust, dirt, stains, labels, fingerprints, protection and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to specified finish. (a) In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces to ensure performance.

K. Contractor vacuum clean and mop all surfaces of pedestal floors and supports, including entire area beneath pedestal floors.

L. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

M. Leave Project clean and ready for occupancy.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

A. This section contains administrative requirements for design and construction professionals working with Williams College.

B. Closeout Procedures documents are Appendix IX of these standards.

C. The Williams College closeout requirements shall be reviewed, and fully integrated and implemented during the initial design phase of the project, as well as prior to start of construction operations.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This section contains administrative requirements for design and construction professionals working with Williams College.

B. Provide QR inventory/asset tags for equipment. See Appendix VII.

C. Verify which equipment is to be tagged with Williams College Facilities Operations Group.

D. Verify data to be coded with Williams College Facilities Operations Group.

E. See Appendix V for typical asset log and equipment list.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 78 46
EXTRA STOCK MATERIALS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Provide spare LED drivers for all LED fixtures installed.

1. Consult with the Williams College Facilities Operations Group for quantity and where the drivers should be stored. A minimum of 2 drivers per type shall be provided.

B. No other attic stock to be provided.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 01 81 13
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section contains administrative requirements for design and construction professionals working with Williams College.

B. Sustainable Design Requirements

1. Sustainable Design Requirements documents are an exhibit to the Form of Agreement.
2. The Williams College goals for sustainability, including energy use and recycling, shall be reviewed, and, fully integrated and implemented during the design phase of the project as well as prior to start of construction operations.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 91 00
COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

3. Section 01 81 13 – Sustainable Design Requirements. Any and all references to LEED herein assume the level of LEED requirements (if any) identified in the Sustainable Design requirements document(s).

B. It is of primary concern that all systems and assemblies in the project perform in accordance with the design intent and the College's operational needs. The process of assuring that such performance is achieved is referred to as "commissioning."

C. Commissioning requires cooperation and direct involvement by all parties throughout the construction process. Successful commissioning requires that installation of all building systems and assemblies not only comply with contract requirements but also that it is achieved early enough in the construction phase to provide full operational check-out, testing and adjustments prior to Substantial Completion. In addition to fulfilling scheduling and planning requirements, the Trade Subcontractors are further responsible for documenting the equipment and system installation and operational verification for all systems and assemblies.

D. The CM/GC and Trade Subcontractors responsibilities are as outlined in Section 1.3.

E. This Section includes a description of the commissioning process to be used for this Project and applies to all commissioned systems and assemblies.

F. Overall Quality Assurance/Quality Control (QA/QC): Quality assurance and quality control on this Project shall be accomplished by the following, as specified. Not all elements are monitored by the commissioning process.

1. Submittal reviews of Shop Drawings and material descriptions and certifications.

2. Qualifications and approvals of certain specified sub-tier Contractors and testing agencies or laboratories.

3. Inspection, testing and certifications by agencies provided by the College, including on-site and laboratory testing.

4. Inspection, testing and certifications by agencies provided by the Trade Subcontractors, including on-site and laboratory testing.

5. Inspection and testing by regulatory agencies.

6. CM/GC and Trade Subcontractor and College checks, inspections, tests and certifications.

7. Mock-ups and evaluations.

8. Commissioning: Commissioning enhances installation and setup and verifies the functional performance of the more dynamic systems through observation and testing as specified in this Section. Commissioning also may cover the QA/QC of certain static building elements or assemblies. Some QA/QC activities will be overseen by the commissioning process, while other QA/QC activities will be overseen by the CM/GC, the Architect or College. Generally, the QA/QC activities that have traditionally been conducted in the past remain outside the formal commissioning umbrella, such as concrete testing, inspection of static building elements, and regulatory or code inspections. However, compiling the documentation of some of these traditional activities may be within the commissioning scope, as specified herein.

G. Commissioning Process Overview: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a planning meeting followed by a kick-off meeting conducted by the Commissioning Authority where the commissioning process is planned and reviewed with the commissioning team members.

2. Additional meetings will be required throughout construction, scheduled by the Commissioning Authority with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.

3. Equipment and assembly documentation is submitted electronically to the Commissioning Authority during normal submittals, including detailed start-up procedures and early copies of Operation and Maintenance data.

4. The Trade Subcontractor develops start-up plans for selected equipment with review by the Commissioning Authority. The Commissioning Authority and/or Trade Subcontractor develop construction checklists to be completed by the Trade Subcontractor during the start-up process. Responsibilities among parties are summarily listed in Supplement 3 to this section.

5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before testing.

6. The Trade Subcontractor, under their own direction, execute and document the construction checklists and perform start-up and initial checkout. The Commissioning Authority documents that the checklists and start-up were completed through spot witnessing and reviewing Trade Subcontractor's completed checklists and startup reports.

7. The Commissioning Authority performs periodic construction observation.

8. The Commissioning Authority and/or Trade Subcontractor develop specific written equipment, system and assembly test procedures for all commissioned equipment.

9. The test procedures are executed by the Trade Subcontractor, under the direction of, and documented by the Commissioning Authority for most equipment. Selected testing is directed and documented by the Trade Subcontractor (see Supplement 3 to this Section).

10. Items of non-compliance in material, installation or setup are corrected by the Trade Subcontractor and the system is re-tested.

11. The Commissioning Authority reviews the O&M manuals for clarity, accessibility and completeness.

12. The Commissioning Authority reviews, pre-approves and coordinates the training provided by the Trade Subcontractor and verifies that is was completed.

13. Commissioning is complete before Substantial Completion, except for trend log monitoring, seasonal testing, near-warranty end activities, verification of later controls system training sessions and review of final red-line drawings.

14. Opposite season or deferred testing and near-warranty-end activities are conducted, as specified.

H. Design phase reviews, not commissioning during construction, ensure that any given feature qualifies for a Leadership in Energy and Environmental Design (LEED) credit. Gathering LEED required documentation is not part of the commissioning scope of this Project, other than for the commissioning credit itself. All required documentation and procedures to comply with LEED Energy and Atmosphere commissioning prerequisite and the additional point are included in the commissioning scope.

I. LEED requires that all features in the Water Efficiency and in the Energy and Atmosphere and most of the Indoor Environmental Quality areas are appropriately commissioned. The following equipment, systems, assemblies and features will be commissioned utilizing the traditional construction phase commissioning process that includes submittal review, construction checks, testing, observation, and training and documentation verification. All general references to equipment in this document refer only to equipment that is to be commissioned. The responsibility for developing and reviewing forms, overseeing, documenting and witnessing execution and reviewing reports of checks and tests is distributed among constructors, designers and College parties and differs for different equipment types. The Check and Testing Responsibility Table (Supplement 3) included as a supplement to this Section lists these responsibilities.

1. HVAC and mechanical system and all integral equipment controls. All HVAC systems shall be commissioned, including, but not limited to:

    a. Chilled water system (chiller, cooling tower, filtration system, chemical treatment, piping, pumps)

    b. Heating water system (boilers, piping, pumps)

    c. Air handlers

    d. Hydronic piping (including air separators and expansion tanks)

    e. Ductwork

    f. Thermal comfort, temperature and humidity control

    g. Variable speed drives

    h. Air terminal boxes

    i. Fan coil units

j. Restroom exhaust system
k. Facilities Monitoring and Control System
l. TAB work
m. HVAC and envelope differential pressure relationships
n. Fire protection system

2. Electrical Systems:
   a. Scheduled lighting controls
   b. Lighting occupancy sensors
   c. Emergency power generator system and ATS
   d. Fire alarm system
3. Laboratory and Clean Room
   a. Cleanroom makeup air units
   b. Cleanroom fan filter units
   c. Cleanroom certification
   d. Fume hoods and snorkel exhaust
   e. Hood and process exhaust systems
   f. Laboratory pressure and temperature control
   g. Biological safety cabinets
   h. Safety cabinets
   i. Cold rooms
   j. TAB work
4. Process Mechanical
   a. Treated Water System
   b. Vacuum System
   c. Compressed Air Systems
   d. Bio-waste sterilization
   e. Biomedical prep and glass cleaning
   f. Pure water systems

g. Process gas systems

J. The following static elements and features will be commissioned utilizing documented submittal review and observation, without testing: Details are given later in this Section.

1. Static LEED Water and Wastewater Efficiency Features: Low flow faucet and shower aerators.

2. Static LEED Energy Features:

   a. Exterior windows and doors.

   b. Envelope and pipe insulation.

3. Static LEED Indoor Environmental Quality (IEQ) Features:

   a. IAQ management during construction and turnover.

   b. Envelope air and moisture control design and integrity.

K. Commissioning will be directed by a Commissioning Authority under the direction of the College.

L. Related Sections

1. The General and Supplementary Conditions, applicable requirements of all Divisions of the Contract Specifications and all Contract Drawings apply to the work of this Section. In the event of conflict between specific requirements of the various documents, the more restrictive or extensive requirement shall govern.

2. Specific commissioning requirements and related issues are given in the following Sections of the Specifications.

3. Division 01 Section "General Requirements", Submittal Procedures: Alerts CM/GC of submittal requirements for commissioning.

4. Division 01 Section "General Requirements", Closeout Procedures: Lists some commissioning task required for substantial completion and final acceptance.

5. Division 13 Section "Commissioning of Controlled Environment Rooms", Process Systems Commissioning requirements for lab and clean room process equipment and systems.

6. Division 23 Section "HVAC Commissioning": Special Mechanical system requirements and testing requirements by system.

7. Division 26 Section "Electrical Systems Commissioning: Electrical component testing requirements.

8. Division 01 Section "Demonstration and Training": Training requirements.

9. Division 01 Section "General Requirements", O&M manual requirements.

10. Division 23 Section "Common Results for HVAC": Alerts Trade Subcontractor to commissioning in other sections.

11. Division 26 Section "Common Results for Electrical": Alerts Trade Subcontractor to commissioning in other sections.

1.2 DEFINITIONS

A. Active Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

B. Approval: Acceptance that a piece of equipment, system or issue related to it complies with the Contract Documents.

C. Architect/Engineer: The prime consultant (Architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

D. Basis of Design: See Design Basis.

E. Certified Testing Company: An industry certified company utilizing industry certified technicians on this project who will perform inspections and testing for equipment and systems. This company is not affiliated or owned by the equipment manufacturer.

F. Commissioning: Commissioning is a systematic process of ensuring that all building systems and assemblies perform interactively according to the College's objectives and requirements. This is achieved by beginning in the design phase and documenting the College's Project requirements and continuing through construction, acceptance and the warranty period with actual verification of function and performance. The commissioning process encompasses and coordinates the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, testing and training. The commissioning process does not take away from or reduce the responsibility of the system designers or installing Trade Subcontractors to provide a finished and fully functioning product. Commissioning during the construction phase is intended to achieve the following specific objectives:

1. Ensure that applicable equipment, systems and assemblies are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing Trade Subcontractors.

2. Ensure and document that equipment, systems and assemblies function and perform according to the Contract Documents and the College objectives and requirements.

3. Ensure that electronic O&M manuals are complete.

4. Ensure that the College operating personnel are adequately trained.

G. Commissioning Authority: An independent party, not otherwise associated with the A/E team members, CM/GC or the Trade Subcontractors. The Commissioning Authority directs and coordinates the day-to-day commissioning activities in concert with the CM/GC.

H. Commissioning Plan: An overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process. The commissioning plan includes details of the commissioning scope; systems to be commissioned; rigor of commissioning; team contact information; roles and responsibilities of all players; communication and reporting protocols; commissioning process overview as well as details of submittal activities; construction observation, construction checklisting and start-up activities; the process for dealing with deficiencies; test procedure development and execution; O&M manual review and training issues; warranty period activities; description of summary report, description of progress and reporting logs and initial schedule including phasing, if applicable. The Commissioning Authority updates the plan as construction progresses.

I. Contract Documents: The documents binding on parties involved in the construction of this Project (Drawings, Specifications, Change Orders, Addenda, Contracts, Requests for Information).

J. CM/GC: The Construction Manager/General Contractor or authorized representative.

K. Facilities Monitoring and Control System (FMCS): The central building energy management control system.

L. Construction Checklist: A list of items to include in the installation, start-up and initial checkout of a piece of equipment or assembly. Construction checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels, labels affixed, gauges in place, sensors calibrated, etc.). Some construction checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). Construction checklists augment and are combined with the manufacturer’s start-up checklist. An example is provided as supplement to this Section.

M. Datalogging: Monitoring flows, currents, status, pressures, etc., of equipment using stand-alone dataloggers separate from the control system.

N. Deferred Tests: tests that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

O. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the College’s objectives).

P. Design Basis: The basis and assumptions for calculations, decisions, schemes and product selections to meet the College’s Project requirements and objectives and to satisfy applicable regulatory requirements, standards and guidelines.

Q. Design Narrative: A narrative submitted with each design submittal describing the concepts and features in the Drawings. The Design Narrative is written by the designer, is updated, and increases in detail with each phase of the design. Initially, it may describe general building and space use and later should include detailed space usage and system and assembly descriptions.

R. Design Record: The compilation of the following five elements: College Project Requirements, College Objectives, Design Narrative, Design Basis and Performance Metrics.

S. Documenting Tests: The recording of what actions were taken to perform each individual test procedure, along with the results or system response of the procedure, with any deficiencies noted.

T. Emergency Power and Fire Alarm Response Matrix: A matrix listing all equipment and components (air handlers, dampers, valves, fire doors, elevators, control system, security system, lighting, etc.) with their status and action after each fire alarm initiation type, under emergency power and the requirements to bring each system back on line.

U. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with the College present.

V. Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed.

W. Issues Log: Ongoing record of the issues identified during the commissioning process that require or did require correction. For each entry the log includes a unique identification number, identification date, identification party, a short description of the issue, the equipment or assembly it is associated with, a long description of the issue, including cause, implications of the issue, recommendations for correction, assignment of responsibility for correction, an issue closed date and the name of the party verifying the correction. The Commissioning Authority is responsible to maintain the log.

X. Manufacturer's Service Representative (MSR): A company that is certified and trained by a manufacturer to provide startup, testing, and troubleshooting service for equipment.

Y. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Z. NETA: International Electrical Testing Association, Inc.

AA. Non-Compliance: See Deficiency.

BB. Non-Conformance: See Deficiency.

CC. Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation). See also "Simulated Signal."

DD. College: The representative on the Project that has the authority to act in the College's behalf in all issues.

EE. College-Contracted Tests: Tests paid for by the College outside the CM/GC's contract and for which the Commissioning Authority does not oversee. These tests will not be repeated during tests if properly documented.

FF. College Objectives: A distillation of the most salient concepts within the College's Project Requirements considered important to the College to have in writing and to be tracked through design and construction. The College Objectives are sometimes referred to as the design intent.

GG. College Project Requirements: Documentation of the functional requirements of the facility and the expectations of how it will be used and operated. This includes Project and design goals, measurable performance criteria, budgets and schedules and supporting information. This document is analogous to what has traditionally been referred to as the College Program.

HH. Performance Metrics/Benchmark: Measurable indicators that allow verification that a specific College Objective or Requirement or element in the Design Narrative has been met. Performance Metrics are identified throughout the design of the Project with as many as possible being generated during the development of the College Objectives. Metrics are most applicable for those College Objectives that allow for a numerical quantitative evaluation. However, some College Objectives may have Performance Metrics that are not numerical.

II. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

JJ. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

KK. Seasonal Tests: Tests that are deferred until the system(s) will experience conditions closer to their design conditions.

LL. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

MM. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

NN. Specifications: The construction Specifications of the Contract Documents.

OO. Start-up: The initial starting or activating of dynamic equipment, including executing construction checklists.

PP. Trade subcontractor: A sub-tier Contractor to the CM/GC

QQ. Systems Manual: A manual providing to the immediate and future operating staff the information needed to understand and optimally operate each system. The manual is in addition to the O&M Manuals submitted by the CM/GC. The systems manual focuses on operating, rather than maintaining the equipment, particularly the interactions between equipment. Some components of the manual may reside in the CM/GC-submitted O&M Manuals.

RR. Test: Assessments that verify specific components, assemblies, systems, and interfaces among systems function and perform in accordance with the College's objectives and the Contract Documents. Testing may include using manual (direct observation) or monitoring methods. Testing is the dynamic testing of specific and interacting equipment and systems in full operation. Tests are generally performed after construction checklists and start-up are complete. Some procedures in construction checklists test components, but reference to "testing" generally refers to those equipment and system tests conducted after Trade Subcontractor startup and initial checkout.

SS. Test Procedures (TP): The written procedures and documentation forms of tests used to guide and record testing. For mechanical systems, TPs are composed of repeatable, step-by-step procedures and include the test prerequisites, the test process, the expected outcomes and acceptance criteria. Forms or space for recording the results of tests may be included integrally in the written procedures or attached on separate sheets. For electrical component testing, the procedures may be less step-by-step-like than for dynamic mechanical equipment. For each piece of equipment, checks and test procedures and their documentation record forms may be different documents or combined in the same document, but checks and tests should be grouped. Responsibility for test procedure development is shared between the Commissioning Authority and the Trade Subcontractor according to the Check and Check and Testing Responsibility Table, attached as a supplement to this Section.

TT. Test Requirements: Requirements specifying what modes and functions, etc., shall be tested. The test requirements are not the detailed test procedures.

UU. Trending: Monitoring using the building control system.

VV. Vendor: Supplier of equipment.

WW. Warranty Period: Refer to Division 1 for a technical definition relative to equipment. For commissioning purposes and where referenced in a commissioning section, Warranty Period is defined as one year from substantial completion.

1.3 RESPONSIBILITIES

A. Overview: The responsibilities of the non-CM/GC or Trade Subcontractor parties in the commissioning process are summarized in the following articles. It is noted that the services for the College, Architect, mechanical and electrical designers/Engineers, and Commissioning Authority are not provided for in this Contract. That is, the CM/GC or Trade Subcontractor are not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process. Additional responsibilities of subcontractors to the CM/GC are found in other Sections of Division 1, General Requirements.

B. Architect and Mechanical and Electrical Engineers of Record:

1. All tasks of the designers are applicable only if it is within their contracted scope of services.

2. Construction Phase:

   a. Review the Commissioning Plan.

   b. Attend the commissioning planning and kick-off meetings and selected commissioning team meetings.

   c. The mechanical and electrical engineer attend the controls integration meetings.

   d. Perform normal submittal review, construction observation, O&M manual review.

   e. With the Trade Subcontractors and Commissioning Authority, actively assist in the development of the emergency power and fire alarm response matrix.

   f. Review the coordination Drawings.

   g. Assist (along with the) in clarifying the operation and control of commissioned equipment in areas where the Specifications, control Drawings or equipment documentation is not sufficient for writing detailed testing procedures.

   h. Witness selected testing.

   i. Coordinate resolution of system deficiencies and warranty issues identified during commissioning.

   j. Provide an overview of system design and function during selected operator trainings.

   k. Provide design basis and design narratives documentation for the Systems Manual.

   l. Review Systems Manual.

3. Warranty Period: Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning activities.

C. Commissioning Authority:

1. Construction Phase:

a. The primary role of the Commissioning Authority is to develop and coordinate the execution of a process of improved equipment installation and checkout and to verify and document that systems are functioning in accordance with the documented objectives of the College and in accordance with the Contract Documents. The Commissioning Authority is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management, unless specifically stated otherwise in the Contract Documents. The Commissioning Authority may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the CM/GC and Trade Subcontractors.

b. Coordinate the commissioning work and with the CM/GC to ensure that commissioning activities are being scheduled into the master schedule.

c. Revise, as necessary, the construction phase commissioning plan developed during design, including scope and schedule.

d. Plan and conduct commissioning meetings including the planning and kick-off meetings as needed and distribute minutes.

e. Request and review additional information required to perform commissioning tasks, including O&M materials, Trade Subcontractor start-up and checkout procedures. Before start-up, gather and review the current control sequences and interlocks and work with Trade Subcontractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

f. Equipment List Matrix.

    1). Develop an equipment list matrix of commissioned equipment in a computerized spreadsheet in a grouped and organized format.

    2). Include:

        a). Brief equipment or system name

        b). Tag or ID number

        c). Governing specification section

        d). Submittal reference number

        e). Installation location by room number or coordinates

g. Track status of each piece of equipment in the equipment list matrix for: receipt of documentation, submittal reviewed, construction checklist development and execution progress, startup, test form development and execution, trend log completion, O&M manual submission, training agenda development or receipt and training completion, red-line document submission and opposite season testing.

h. Develop the format for, and coordinate the completion of the emergency power and fire alarm response matrix as defined in this Section.

i. Review normal Trade Subcontractor submittals applicable to systems being commissioned concurrent with the A/E reviews for compliance with commissioning and O&M manuals and coordination issues.

j. Review requests for information and change orders for impact on commissioning and College's objectives.

k. Review coordination Drawings and ensure that trades are making a reasonable effort to coordinate.

l. Write and distribute construction checklists for commissioned equipment as assigned in this Section.

m. Develop an enhanced start-up and initial systems checkout plan with Trade Subcontractors for selected equipment.

n. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

o. Coordinate with the Architect to verify that any sustainable design requirements affected by system performance or commissioning are addressed.

p. Document construction checklist completion by reviewing completed construction checklists and by selected site observation.

q. Document systems start-up by reviewing start-up reports and by selected site observation.

r. Write step-by-step test procedures and documentation formats for commissioned equipment and assemblies, as assigned in the Check and Check and Testing Responsibility Table provided as a Supplement to this Section. Test procedures will include active testing, energy management control system trending and may include stand-alone data-logger monitoring.

   1). Existing written testing requirements and procedures in accepted or required standards, guidelines or Specifications will suffice as the test procedures for the following: Regulated tests such as fire alarm, fire suppression, elevators, NETA electrical equipment tests, test procedures within these specifications and common Trade Subcontractor tests such as duct and piping tests.

s. Coordinate and assist in development of test plans, execution and documentation of tests of commissioned equipment overseen by regulatory authorities and ensure that such tests meet the testing and documentation rigor desired by the College. The systems for which this applies are indicated in the Check and Testing Responsibility Table in the supplements to this Section. Testing and commissioning for these systems shall be per the requirements of those Sections of the Specifications and the governing codes and standards. The Commissioning Authority shall work with the CM/GC and Trade Subcontractors and College to ensure that these tests are scheduled and coordinated with the interfaces to other systems on the Project as well as requirements of the authorities having jurisdiction. Coordination efforts shall include but not be limited to:

   1). Developing a logical test plan that flows from the component level on the various systems to the integrated testing of the systems as they interact with each other.

   2). Verification that all necessary documentation requirements are met for all parties including but not limited to the authorities having jurisdiction, the College and the insurance underwriter.

3). Promoting and being proactive in the process and ensuring that all involved parties ommunicate effectively across the inter-discipline boundaries as required for successful integrated testing of the systems.

Coordinate testing for all commissioned systems and assemblies. Witness and document active tests performed by the Trade Subcontractors for all commissioned systems and assemblies, except: a) some smaller equipment may be tested and documented by the Trade Subcontractors, at the Commissioning Authority's discretion, b) electrical equipment testing and regulated testing may be directed and documented by the Trade Subcontractor with only spot witnessing and report review by the Commissioning Authority. Refer to the Check and Testing Responsibility Table provided as a supplement to this Section for more specific delineation. The testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including start-up, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction check listing by the installing Trade Subcontractors, and spot-checked by the commissioning provider during testing. Analyze functional performance trend logs and monitoring data to verify performance. Coordinate retesting as necessary until satisfactory performance is achieved.

t. After active testing and initial troubleshooting is complete, monitor system operation and performance for selected data points for up to 2 weeks by requesting trend logs from the Trade Subcontractor from the building automation system. Analyze monitored data to verify operation and performance and issue a written report.

u. Maintain a master Issues Log and a separate record of testing. Report all issues as they occur directly to the College. Provide directly to the College written progress reports and test results with recommended actions.

v. Review equipment warranties to ensure that the College responsibilities are clearly defined.

w. Oversee and approve the training of the College’s operating personnel.

x. Review and approve the preparation of the O&M manuals for commissioned equipment.

y. Compile a Commissioning Record.

z. Compile a Systems Manual according to the definition and description in this Section for all commissioned systems.

2. HVAC and Mechanical-Specific Tasks of the Commissioning Authority

a. Controls Integration Meetings: Coordinate the approval process for the control system database and programming (point names, alarm limits, access levels, graphic details and layout, specific control strategies and sequences, etc.) via a series of meetings attended by the Trade Subcontractor, College, and Mechanical Engineer. The meetings shall occur after the software and data base drawings are issued for initial review, but prior to the development of the database and code for any piece of equipment.

b. Witness HVAC piping pressure test and flushing, sufficient to be confident that proper procedures were followed. Include documentation of all testing in the Commissioning Record.

c. Witness any ductwork testing and cleaning sufficient to be confident that proper procedures were followed. Include documentation of all testing in the Commissioning Record.

d. Approve air and water systems balancing by selected site observation, by reviewing completed reports and by spot testing.

e. Coordinate and approve the start-up of permanent equipment for temporary space conditioning during construction and review the plans for the use of temporary space conditioning equipment.

3. Process Systems Commissioning:

a. Refer to Division 13 Section "Commissioning of Controlled Environment Rooms", Process Systems Commissioning for specific requirements.

4. Electrical System Specific Tasks of the Commissioning Authority: See Division 26 Section Commissioning of Electrical Systems" for Electrical System Requirements.

5. Static LEED Systems:

a. Refer to the Static elements commissioning article later in this Section.

6. Warranty Period:

a. Coordinate and supervise required opposite season or deferred testing and deficiency corrections and provide the final testing and sequence of operation update documentation for the Commissioning Record and O&M manuals.

b. Return to the site approximately 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have with operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify deficiencies that may come under warranty or under the original construction contract. Assist facility staff in developing reports and documents and requests for services to remedy outstanding problems.

D. College:

1. Construction Phase:

a. Furnish a copy of all Construction Documents, addenda, requests for information, change orders and approved submittals and Shop Drawings related to commissioned equipment to the Commissioning Authority for their permanent retention.

b. Facilitate the coordination of the commissioning work by the Commissioning Authority.

c. With the CM/GC and Commissioning Authority, ensure that commissioning activities are being scheduled into the master schedule.

d. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Commissioning Plan.

e. Participate in issue resolution as necessary.

f. Provide final approval for the completion of the commissioning work.

g. Assist in the Commissioning Authority. The LBNL staff will be teamed with CH2M HILL and will perform many commissioning tasks during all phases of the process.

2. Warranty Period: Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

E. CM/GC

1. The CM/GC is fully responsible to the College for all Trade Subcontractor and CM/GC listed responsibilities in the specifications. Separate responsibility listings are given in this Section for clarity purposes.

2. Construction Phase.

a. The CM/GC shall designate a Commissioning Coordinator to organize, schedule and coordinate the execution of the CM/GC's and Trade Subcontractor's commissioning responsibilities. The Commissioning Coordinator shall have experience in project management, scheduling and in the technical aspects of mechanical and electrical systems.

b. With the Commissioning Authority, ensure that commissioning activities are being scheduled into the master schedule.

c. Include Trade Subcontractor’s cost associated with commissioning in the total contract price.

d. Furnish a copy of all submittals and Shop Drawings related to commissioned equipment to the Commissioning Authority for their permanent retention during the normal submittal review cycle.

e. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training that will meet the requirements of the Specifications.

f. Notify the Commissioning Authority when the installation will begin for static assemblies that are being commissioned, dates for pipe and duct system testing, flushing, cleaning, start-up of each piece of equipment and starting of testing adjusting and balancing. Notify the Commissioning Authority ahead of time, when commissioning activities not yet performed or not yet scheduled may delay construction.

g. Provide time in selected construction meetings to cover commissioning-related issues.

3. Warranty Period.

a. Schedule and coordinate the Trade Subcontractors in correcting outstanding commissioning tasks and deficiencies.

F. CM/GC and Trade Subcontractors:

1. The details of this article apply to both the CM/GC and sub-tier Contractors providing commissioned equipment. Other responsibilities for each party are listed in individual articles specific to each party.

2. Construction Phase.

   a. Coordinate with the Commissioning Authority to facilitate the commissioning work.

   b. Be proactive in seeing that commissioning processes are executed and that the requirements of the Commissioning Authority for the commissioning work are coordinated into the over-all construction schedule.

   c. Attend the commissioning planning and kick-off meetings and other necessary meetings scheduled by the Commissioning Authority to facilitate the commissioning process.

   d. Participate in the controls integration meetings coordinated by the Commissioning Authority, prior to submitting the controls submittal.

   e. With the Architect and Commissioning Authority, actively assist in the development of the emergency power and fire alarm response matrix during the initial submittal period.

   f. The CM/GC and Trade Subcontractors shall respond to notices of issues identified during the commissioning process, making required corrections or clarifications and returning prompt notification to the Commissioning Authority according to the process given in Division 01 Section "General Commissioning Requirements".

   g. When completion of a task or other issue has been identified as holding up any commissioning process, particularly functional testing, the Trade Subcontractor shall notify the CM/GC within one day of identification. The CM/GC shall within two days of notification of the issue, notify the Commissioning Authority and provide an expected date of completion or resolution of the issue. The CM/GC shall notify the Commissioning Authority within one day of completion. It is not the responsibility of the Commissioning Authority to obtain this status information through meeting attendance, asking questions or field observation.

G. Trade Subcontractors:

1. Construction Phase:

   a. In addition to the other responsibilities for the Trade Subcontractors listed in this Section,

   b. Provide additional requested documentation, prior to normal O&M manual submittals, to the Commissioning Authority for development of installation, start-up and testing procedures.

   c. Typically this will include detailed manufacturer installation, start-up, operating, troubleshooting and maintenance procedures, full details of any College-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the College to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.

   d. The Trade Subcontractor shall provide the Commissioning Authority additional documentation necessary for the commissioning process, when requested.

   e. Assist in clarifying the operation and control of commissioned equipment or assemblies in areas where the Specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

f. Submit a written plan to the College and Commissioning Authority for temporary startup of equipment used for space conditioning. Obtain plan approval of College and Commissioning Authority prior to such startup.

g. Notify the CM/GC when the installation will begin for static assemblies that are being commissioned, dates for pipe and duct system testing, flushing, cleaning, start-up of each piece of equipment and starting of testing adjusting and balancing. Notify the CM/GC ahead of time, when commissioning activities not yet performed or not yet scheduled may delay construction.

h. During the installation, start-up and initial checkout process, document the execution of installation, start-up and initial checkout with parties having direct knowledge of each item being checked off and provide a copy to the Commissioning Authority.

i. During construction, maintain red-line documents for Trade Subcontractors-generated coordination drawings. Update after completion of commissioning (excluding deferred seasonal testing).

j. Record daily all issues that arise during the testing, adjusting and balancing work, such as damaged or missing duct or insulation, sensors, wiring, valves, dampers, controls, programming, equipment, components, etc. or items that will reduce the effectiveness of the installation or prevent accurate air and water balancing or systems or building control. During balancing, provide the Commissioning Authority this list of issues once a week within 1 day of the end of the reported week.

k. Review test procedures developed by the Commissioning Authority to ensure feasibility, safety and equipment protection and provide necessary alarm limits to be used during the tests.

l. Develop test plans with review and approval of the Commissioning Authority per the Check and Testing Responsibility Table provided as a supplement to this Section.

m. Write step-by-step test procedures and documentation formats for commissioned equipment and assemblies, as assigned in the Check and Testing Responsibility Table provided as a Supplement to this Section. Test procedures will include active testing, energy management control system trending and may include stand-alone data-logger monitoring.

n. Existing written testing requirements and procedures in accepted or required standards, guidelines or Specifications will suffice as the test procedures for the following: Regulated tests such as fire alarm, fire suppression, elevators, NETA electrical equipment tests, test procedures within these specifications and common industry tests such as duct and piping tests.

o. Execute testing for selected systems and assemblies under the direction of, and documented by the Commissioning Authority as listed in the Check and Testing Responsibility Table. Direct, execute, and document testing on selected systems as listed in the Check and Testing Responsibility Table provided as a supplement to this Section.

p. Assist and cooperate with the Commissioning Authority by putting all commissioned equipment and systems into operation and continuing the operation during each working day of testing, as required.

q. Remedy outstanding Architect "punch list" items that may affect equipment operation before testing. Air and water testing adjusting and balancing shall be completed with discrepancies and problems remedied before testing of the respective air- or water-related systems.

r. Provide all tools or the use of tools to start, check out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the Commissioning Authority.

s. Provide skilled technicians and perform testing under the direction of the Commissioning Authority for equipment and assemblies specified for testing in this Section. In particular, the person tasked with operating the controls system during testing shall be familiar with this building and control program. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete necessary tests, adjustments and problem-solving. For larger mechanical equipment, provide the services of the start-up technician for the beginning of the testing of the equipment.

t. Ensure that the local authorities having jurisdiction are available to witness any acceptance test (e.g., fire alarm testing, smoke cycle testing, fire damper acceptance testing, sprinkler system hydro-testing, etc.) that is a condition of occupancy for the building.

u. Provide assistance to the Commissioning Authority in interpreting apparent system performance problems from monitored and test data.

v. Respond in writing to each issue. Correct deficiencies (differences between specified and observed performance) as interpreted by the Commissioning Authority, College and Architect and retest the equipment.

w. Train College personnel using expert qualified personnel according to the Contract Documents.

x. Prepare electronic O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions and submit a copy to the Commissioning Authority for review.

y. Provide necessary documentation for the Systems Manual as described in this Section.

z. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty during occupancy. Provide this information to the Commissioning Authority.

2. Warranty Period:

a. Correct deficiencies and make necessary adjustments to O&M manuals and red-line documents for applicable issues identified in any seasonal or warranty period testing.

H. Equipment Suppliers:

1. Construction Phase:

a. Provide requested submittal data, including detailed start-up and checkout procedures and specific responsibilities of the College to keep warranties in force for all commissioned equipment or assemblies.

b. Assist in equipment or assembly testing per agreements with Trade Subcontractors.

c. Include all special tools and instruments, when only available from vendor, specific to a piece of equipment, required for testing equipment according to these Contract Documents in the base bid price to the CM/GC or Trade Subcontractors.

d. College to provide information requested by Commissioning Authority regarding equipment sequence of operation and testing procedures.

e. Review test procedures for equipment installed by factory representatives.

f. For larger primary equipment, provide the services for the first part of testing, of the technician that conducted start-up. For electrical commissioning, see Table of Testing Responsibility provided as a supplement to this Section.

g. Provide expert qualified staff for equipment training.

1.4 SUBMITTALS

A. The CM/GC and Trade Subcontractors shall provide the Commissioning Authority with information required to facilitate the commissioning process from written requests.

B. Standard Equipment and Assembly Submittals.

1. Prior to standard equipment and assembly submittals being issued, the CM/GC shall provide the Commissioning Authority with a submittal register. The Commissioning Authority will check which submittals they desire to review and comment on and which they need only copies of the approved submittals.

2. The submittals reviewed may be done in parallel with A/E reviews or in series with them, depending on protocol set by the College.

3. The reviews will consist of commenting relative to conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment, adequacy for developing test procedures and for O&M issues. The reviews are intended primarily to aid in the development of testing procedures and only secondarily to verify compliance with equipment Specifications.

C. Other Equipment and Assembly Information.

1. When not included with the standard submittals, the Trade Subcontractors shall provide to the Commissioning Authority requested shop drawings, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of College contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. This documentation will be required prior to the normal O&M manual submittals.

D. All equipment and assembly documentation requested by the Commissioning Authority shall be included by the Trade Subcontractors later in the O&M manuals.

E. The Trade Subcontractors shall submit all company and required staff qualifications.

F. The Trade Subcontractors shall submit checklists and startup and test plans, forms and procedures as indicated on the Check and Testing Responsibility Table.

G. The Trade Subcontractors and Architect shall provide additional design narrative information requested by the Commissioning Authority, depending on the completeness of the Design Record documentation and sequences provided with the Specifications.

1.5 QUALITY ASSURANCE

H. Test Equipment:

1. All standard testing equipment required for the Trade Subcontractors to perform installation, start-up and initial checkout and required testing shall be provided by the Trade Subcontractors.

2. Special tools and instruments, only available from vendor, specific to a piece of equipment, required for testing equipment according to these Contract Documents shall be included in the base bid price.

3. The Trade Subcontractors shall provide datalogging equipment for setting up and testing of cold rooms, clean room certification, fume hoods and lab room pressurization and equipment required to perform specified electrical equipment testing.

4. Datalogging equipment required for testing equipment in support areas shall be provided and used by the Commissioning Authority.

I. Test Equipment Calibration Verification:

1. Trade Subcontractors shall submit, within 90 days of notice to proceed and 30 days before any testing is performed, documentation of meeting the following calibration requirements.

2. Electrical equipment testing instruments must be calibrated in accordance with the following frequency:

   a. Field Instruments: Analog, 6 months maximum, digital, 12 months maximum.

   b. Laboratory Instruments: 12 months.

   c. Leased specialty equipment: 12 months where accuracy is guaranteed by lessor.

3. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

   a. If not otherwise given, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 degrees F and a resolution of + or - 0.1 degrees F. Pressure sensors shall have an accuracy of + or - 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

1.6 COORDINATION

A. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority, the College, the CM/GC, the Architect and design engineers, the mechanical contractor, the electrical contractor, the testing adjusting and balancing contractor, the controls contractor, any other installing subcontractors or suppliers of commissioned equipment or assemblies and the College's building or plant operator/Engineer.

B. Management: The Commissioning Authority is hired by the College directly. The Commissioning Authority directs and coordinates the commissioning activities and the reports to the College. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

C. Scheduling: The CM/GC shall provide sufficient notice to the Commissioning Authority regarding the installation of static assemblies being commissioned and the schedule for the construction checklists, start-up and initial checkout of all commissioned dynamic equipment and systems. Refer to Schedule under Part 3, EXECUTION, for additional scheduling details.

D. Meetings: Refer to Part 3, EXECUTION, for a description of meetings required as part of the commissioning process.

E. General: The CM/GC and the Trade Subcontractors will coordinate with the Commissioning Authority in a number of areas as described in this Section in order to facilitate the successful completion of the commissioning plan.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 MEETINGS

A. Planning Meeting: Within 30 days of commencement of construction, the Commissioning Authority will schedule, plan and conduct a commissioning planning meeting with the Architect, and mechanical and electrical engineering subconsultants, the CM/GC, College and facility operator or representative. During this meeting, the overall scope and process of the commissioning effort for this Project will be described, issues and suggestions from all parties given, management and reporting protocols finalized and the Project schedule discussed. From information gathered in this meeting, the Commissioning Authority will update the Commissioning Plan preparatory to the commissioning kick-off meeting. Meeting minutes will be distributed to all parties by the Commissioning Authority.

B. Kick-off Meeting: Within 30 days from the planning meeting, the Commissioning Authority will schedule, plan and conduct a commissioning kick-off meeting with the entire commissioning team in attendance, including the controls, sheet metal, electrical, mechanical, test, adjusting and balancing and other appropriate Trade Subcontractors and the facility operator or representative in attendance. One week prior to this meeting, the updated commissioning plan will be distributed to all members for their review. The commissioning plan, the overall commissioning process and general responsibilities of each team member, reporting and communication protocols and next steps will be discussed. Meeting minutes will be distributed to all parties by the Commissioning Authority.

C. Temporary or Early Startup of Equipment. When equipment will be used in a temporary mode prior to operating the equipment permanently, a meeting shall be held that discusses the issues surrounding indoor environmental quality, moisture intrusion, building pressurization, duct and equipment cleanliness, checkout of safeties and fire alarm and protection, etc.

D. Miscellaneous Meetings: Deficiencies in compliance with the contract documents identified through the commissioning process or other means shall be discussed, as needed, in portions of regular construction meetings. Meetings dedicated to deficiencies or commissioning status, coordination and planning shall also be conducted. The Commissioning Authority will plan, conduct and take minutes at commissioning meetings. When practical, commissioning meetings will be an appendage to regular construction meetings. All commissioning meetings shall be attended by the CM/GC, the mechanical and the controls subcontractors. Selected meetings shall require the attendance of the electrical, sheet metal, fire alarm, TAB or other trades of commissioned systems or assemblies. The number of specific meetings dedicated to commissioning, besides those specifically listed in this Section are expected to consist of:

1. From 30 days prior to setting ductwork or mechanical equipment until the startup of the first piece of major mechanical equipment: one-hour meetings every 6 weeks.

2. From the startup of the first piece of major mechanical equipment until the beginning of functional testing of mechanical equipment: one-hour meetings every two weeks.

3. From the beginning of functional testing of mechanical equipment until all mechanical equipment has had the first round of testing conducted: 1 hour meetings once a week.

4. From the end of the first round of testing until all deficiencies are corrected: 1 hour meetings once a week or as set by the College.

5. If the number of deficiencies is abnormal or coordination or cooperation is insufficient, additional meetings or meeting durations shall be required.

E. Controls Integration Meetings: The Commissioning Authority coordinates a series of meetings to go over the control drawings, sequences of operation, points list and database and controls submittal requirements. These meetings are held prior to a formal control drawing submittal and any programming. The intent is to clarify control related issues for the controls contractor, mechanical, fire alarm and electrical contractor, College facility staff and Commissioning Authority prior to final point database development, programming and the formal control drawing submittal.

1. The controls contractor shall attend all meetings. The mechanical, electrical and general contractor shall attend when issues regarding equipment they are responsible for are discussed. The mechanical and electrical designers attend as needed according to their contracts. The control technicians attending the meetings must be the same technicians that are/will install and program the DDC system.

2. Preliminary control drawing submittals and sequences by system are provided by the Controls Contractor, reviewed beforehand and discussed at these meetings.

3. Primary issues discussed and clarified are:

   a. Control drawing content and format

   b. Point database (points (monitored points, software points, naming conventions, alarms, report format)

   c. Sequences of operation and setpoints (clarity, completeness, design intent, functionality, and enhancements for control, energy and O&M)

d. Interlocks to packaged controls and other systems, including filling in the fire alarm and emergency power response matrices

e. Operator workstation graphics

f. Field sensor and panel locations

4. A site walk-through with the Controls Contractor, Commissioning Authority and Engineer shall be conducted where precise locations of panels, sensors, thermometers, flow meters and stations and valve taps will be identified.

5. The Commissioning Authority takes minutes at these meetings, which may include marked up data base forms and sequences of operation.

3.2 CONSTRUCTION CHECKLISTS, START-UP, AND INITIAL CHECKOUT

A. The following procedures apply to all equipment and assemblies to be commissioned:

1. Static Elements: Systems or assemblies that are static in nature (not dynamic like mechanical or some electrical systems) may have very simplified construction checklists for installation and may have no start-up or testing requirements. Refer to the Static Elements article later in this Section for specific requirements.

2. Construction Checklists:

a. The Commissioning Authority develops new or adapts existing representative construction checklists and procedures for commissioned equipment and assemblies according to the notation in the list of commissioned systems in Part 1, GENERAL, of this Section. A representative checklist for mechanical systems is found as a supplement to this Section. Electrical equipment component check forms are considerably simpler than the mechanical example.

b. Calibrations: The construction checklists will contain requirements for calibrations when applicable. The Trade Subcontractors is responsible to calibrate all field-installed sensors and actuators using test and documentation methods approved by the Commissioning Authority.

c. On each Construction Checklist the CM/GC shall identify which trade or contractor is responsible for executing and documenting each of the line item tasks and shall note that trade on the checklist form.

d. Checklists may be attached to test procedure forms.

3. Manufacturer Installation and Startup Procedures:

a. The Trade Subcontractors shall document their installation and startup utilizing manufacturer installation and startup procedures, checksheets and reports, in addition to the commissioning construction checklists.

b. The completed manufacturer startup reports shall be submitted to the Commissioning Authority within 5 days of startup. The Contractor shall clearly note any items that have not been completed and the plan for their completion.

4. Execution of Construction Checklists and Start-up:

    a. Each piece of equipment shall receive full construction checkout by the Trade Subcontractors following the approved plan and forms. No sampling strategies are used. Only individuals that have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall initial or check that item off. It is not acceptable for non-witnessing supervisors to fill out the forms.

    b. The Trade Subcontractors shall complete the pre-start procedures in the construction checklist prior to starting equipment, including but not limited to verification of completion of wiring, safeties, lubrication, drive rotation and proper electrical test readings. Startup shall be conducted under supervision of responsible manufacturer representatives for major pieces of equipment. The CM/GC shall notify the Commissioning Authority at least 5 days in advance of any equipment start-up, providing the Commissioning Authority a copy of the pre-start sections of the installation and start-up plan at that time.

    c. The Commissioning Authority shall observe installation, start-up and checkout of selected systems. Procedures on the plans and checklists will be spot-checked by the Commissioning Authority prior to testing.

    d. The Trade Subcontractors and vendors shall execute start-up and provide the Commissioning Authority with a signed and dated copy of the completed construction checklists and installation and start-up documentation. The Trade Subcontractors shall clearly note any items that have not been completed and the plan for their completion.

    e. The Trade Subcontractors shall operate each commissioned device or assembly to the full extent of its capability, from minimum to maximum, under automatic and manual control and verify that the equipment, system and assembly is functioning according to the specifications, manufacturer's recommendations and good operating practice.

    f. The Construction Checklist and manufacturer installation and startup checksheets and procedures for a given system shall be successfully completed and submitted prior to formal testing or testing, adjusting and balancing of the equipment.

    g. Where final balancing of a system or particular components thereof are not specifically indicated to be performed by the College or College's consultants, the CM/GC and Trade Subcontractors shall provide final balancing and adjustments for operation within specified tolerances prior to testing and demonstration of such system.

    h. The Trade Subcontractors shall submit installation, startup and checkout documentation prior to testing equipment.

    i. The Commissioning Authority will review installation, startup and checkout documentation and identify incomplete areas.

    j. The Trade Subcontractors shall correct all areas that are deficient or incomplete in the checklists in a timely manner.

3.3 PHASED START-UP AND TESTING--CLEAN ROOM

A. The Project will require start-up and initial checkout to be executed in phases. This phasing will be planned and scheduled in detail in coordination meetings. Results will be added to the master schedule.

1. The intent of this phasing is to ensure that sufficient chilled and heating water and electrical power (including backups) are confidently available to the systems serving the clean room during successively cleaner clean room stages, without requiring processes that will contaminate the clean room.

2. This will require that primary equipment (chillers, boilers, clean room air handlers, power and generator) will be started, partially balanced and functionally tested and put into active operation. Then, later as ancillary and secondary portions of the primary equipment are finished and tested, both primary and secondary systems shall be functionally tested as a complete system, with some primary system functions being tested twice.

3. Any equipment started up or tested which later is modified shall have affected portions or potentially affected portions of equipment, sequences and interlocks retested to ensure that the entire system or assembly functions properly.

3.4 TESTING

A. This sub-section applies to all commissioning testing for all Divisions of the Project Manual.

B. The Trade Subcontractors shall be responsible to test fully all systems and assemblies according to the Specifications. The Commissioning Authority will direct, witness and document most of the mechanical systems tests. The electrical Trade Subcontractors shall direct and document most electrical component tests with the Commissioning Authority spot witnessing and reviewing completed reports. The Trade Subcontractors shall execute all tests, except at the discretion of the Commissioning Authority and approval of the Trade Subcontractors, the Commissioning Authority may execute tests of selected equipment. Refer to the Check and Testing Responsibility Table provided as a supplement to this Section for details.

C. Tests for a given system or assembly shall not be conducted until they are fully operational under normal and reliable control with control calibrations, programming and control system graphics complete and checked out and the Trade Subcontractors have submitted a completed construction checklist and where applicable a startup report, satisfactory to the Commissioning Authority.

D. Testing Requirements: The testing requirements for specific systems and assemblies are found in other specification sections.

E. Objectives and Scope:

1. The objective of testing is to demonstrate that each system is operating according to the documented College Objectives and Contract Documents. For dynamic systems, testing facilitates bringing the systems from a state of initial operation to full dynamic operation. For static elements, testing verifies the performance of the assembly in its installed state under conditions specified in the testing requirements. Additionally, during the testing process, areas of deficient performance are identified and corrected.

2. In general, testing shall include testing each sequence in the sequence of operations, and other significant modes, sequences and control strategies not mentioned in the written sequences; including, but not limited to startup, shutdown, unoccupied and manual modes, modulation up and down the unit's range of capacity, power failure, alarms, component staging and backup upon failure, interlocks with other equipment, and sensor and actuator calibrations. All interlocks and interactions between systems shall be tested. All larger equipment will be individually tested. Like units or assemblies that are numerous (many

smaller rooftop packaged units, air terminal units, exhaust fans, windows, etc.) may have an appropriate sampling strategy applied. Heating equipment must be tested appropriately during winter and air conditioning equipment must be tested appropriately during summer to demonstrate performance under near-design conditions.

F. Development of Functional and Performance Test Procedures:

1. Test procedures and documentation forms are not finalized until after equipment and control system submittals and shop drawings are approved. The party responsible for developing, reviewing and approving the procedures is given in Supplement 3 to this Section.

2. The party responsible for writing the test procedures obtains needed documentation which generally includes equipment Specifications, testing requirements, O&M manuals, approved submittals and shop drawings, start-up instructions, sequences of operation, and mechanical, electrical and control drawings and writes detailed step-by-step testing procedures to comply with the testing requirements.

3. Prior to execution, any test procedures developed by the Commissioning Authority are provided to the Trade Subcontractors who shall review the tests for feasibility, safety, equipment and warranty protection.

4. Prior to execution, test forms developed by the Trade Subcontractors are reviewed and approved by the Commissioning Authority.

5. Test procedures shall be written and submitted to reviewers at least 14 days prior to executing the tests.

G. Test Procedure Format: Three sample test forms for mechanical equipment are provided in Supplement 2 to this Section. The final test procedure forms shall include (but not be limited to) the following information:

1. System and equipment or component name(s).

2. Equipment location and ID number.

3. Unique test ID number, and reference to unique construction checklist and start-up documentation ID numbers for the piece of equipment.

4. Date.

5. Project name.

6. Participating parties.

7. A copy of the Specification Section describing the test requirements.

8. A copy of the specific sequence of operations or other specified parameters being verified.

9. Formulas used in any calculations.

10. Required pre-test field measurements.

11. Instructions for setting up the test.

12. Special cautions, alarm limits, etc.

13. Specific step-by-step procedures to execute the test for each sequence or feature being verified, in a clear, sequential and repeatable format. Each must be tailored and applicable to this project.

14. Acceptance criteria of proper performance with a “Yes/No” check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.

15. A section for comments.

16. Signatures and date block for the Commissioning Authority.

H. The Commissioning Authority will review College-contracted, factory testing, required College-witnessed acceptance tests and tests conducted by regulatory authorities which the Commissioning Authority is not responsible to oversee, including documentation format, and will determine what further testing or format changes may be required to comply with the Specifications and rigor desired by the College. Redundancy of testing shall be minimized. Documentation of these tests will be included in the Commissioning Record.

I. Test and Verification Methods:

1. Testing and verification for most dynamic equipment shall be achieved by an appropriate combination of active testing (persons manipulate the equipment and observe its function) or by monitoring the performance and analyzing the results using the control system’s trend log capabilities or by stand-alone dataloggers. For certain tests documenting with photographs, video or audio recordings may be appropriate. The testing requirements sections of the Specification describe which methods shall be used for each test. The Commissioning Authority may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the College.

2. Simulated Conditions: Simulating conditions other than by overwriting a value shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

4. Simulated Signals: Using a signal generator, which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

5. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55 degrees F, when the outside air temperature is above 55 degrees F, temporarily change the lockout setpoint to be 2 degrees F above the current outside air temperature.

6. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions

and responses. Much of this verification is completed during construction checklists and calibrations.

7. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Trade Subcontractors shall provide all necessary materials, system modifications, etc., to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Trade Subcontractors shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. The specific recommended sampling rates are specified with the testing requirements. It is noted that no sampling by the Trade Subcontractors is allowed in construction checklist execution.

9. Testing Order: In general, testing is conducted after construction checklisting and start-up has been satisfactorily completed. The control system is sufficiently tested and approved by the Commissioning Authority before it is used for testing, adjusting and balancing, or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before testing of air-related or water-related equipment or systems. Testing generally proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is verified.

10. Trend Logs and Monitoring: Trend logs required in the testing requirements shall be set up and executed by the Trade Subcontractors and provided to and analyzed by the Commissioning Authority. Monitoring using dataloggers will be conducted by the Commissioning Authority. Trend logs and monitoring are conducted after active testing and subsequent trouble-shooting are complete and systems are in normal operation without frequent service shutdowns, etc.

J. Problem Solving: The burden of problem solving is on the CM/GC and Trade Subcontractors and the Architect, though the Commissioning Authority may recommend solutions to problems found.

3.5 ISSUES AND NON-CONFORMANCE

A. Issue Management

1. The Commissioning Authority will record the results of document reviews, field observations, tests conducted or reviewed and trend logs or monitoring. All deficiencies or non-conformance issues will be recorded on a master Issues Log kept by the Commissioning Authority. The Issues Log will be kept updated by the Commissioning Authority.

2. A current copy of the Issues Log will be provided to the CM/GC and College on a regular basis, as requested by the CM/GC or College. New issues since the last printing will be explicitly identified.

3. Issues warranting a request for information (RFI) will be forwarded by the Commissioning Authority to the designated party for developing the RFI, or the Commissioning Authority will generate and forward the RFI directly.

4. Issues of non-compliance or items that are incomplete or require Designer input will be sent to the CM/GC or Designer and College by the Commissioning Authority via appropriate channels.

5. For some issues it may be unclear whether the issue requires a Designer response prior to action. The Commissioning Authority will in those cases send the issue either to the Designer or to the CM/GC, or possibly both. If the Designer or CM/GC believe it is not their initial responsibility, they shall state this in a reply to the Commissioning Authority within two days of receipt. The Commissioning Authority will forward to the designated party.

6. The Issue Memorandum sent via email to the CM/GC or Designer on each issue will include a statement whether the resolution of the issue is holding up or will likely delay a commissioning process and a deadline for a response. Responses can be made by replying to the original email.

7. When completion of a task or other issue has been identified by the Commissioning Authority as holding up or is likely to delay any commissioning process, particularly functional testing, the CM/GC or Designer, as applicable, shall likely be required (as noted in the Issue Memorandum) , within two days of notification of the issue, to notify the Commissioning Authority in writing providing the planned actions and an expected date of completion. The CM/GC shall notify the Commissioning Authority in writing within one day of completion listing the actions taken to resolve the issue. It is not the responsibility of the Commissioning Authority to obtain this status information through meeting attendance, asking questions or field observation.

8. The Commissioning Authority documents resolutions in the Issues Log and schedules retesting and reinspection as needed.

9. Corrections of minor issues identified may be made during the tests at the discretion of the Commissioning Authority and with the issue and resolution documented in the Issues Log.

10. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Authority will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the written request of the College.

    a. Cost of Retesting: Problems identified during testing will fall into the following five categories.

        1). Equipment or hardware not installed or not installed properly.

        2). Controls program not per the approved sequence of operation (either the specific specified sequence was not programmed, or the methods and subroutines used to meet the specified sequence or performance requirement do not meet the objectives).

        3). Air or water balancing does not meet the design documents when the system has the capacity to do so.

        4). Specified design control sequences, setpoints or schedules require modification to achieve proper operation or control.

        5). Design balancing quantities require modification.

b. If a delay occurs because of the case of (1), (2) or (3) in the article immediately above, no additional compensation will be given to the subcontractor involved in troubleshooting, making corrections or retesting.

c. If a delay occurs because of the case of either (4) or (5) in the article above, additional compensation may be required depending on how quickly revisions can be made.

d. The determination of the cause of the problem will be by agreement between the College, the Architect and design subconsultants, the Commissioning Authority and the CM/GC.

e. For a deficiency identified, not related to any construction checklist or start-up omission or fault, the following shall apply: The Commissioning Authority will direct, document and evaluate the retesting of up to 10% of the test procedures of the equipment once at no "charge" to the Trade Subcontractor or CM/GC for their time. However, the Commissioning Authority's time for additional retesting beyond 10% will be charged to the CM/GC.

f. The time for the Commissioning Authority to direct, document and evaluate any retesting required because a specific construction checklist or start-up test item, reported to have been successfully completed, but determined during testing to be faulty, will be charged to the CM/GC.

g. The CM/GC shall reimburse the College and Commissioning Authority for costs when a scheduled test cannot be completed due to:

1). Failure of the CM/GC to schedule the test with all parties required to perform the test or with regulatory authorities required to witness the test.

2). Failure of the CM/GC to provide required notice for tests that have been cancelled or rescheduled.

3). Failure of the CM/GC or Trade Subcontractors to have in place test equipment, support equipment, instrumentation, permits, or other ancillary equipment or systems required for successful execution of the test.

4). Failure of the Trade Subcontractors to complete pre-start or start-up procedures or other work required as a prerequisite for execution of the test.

11. The CM/GC shall respond in writing to the Commissioning Authority and College at least as often as commissioning meetings are being scheduled concerning the status of each outstanding issue identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

12. Any required retesting by the Trade Subcontractors shall not be considered a justified reason for a claim of delay or time extension by the Trade Subcontractors.

B. Failure Due to Manufacturer Defect: For identical or near-identical components numbering more than 10 (e.g., terminal units, diffusers, traps, valves, etc.). If in the opinion of the College or Designer, 10 percent, or 3, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance Specification, all identical units may be considered unacceptable by the College. In such case, the Trade Subcontractors shall provide the College with the following:

1. Within 1 week of notification from the College, the Trade Subcontractors or manufacturer's

representative shall examine all other identical units making a record of the findings. The findings shall be provided to the College within 2 weeks of the original notice.

2. Within 2 weeks of the original notification, the Trade Subcontractors or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc., and all proposed solutions, which shall include full equipment submittals. The proposed solutions shall not significantly exceed the Specification requirements of the original installation.

3. The College will determine whether a replacement of all identical units or a repair is acceptable.

4. Two examples of the proposed solution will be installed by the Trade Subcontractors and the College will be allowed to test the installations for up to 1 week, upon which the College will decide whether to accept the solution.

5. Upon acceptance, the Trade Subcontractors and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within 1 week from when parts can be obtained.

C. Approval and Acceptance: The Commissioning Authority will note each satisfactorily demonstrated function on the test form. However, formal approval of an entire test form is not normally given. Functional approval or acceptance of a system is indicated after all testing and monitoring is complete and there are no outstanding issues for that equipment or assembly in the Commissioning Authority's Issues Log.

3.6 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and testing may be delayed upon written approval of the College.

B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in the testing requirements shall be completed as part of this contract. The Commissioning Authority will coordinate this activity. Tests will be executed, documented and deficiencies corrected by the Trade Subcontractors, with facilities staff and the Commissioning Authority witnessing. The Trade Subcontractors shall make needed final adjustments to the O&M manuals and Record Documents due to the testing results.

3.7 DOCUMENTATION

A. Commissioning Plan: The Commissioning Plan is defined in this Section and follows the process outlined in the Specifications. The Commissioning Authority will develop and update the commissioning plan as construction progresses. The Specifications will take precedence over the Commissioning Plan.

B. Schedule: The College and CM/GC and the Trade Subcontractors shall work with the Commissioning Authority using established protocols to schedule the commissioning activities. The College and CM/GC shall integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. As construction progresses, more detailed commissioning schedules shall be developed. The CM/GC shall provide a minimum of 2 weeks' notice prior to the date of testing to the College and Commissioning Authority. In addition, the Commissioning Authority and College shall be notified 36 hours in advance when tests are canceled or rescheduled.

C. Documentation required of the Trade Subcontractors shall consist of the following:

1. Construction checklist form completed.

2. Startup and initial checkout forms completed.

3. Completed test forms and record of deficiencies and incomplete items for tests they are responsible to document.

4. Training record (see Division 01 Section "Demonstration and Training").

5. Contributions to Systems Manual (flow diagrams, fire alarm and emergency power matrix, seasonal startup and shutdown procedures, red-line drawings).

D. Reporting and Documentation by the Commissioning Authority:

1. The Commissioning Authority will provide regular reports of all issues and progress directly to the College with increasing frequency as construction and commissioning progresses. Issues that are in the schedule critical path or which significantly affect budget or building performance will be reported within 2 days of identification.

2. The Commissioning Authority will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

3. The Commissioning Authority will witness and document the results of all functional and performance tests using the specific procedural forms developed for that purpose. The Commissioning Authority will include the filled out forms in the Commissioning Record.

4. Systems Manual: A Systems Manual will be compiled by the Commissioning Authority. See details in this Section.

5. Commissioning Record: The Commissioning Authority is responsible to compile, organize and index commissioning data by equipment and assembly into labeled, indexed and tabbed, three-ring binders and deliver it to the College, to be included with the O&M manuals. Three copies of the manuals will be provided. The record will contain for all systems and assemblies together the Summary Report, Issues Log, Commissioning Plan, progress reports, submittal reviews, O&M manual reviews, summary training record, Design Record, testing schedule. Then for each system or assembly the sequence of operation, construction checklist, start-up report, test record, training record, and the indexed and fully labeled trend log analysis of all systems. Included in the record will be all outstanding non-compliance items specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific test, inspection, trend log, etc. where the deficiency is documented.

6. Summary Report: The summary commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of

commissioned equipment or assembly, the report will contain the disposition of the Commissioning Authority regarding the adequacy of the equipment, documentation and training meeting the Contract Documents in the following areas: 1) installation, including equipment meeting the equipment Specifications, 2) functional performance and efficiency, 3) equipment O&M manual documentation, and 4) operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. will also be listed. Each non-compliance issue will be referenced to the specific test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment will include a brief description of the verification method used (active testing, FMCS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

E. Systems Manual: The Commissioning Authority (CA) will compile a Systems Manual. The following components of the manual are organized and indexed by system into one compilation. The responsibility of the Trade Subcontractors and other parties in the System Manual development are given in brackets.

1. Design Record: The Design Record for each system or assembly included in the Systems Manual, consists of:

   a. College Requirements and Objectives (see Definitions). [By Architect.]

   b. Design Basis (see Definitions). [By Architect.]

   c. Design Narrative (see Definitions). [By Architect.]

   d. Performance Metrics/Benchmarks, if developed (see Definitions). [By CA, if in scope.]

2. Fire and life safety and emergency power criteria including a general strategy narrative, detailed sequences and an HVAC fire and emergency power response matrix. [Format by CA and content by Trade Subcontractors and Architect.]

3. Flow Diagrams: Include reductions of the flow or one-line diagrams from the drawings for all commissioned systems for which flow drawings exist. [By Trade Subcontractors]

4. Seasonal start-up and shutdown, manual and restart operation procedures. [By Trade Subcontractors.]

5. Complete as-built Control Drawings with points list, valve schedules, schematics, control system architecture and full sequences of operation (see example sequence of operation for rigor and format as a supplement to this Section). [By Trade Subcontractors.]

6. A description of and rationale for all energy and water saving features and strategies with operating instructions and caveats about their function and maintenance relative to energy use. [By CA.]

7. Recommendations for recalibration frequency of sensors and actuators by type and use. [By CA.]

8. Plans for continuous commissioning or recommended frequency for recommissioning by equipment type with reference to tests conducted during initial commissioning. [By CA.]

9. Description of the primary recommended standard trend logs in the control system that will

assist in maintaining comfort, energy efficiency and system control. This will include sample plots with explanations of what to look for in the graphs. [By CA.]

10. Specific recommendations regarding seasonal operational issues that affect energy use. [By CA.]

11. A list of all user adjustable setpoints and reset schedules with a discussion of the purpose of each and the range of reasonable adjustments with energy implications. Include a schedule frequency to review the various setpoints and reset schedules to ensure they are at current relevant and efficient values. [By CA.]

12. A list of time of day schedules [by Trade Subcontractors] and a schedule frequency to review them for relevance and efficiency [by CA].

13. Guidelines for establishing and tracking benchmarks for whole building energy use and primary plant equipment efficiencies. [By CA.]

14. Guidelines for ensuring that future renovations and equipment upgrades won’t result in decreased energy efficiency and maintaining the final design intent. [By CA.]

15. A list of diagnostic tools, with a description of their use that will assist facility staff in operating equipment more efficiently. [By CA.]

    a. Troubleshooting table for ongoing achievement of the College’s project requirements and system performance [By CA].

    b. Systems to be included in the Systems Manual: All the systems listed in this Section as being commissioned.

F. O&M Documentation Completion and Review:

1. The Commissioning Authority will provide an O&M Manual Checklist that lists the elements of the manuals required by the specifications. The Trade Subcontractors shall fill out this checklist for each manual and submit with the manual.

2. Prior to substantial completion, the Commissioning Authority shall review the O&M manuals for systems that were commissioned to verify compliance with the Specifications. This verification will be conducted by sampling the manuals against the O&M Manual Checklist. The Commissioning Authority will communicate deficiencies in the manuals to the College and the Architect. If systemic deficiencies are found, the Trade Subcontractors shall go back through those checklist items on every manual and verify compliance.

3. Upon a successful review of the corrections, the Commissioning Authority will recommend approval and acceptance of these sections of the O&M manuals.

4. The Commissioning Authority will also review each equipment warranty and verify that all requirements to keep the warranty valid are clearly stated.

5. This work does not supersede the Architect’s review of the O&M manuals.

G. QR Coding: Provide QR coding as required by Exhibit IV.

H. Summary of Written Work Products: Written work products generated as part of the commissioning process are described in various parts of the Specifications and in the Commissioning Plan. In summary, the written products are:

	Product	Developed By
1.	College requirements and objectives	Architect per College Project Design Requirements
2.	Design narratives and design basis	Architect
3.	Final commissioning plan	Commissioning Authority
4.	Commissioning meeting minutes	Commissioning Authority
5.	Commissioning schedules	College and CM/GC with input from the CA
6.	Special equipment/assembly submittals	Trade Subcontractors
7.	Sequence clarifications	Trade Subcontractors and Architect, as needed
8.	Construction checklist forms	Commissioning Authority and Trade Subcontractors
9.	Start-up and initial checkout plan	Trade Subcontractors and Commissioning Authority
10.	Construction checklists, start-up and initial checkout forms filled out by Trade Subcontractors	Trade Subcontractors
12.	Emergency power and fire alarm response matrix.	Format by Commissioning Authority and content by Trade Subcontractors and Architect
13.	Issues Log	Commissioning Authority
14.	Commissioning Progress Record	Commissioning Authority
15.	Test forms	Commissioning Authority and Trade Subcontractors
16.	Filled out tests	Commissioning Authority and Trade Subcontractors
17.	Commissioning Record	Commissioning Authority
18.	Overall training plan	Commissioning Authority and College
19.	Specific training agendas and record	Commissioning Authority and Trade Subcontractors
21.	Systems Manual	Commissioning Authority

3.8 TRAINING OF COLLEGE PERSONNEL

A. The Trade Subcontractors are responsible to provide training for College personnel per the Contract Documents. The Trade Subcontractors shall work with the Commissioning Authority to develop appropriate training and orientation agendas for equipment and assemblies and provide skilled trainers for the sessions. The Commissioning Authority will ensure that the Trade

Subcontractors executes training per the Contract Documents and will provide a brief system overview at the beginning of the training sessions for the primary equipment. The training program is described in Division 01 Section "Demonstration and Training".

3.9 STATIC ELEMENTS COMMISSIONING

A. The following tasks constitute the commissioning of the listed LEED static elements.

1. Water Use Reduction Credit 3. Static features (shower and faucet aerators, low flow fixtures, etc.) will have submittals reviewed by the College to verify that they meet the specified LEED standards. The Commissioning Authority verifies that submittals were approved by the College or Architect. The College or Architect perform site observation to ensure that submitted products were installed properly.

2. Energy and Atmosphere Features. The static energy features (wall, roof and pipe insulation and the envelope assembly, including windows and doors) for the energy Credit 1 will have submittals reviewed for compliance with the specifications by the Architect. The Commissioning Authority verifies that submittals were approved by the College or Architect. The College or Architect perform site observation to ensure that submitted products were installed properly according to good thermal practice for air and water leakage potential.

3. IAQ management plan (Credit 3.1 and 3.2) features (IAQ management plan and building flush-out) are not explicitly required to be commissioned in LEED, but for this project the Commissioning Authority will review the CM/GC's submittal of means and methods of the plan and ensure that a party has been assigned responsibility by the CM/GC to monitor compliance with the plan.

4. Indoor chemical and pollutant source control (Credit 5) features. Entry-way systems, isolation and ventilation of house-keeping rooms, copy rooms and other chemical containing spaces and plumbing systems serving chemical mixing will receive on-site observations by the Commissioning Authority to verify that specified and submitted features are installed and operating properly. The isolation rooms or rooms with required differential pressures will be verified through testing when specified in Division 13 Section "Commissioning of Controlled Environment Rooms".

5. Envelope air and moisture control design and integrity. Differential pressures will be measured between inside and outside to ensure the building is positively pressurized at the envelope. See test requirements in Division 13 Section "Commissioning of Controlled Environment Rooms".

3.10 SUPPLEMENTS

A. The supplements listed below, and attached following “END OF SECTION,” are a part of this Specification:

1. Representative Construction Checklist.
2. Representative Test.
3. Check and Testing Responsibility Table.
4. Sample Sequence of Operation.

END OF SECTION

SECTION 02 42 00
REMOVAL AND SALVAGE OF CONSTRUCTION MATERIALS

PART 1 GENERAL

A. Williams College reserves the right to require that select materials be carefully removed and turned over to and/or delivered to the College or to others at the College's discretion.

PART 2 PRODUCTS

A. For purposes of the section, the term "materials" shall include without limitation: systems, materials, equipment, fixtures, furnishings, etc.

PART 3 EXECUTION

A. Coordinate with Project Manager and the Williams College Facilities Operations Group to develop a list of all materials to be salvaged.

B. The work includes removal and salvage of identified materials, and removal of resulting rubbish and debris.

C. Before beginning any removal or salvage work, survey the site and examine the drawings and specifications to determine the extent of the work.

D. Take necessary precautions to avoid damage to existing materials that are to remain in place, to be reused, or to remain the property of the College.

E. Service/system requirements: locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems as required for safe and complete removal of salvage materials.

F. Sort and organize salvaged materials as they are removed from the structure.

G. Pack, crate or band materials to keep them contained and organized.

H. Store items in a secure and weather protected area until removed from the site or transferred to owner.

I. Transport items and deliver to the college as directed by the project manager. Contractor may assume that all deliveries will be on the Williams College campus.

J. Protect items from damage during transport and storage.

K. Repair or restore materials damaged by the contractor to original condition, or replaced, as approved by the Project Manager.

END OF SECTION

SECTION 04 05 13
MASONRY MORTARING

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Period Masonry

1. Williams College maintains a database of masonry, mortar analyses and characteristics for its buildings. These material specifications shall be followed in their entirety. Any deviation from the database requires explicit consent from the Williams College Project Manager.
2. Coordinate with the College Project Manager for review of the database information.
3. All masonry and/or mortar for which there is information in the database shall be maintained, repaired, patched, or replicated making best use of the data available.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 05 52 00
METAL RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Provide pipe, tube or solid bar-stock handrails and railing systems as design dictates.

B. Wooden railing systems are permitted when appropriate for interior applications.

1.2 SUBMITTALS

A. All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College PMIS webportal.

B. Product Data: Submit manufacturer's product data and installation instructions foreach material and product used.

C. Shop Drawings: Submit shop drawings indicating material characteristics, detailsof construction, connections, and relationship with adjacent construction.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers.

B. Deliver, handle, store and use materials in accordance with manufacturer's instructions.

C. Handrail and Railing Structural Performance: In accordance with applicable Building Code.

PART 2 PRODUCTS

2.1 MATERIALS

A. Hand railings may be any of the following materials provided it is compatible with the environmental conditions and accompanied by a corresponding finish system and installation technique. For recommended installation details for exterior metal railings, please refer to Figures 1, 2, and 3 at the end of this section.

1. Carbon Steel**:
   a. Pipe: ASTM A 53, Type E or F, Grade B, Sch. 40 for railings and Sch. 80for posts.
   b. Tubing: ASTM A500 Grade B or C.
   c. Plate, Shapes and Bars: ASTM A36.
   d. Castings: ASTM A48 (Gray Iron) or ASTM A47 (Ferric malleable iron).

**Only Corrosion-resistant materials are to be used for embedded posts in Williams' existing historic masonry stair or floor materials. Carbon steel, even when galvanized, should not be used for exterior hand rails that are to be anchored in masonry other than concrete.

2. Stainless Steel:

    a. Pipe: 304 or 316 Sch. 40 for railings and Sch. 80 for posts.
    b. Tubing: 304 or 316.
    c. Plate, Shapes, Bars: Type 304 or 316.
    d. Castings: CF 8 (304) or CF 8M (316).

3. Aluminum:
    a. Pipe: 6061-T6 Sch. 40 for railings and Sch. 80 for posts.
    b. Tubing: 6063-T52
    c. Plate, Shapes and Bars: 6061-T6511
    d. Castings: A380

4. Copper Alloy (Brass and Bronze):
    a. Pipe: C65300 Silicon Bronze, C61300 Aluminum Bronze
    b. Tubing: C65300 Silicon Bronze, C61300 Aluminum Bronze
    c. Plate, Shape, Bar: C65300 Silicon Bronze, C61300 Aluminum Bronze
    d. d. Castings: C65300 Silicon Bronze, C61300 Aluminum Bronze
    e. e. Bronze assemblies should be of matched grade.

2.2 FINISHES

A. Each material listed above requires a unique finish system compatible with the material.

1. Carbon Steel
    a. Use COLORGavl 20 system for all exterior applications.
    b. Interior railings do not require galvanizing. Powder Coat or paint per Williams paint standards based on performance need.

2. Stainless Steel
    a. Powder coat or paint based on performance need.
    b. Consult paint standards for appropriate finishes.
3. Aluminum
    a. Powder coat or paint based on performance need.
    b. Consult paint standards for appropriate finishes.

4. Copper Alloy
    a. Consult paint standards for finishes on Copper Alloys.

PART 3 EXECUTION

3.1 INSTALLATION

A. Take field measurements prior to fabrication, where possible. Form to required shapes and sizes with true, straight edges, lines and angles. Provide light-tight, hairline joints.

B. Install materials and systems inaccordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

C. Coordinate with work of other sections; provide inserts and templates as needed. Install work plumb and level with uniform appearance.

D. Restore damaged finishes and protect work.

3.2 POST ANCHORAGE TO CONCRETE AND/OR STONE STEPS:

A. All post anchoring media should fill the corresponding hole and slope away from the post.

B. If using epoxy anchoring medium:
   a. Recommended product: Simpson SET Epoxy.
   b. Post base below grade should be round. If square posts are spec'd, embedded portion should be turned round.
   c. DO NOT USE SQUARE POST PROFILE IN ROUND HOLE WITH EPOXY ANHCORING.
   d. Core drill hole no more than ¼" larger than diameter of post.
   e. Grout pocket/post burial to be minimum of 6" deep.
   f. Core hole should be a minimum of 3X the diameter of the hole away from any edges.
   g. Follow manufacturer's instructions for use of epoxy.
   h. See Figure 1 for diagram of this method.

C. If using cementitious grout anchoring medium:
   a. Must be Portland cement based.
   b. Must be non-Shrink.
   c. Recommended Product: CMP Super POR-ROK cementitious grout.
   d. Post base does not need to be round.
   e. If using round posts:
      1. Core drill 1" diameter larger than post.
   f. If using square posts:
      1. Core drill hole large enough for at least ½" grout thickness between corners of post and edge of hole.
   g. Grout pocket/post burial to be minimum of 6" deep.
   h. Core hole should be a minimum of 2X the diameter of the hole away from any edges.
   i. Follow manufacturer's instructions for use of grout.
   j. See figure 2 for diagram of this method.

D. If anchoring posts into Soft Stone: (marble, lime, sand, brown or brick)
   a. Drill through hole in stone.
   b. Anchor post to solid anchoring point BELOW soft stone step.
      1. Poured concrete under step.
      2. Mechanical fastening system under step.
      3. Provide means for drainage at bottom of hole.
   c. Position posts on joints between two stones, if possible.
   d. Use pliable, non-shrink sealant to fill gap between post and hole.
      1. Silicone
      2. Non-shrink caulk.
   e. If this method is not possible, use the Epoxy method (3.2.a) for a minimal hole size.

DI. Handrails on Williams' historic stairs.
   a. Design team should use means of installing handrails without need for drilling new or additional holes.
   b. Use existing holes.
   c. Spec proper anchoring medium and method based on existing hole sizes.

TYPICAL FIGURES (VARIES FROM PROJECT TO PROJECT)

FIGURE 1:
Epoxy anchoring method
For concrete or granite only, not soft stone.

Allow only 1/16” gap around all edges for ¼” to ½” posts.
Allow only 1/8” gap around all edges for 5/8” to 1-1/4” posts.
Epoxy thickness should never exceed 1/8”.

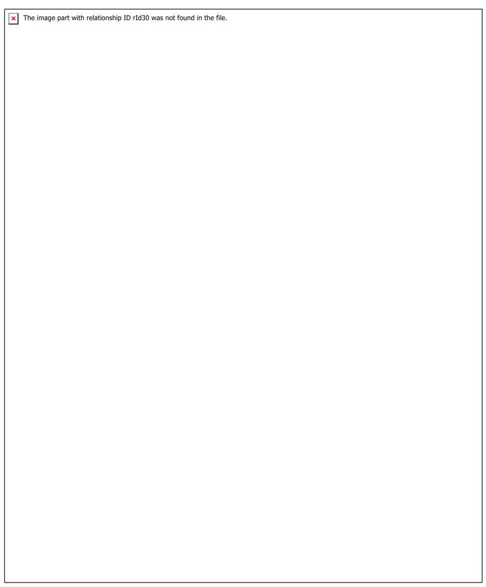


FIGURE 2:
Non-Shrink Cementitious Grout anchoring method
For concrete or granite only, not soft stone.

Using round profiles for portion of post to be buried is ideal.

Ensure minimum ½” clearance in every direction:
1-1/2” square post requires 3.25” hole.
If 3” hole is desired, use 1-1/4” post profile.

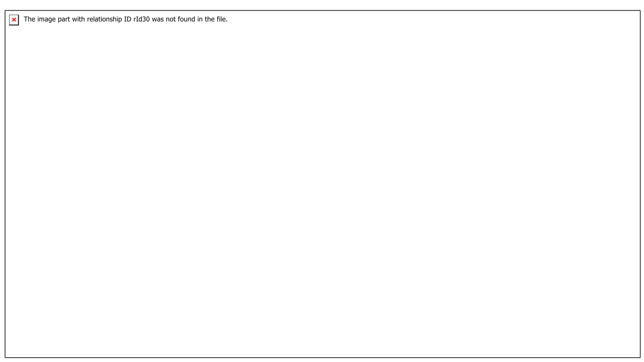
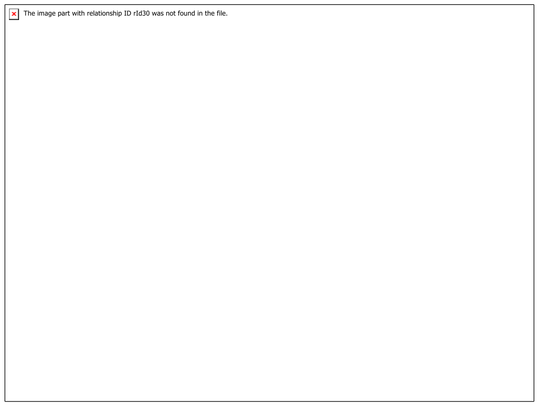


FIGURE 3:
For Soft Stone
(Lime, Marble, Brownstone, Sandstone, Brick)



END OF SECTION

SECTION 06 40 00
ARCHITECTURAL WOODWORK

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Interior casework:

   1. Construction: Typically plywood or MDF. No particleboard.

B. Counters: Laminate or solid surfacing with under mount sinks.

   2. Laminate: Wilsonite, Pionite, Nevamar, or Formica. Wilsonart preferred.

C. Counters with undermount sinks: Use solid surfacing

D. Interior trim: Hardwood, pine or poplar. No MDF.

E. Exterior woodwork

   1. Boral TruExterior preferred; other materials only as approved.

   2. Fasteners and plugs to be per manufacturers' directions.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

A. Access to roofs through windows is not acceptable. Always provide a door, or hatch with fixed ladder for roof access.

PART 2 PRODUCTS

A. Doors to roofs or roof hatch ladders must be lockable.

B. Fixed ladder access to roof hatches must be protected by a ladder security device.

1. Demuth Steel Products, Inc. Model #D527 or approved equal.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 08 11 00
METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General Conditions, Supplementary Conditions, and Division 1- General Requirements, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of standard steel doors is indicated and scheduled on the contract drawings.

1.03 QUALITY ASSURANCE

A. Provide door frames complying with Steel Door Institute “Recommended Specifications: Standard Steel Doors and frames” (SDI-100) and as herein specified.

B. Fire-Rated Assemblies: Where fire-rated assemblies are indicated or required, provide fire-rated door assemblies that comply with NFPA 80 “Standard for Fire Doors and Windows”, and have been tested, listed and labeled in accordance with ASTM E 152 “Standard Methods of Fire Tests of Door Assemblies by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data substantiating that products comply with requirements.

B. Shop Drawings: Submit for fabrication and installation of steel door frames. Include details of each frame type, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of welded joints and connections. Show anchorage and accessory items.

1. Provide schedule of doors using same reference numbers for details and openings as those on the contract drawings.

2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Architect; otherwise, remove and replace damaged items as directed.

C. Store door frames at building site under cover. Place units on 4” high wood blocking (minimum). Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door frames becomes wet, remove carton immediately. Provide ¼” spaces between stacked door frames to promote air circulation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors by one of the following:

1. Ceco Door Products
2. Curries Co.
3. Philipps Manufacturing Co.
4. Steelcraft Manufacturing Co.

2.02 MATERIALS

A. Cold-rolled steel sheets: Commercial quality carbon steel, complying with ASTM A 366 and 568.

B. Galvanized steel sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, A60.

C. Supports and anchors: Fabricate of hot less than 18-gage galvanized sheet steel.

D. Inserts, bolts and fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

E. Welding rods and bare electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

F. Shop applied paint:
   1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.03 FABRICATION, GENERAL

A. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from cold-rolled steel.

B. Fabricate exterior door frames from galvanized sheet steel.

C. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

D. Finish Hardware Preparation: Prepare doors to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by the hardware supplier and/or Williams College Lockshop. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.

E. Reinforce door frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

F. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", as published by DHI.

G. Field Painting:

1). Clean, treat and paint exposed surfaces of steel door frame units, including galvanized surfaces.

2). If the manufacturer's primer is not compatible with the specified paint, apply a coat of acceptable prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

3). Apply asphaltic emulsion coating to frame inside surfaces to be grouted.

2.04 STANDARD STEEL DOOR FRAMES

A. Provide steel frames for doors, transoms, sidelights, borrowed lights and other openings of types and styles as shown on the contract drawings and schedules. Conceal fastenings unless otherwise indicated. Fabricate frames of cold-rolled furniture steel with equal size rabbet and minimum 5/8" stop.

1. Interior Frames: Fabricate frames of 16 gauge for single-swing and 14 gage for double-swing.

2. Exterior Frames: Fabricate frames of 14 gauge for both single and double-swing.

3. Fabricate ALL frames with mitered and welded corners. Knock Down frames will not be accepted unless otherwise indicated.

B. Door silencers: Except on weather-gasket frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

C. Plaster Guards: Provide 26-gage steel plaster guards or mortar boxes, welded to the frame at back of finish hardware cutouts where mortar or other materials might obstruct proper hardware operation and to close off interior openings.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install standard steel door frames in accordance with final shop drawings, manufacturer's data and as herein specified.

B. Placing Door Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.

1. General: Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.

3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.

4. Install fire-rated frames in accordance with NFPA Std. No. 80.

5. In metal stud or wood stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed stud partitions, attach wall anchors to studs with tapping screws.

6. Glazed frames: provide standard glazing beads attached with self-drilling screws.

END OF SECTION

SECTION 08 11 12

STEEL DOORS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General Conditions, Supplementary Conditions, and Division 1 - General Requirements, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of standard steel doors is indicated and scheduled on the contract drawings.

1.03 QUALITY ASSURANCE

A. Provide door complying with Steel Door Institute “Recommended Specifications: Standard Steel Doors and frames” (SDI-100) and as herein specified.

B. Fire-Rated Assemblies: Where fire-rated assemblies are indicated or required, provide fire-rated door assemblies that comply with NFPA 80 “Standard for Fire Doors and Windows”, and have been tested, listed and labeled in accordance with ASTM E 152 “Standard Methods of Fire Tests of Door Assemblies by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data substantiating that products comply with requirements.

B. Shop Drawings: Submit for fabrication and installation of steel doors. Include elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show accessory items.

1) Provide schedule of doors using same reference numbers for details and openings as those on the contract drawings.

2) Indicate coordinate of glazing frames and stops with glass and glazing requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Architect; otherwise, remove and replace damaged items as directed.

C. Store doors at building site under cover. Place units on 4” high wood blocking (minimum). Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide ¼” spaces between stacked doors to promote air circulation.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors by one of the following:

1. Ceco Door Products
2. Curries Co.
3. Philipps Manufacturing Co.
4. Steelcraft Manufacturing Co.

2.02 MATERIALS

A. Cold-rolled steel sheets: Commercial quality carbon steel, complying with ASTM A 366 and 568.

B. Galvanized steel sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, A60.

C. Supports and anchors: Fabricate of hot less than 18-gage galvanized sheet steel.

D. Shop applied paint:

1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.03 FABRICATION, GENERAL

A. Fabricate steel door units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever
Practicable, fit and assemble units in manufacturer’s plant.

B. Fabricate exposed faces of doors of flush design, from only cold-rolled steel.

C. Fabricate exterior doors from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.

D. Thermal-Rated (Insulating) Assemblies:

1. Exterior locations and elsewhere as shown or scheduled, provide doors which have been fabricated as thermal insulating door assemblies and tested in accordance with ASTM C 236.
   Unless otherwise indicated, provide thermal-rated assemblies with a U-Factor of 0.14 BTU or better.

E. Finish Hardware Preparation: Prepare doors to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by the hardware supplier and/or Williams College Lockshop. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.

F. Reinforce doors to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

G. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with “Recommended Locations for Builder’s Hardware”, as published by DHI.

H. Field Painting:

1) Clean, treat and paint exposed surfaces of steel door units, including galvanized surfaces.

2) If the manufacturer’s primer is not compatible with the specified paint, apply a coat of acceptable prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

2.04 STANDARD STEEL DOORS

A. Provide metal doors of types and styles indicated on the contract drawings and schedules.

   1) Interior doors: SDI-100 Grade II, heavy-duty model 1, minimum 18-gage faces

   2) Exterior doors: SDI-100, Grade III, extra heavy-duty, Model 2 minimum 16-gage faces.

B. Doors that are scheduled to be full glass type are to be fabricated with a minimum of 6” stiles, 6” top rail and 12” bottom rail.

C. Doors that are scheduled to be half glass type are to be fabricated with a minimum of 6” stiles, 6” top rail and 12” bottom rail. An additional 6” mid-rail is required where exit devices, or electrical locksets are required.

D. Maximum door height for any interior or exterior door is 96”.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Install standard steel doors in accordance with final shop drawings, manufacturer's data and as herein specified.

B. Door Installation:

1. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

END OF SECTION 08 11 12

SECTION 08 14 00
WOOD DOORS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Construction: AWS Custom Grade; SCL-5 / LSL-5 (5-Ply Lumber Core). Particle Core (PC-5) will not be accepted unless otherwise indicated.

B. All doors must be a minimum of 1-3/4” thick.

C. Fabrication: Pre-drill doors prior to attaching hardware. Provide solid blocking for hardware; through-bolting is not acceptable interior and exterior doors to be 1-3/4” thick minimum.

D. Removable mullions preferred. Vertical rods not acceptable.

E. Wood/Glass Doors: Doors that are scheduled to be full glass or half glass type are to be fabricated with a minimum of 6 inch stiles, 6-inch top rail and 12-inch bottom rail.

F. Add alternate should be solicited for School Guard Glass for all glazing in doors and sidelights of classrooms. - http://schoolguardglass.com/

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

B. Finish Hardware Preparation: Prepare doors to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by the hardware supplier and/or Williams College Lockshop

END OF SECTION

SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Manufactured by Hart & Cooley, Inc. – Milcor Series M or Series MS or approved equal.

B. Provide all access panels for the project by the same manufacturer. So there shall be no division of responsibility, all access panels shall be supplied by a single manufacturer under a single contract.

C. Determine specific locations and sizes for access panels needed to gain ample access to concealed equipment.

D. Minimum door/panel size shall be 12” x 18”.

E. Unless otherwise specified, all access doors and panels shall be self-latching with slotted screwdriver operation.

F. Hinges shall be fully concealed allowing a minimum of 120 degree opening.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

B. Unless otherwise specified, doors/panels shall be factory primed and shall receive the same finish and paint as surrounding surfaces. When installed, the doors/panels shall be completely flush with the surrounding surface.

END OF SECTION

SECTION 08 50 00
WINDOWS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Exterior Windows: Operable, fiberglass-clad wood or aluminum-clad wood preferred.

B. Double-hung operation preferred.

C. Other operation (tilt-turn, casement, awning, etc.) must be approved on a per-project basis. No gear-driven sash operation will be approved.

D. Full aluminum screens required.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE (RESIDENTIAL AND NON-RESIDENTIAL)

PART 1 – GENERAL

A. Please note: All exterior entry doors, doors with high security needs, and doors entering student rooms shall utilize the College's S2 card reader system.

B. A hardware consultant must be used for all projects. Consultant

shall be: Building Specialties Architectural Hardware, Inc.
11 Ramah Circle North
Agawam, MA 01001-1515

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General Conditions, Supplementary Conditions, and Division 1- General Requirements, apply to the work of this Section.

B. All hardware must comply with Williams College standards and the Williams College Corbin Russwin Patented Key System.

1.02 DESCRIPTION OF WORK

A. This Section includes, without limitation:

1. Furnishing and delivering to the project site materials required for a complete installation of finish hardware as shown on the Drawings and as herein specified.
2. Furnishing ALL required templates, wire diagrams and schedules in a timely manner.
3. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate with such trades to assure the steady progress of the work.

1.03 RELATED WORK

A. SECTION 08 11 13 – Hollow metal doors and frames

B. SECTION 08 14 00 – Wood doors

C. SECTION 08 41 13 – Aluminum entrances and storefronts.

D. SECTION 26 05 00 – Common Work Results for Electrical – Relating to S2 Access Control System, magnetic hold-opens and wiring for electrical hardware.

E. SECTION 28 00 00 – Electronic Safety and Security

1.04 SUBMITTALS

A. Schedules: Submit to the Architect for approval six copies of a complete Hardware Schedule. The schedule shall be in vertical format and shall include the manufacturers' numbers, types, sizes, and installation location of all hardware required to complete the job. The Hardware Schedule shall list the Specification Hardware Set Number next to the Schedule Heading Number.

B. Catalogue Cuts: Include with the Schedule two sets of catalogue cuts, together with product data sheets, of all hardware items.

C. Templates: Upon approval of the Hardware Schedule, furnish templates to door and frame suppliers sufficiently in advance so as not to impede the progress of the work. No templates shall be issued or materials ordered until the Hardware Schedule has been approved.

1.05 QUALITY ASSURANCE

A. Quality of hardware (size, weight, quantity and classification) shall conform with the best practices of the Society of Architectural Hardware Consultants (AHC), the Door and Hardware Institute (DHI), and the Builders' Hardware Manufacturers Association (BHMA). Hardware shall comply with all current building codes.

B. The Finish Hardware Supplier shall comply with "Recommended Procedure for Processing Hardware and Templates", as published by the Society of Architectural Hardware Consultants, Section 1971. Use of these procedures have been endorsed by DHI, NAAMM and SDI. Failure to comply with the above and/or failure to submit hardware schedule in exact sequence as therein listed will be cause for rejection of the first hardware schedule submitted for review and approval.

1.06 MARKING AND PACKAGING

A. All packages shall be legibly labeled indicating manufacturers numbers, types, sizes and Hardware Schedule reference number. All hardware shall be wrapped in paper and shall be packed in the same package as all screws, bolts and fastenings necessary for proper installation.

1.07 DELIVERY AND STORAGE

A. The General Contractor shall receive, check against invoices, and store all hardware at the job.

B. Delivery of hardware for the job shall be made in accordance with the GC's instructions.

C. The hardware supplier must furnish the GC with receipts for all hardware received.

D. The GC shall provide adequate locked storage space with shelving for all items of hardware and shall be responsible for such hardware after receipt from the supplier. The GC shall replace all lost or damaged hardware at the expense of the GC.

1.08 KEYING AND KEY CONTROL

A. Supply 6-pin, interchangeable cores (IC) keyed into Williams College's existing Corbin Russwin Patented Key System as directed by the Architect and/or Owner. All locks shall be supplied with temporary cores for the construction period. The permanent cores, permanent keys and bitting list shall be delivered directly to the Williams College Lockshop from the Corbin Russwin factory. The permanent cores shall be installed by the Lockshop and the temporary cores will be returned to the GC or hardware supplier post construction period.

B. After receipt of an approved Hardware Schedule and prior to ordering any locking devices, the hardware supplier shall arrange through the GC for a meeting with the Architect and/or Owner to discuss the keying requirements for this job. A keying layout must be submitted for review by the Lockshop within ten (10) days after such meeting.

C. Furnish the following quantities of keys:

Four	(4)	Grandmaster Keys
Four	(4)	Master Keys per each set
Three	(3)	Change Keys for each different change
Ten	(10)	Master Keys for the temporary cores
Three	(3)	Control Keys for the temporary cores

1.09 SPECIAL REQUIREMENTS

A. Hardware supplier shall determine conditions and materials for all the doors and frames for proper application of hardware.

B. Hardware supplier shall be responsible for the accuracy of the quantities, sizes, finish and proper hardware to be furnished, whether specifically mentioned or not, and shall be responsible for determining all details, such as hand of doors, bevel of locks, etc.

C. Tools for maintenance: All special tools packed with hardware items shall be saved and turned over to the owner upon completion of the work.

D. All strikes for wood jambs with applied trim shall be furnished with lips to protect the trim.

E. Refer to Hollow Metal, Wood and Aluminum Door Sections regarding adequate blocking and reinforcing for surface-applied hardware. The use of thru-bolts is prohibited.

F. All electrified hardware items are to be interfaced with the Fire Alarm System.

1.10 WARRANTIES

A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this contract.

B. Manufacturers shall provide their warranties for work under this Section. However, such warranties shall be in addition to, and not in lieu of, all other liabilities which the manufacturers and GC may have by law or by other provisions of the Contract Documents.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The manufacturers' names listed below in parentheses set a standard of quality for products. Equivalent products of the other manufacturers listed may be acceptable provided said products are equal to the items specified in the quality, weight, design and function, and are approved by Williams College Facilities Operations Group. Equivalent products will not be accepted where "No Substitution" is listed.

Item	Manufacturer(s)
Hinges	(McKinney) Stanley
Locksets/Latchsets	(Corbin Russwin) No Substitution
Deadlocks	(Corbin Russwin), Lori, Adams Rite
Exit Devices	(Sargent) No Substitution
Door Closers	(Corbin Russwin) No
Substitution Automatic Operators	(Norton) No
Substitution	
Door Pulls	(Rockwood), Ives, Burns
Protection Plates	(Rockwood), Ives, Burns, Don-Jo
Wall & Floor Stops	(Rockwood), Ives,
Burns Overhead Stops	(Rixon), ABH, Glynn
Johnson	
Flush Bolts & Coordinators	(Rockwood), Ives, Glynn
Johnson Thresholds	(Pemko), NGP, Zero
Door Bottoms/Sweeps	(Pemko), NGP,
Zero Perimeter Gasketing	(Pemko), NGP,
Zero	
Astragals	(Pemko), NGP, Zero
Silencers	(Rockwood), Ives, Burns

2.02 HINGES

A. Number of hinges per door: unless otherwise noted, two hinges are to be provided for doors up to and including five feet in height, and an additional hinge for each additional two-and-one-half in the height.

B. Hinges for interior doors shall be steel and hinges for exterior doors shall be stainless steel. McKinney T4A Series, sized as follows:

Door Width	Hinge weight	Hinge Height
Under 42 inches	Regular Weight	4 ½ inches
42 inches and over	Heavy Weight	4 ½ inches
44 – 48 inches	Heavy Weight	5 inches

1. Unless otherwise noted, width of hinges shall be 4 ½ inches.

C Where spring hinges are specified use 4 ½ x 4 ½.

D. Where electric hinges are specified; use McKinney Quick Connect (QC) hinges as detailed.

1. Electric hinges are required at all electric lock & exit device locations.
2. Door loops (whips) will not be accepted.
3. QC door and frame wire harnesses shall be supplied at all electrified openings.
4. PoE hinges and harnesses shall be supplied where PoE locksets are detailed

E. Furnish Non-Removable Pins (NRP) at all exterior doors and doors with electric hardware.

2.03 LOCKSETS AND LATCHSETS

A. Unless otherwise noted, locksets and latchsets shall be heavy duty mortise type. Corbin Russwin ML2000 Series x LWM escutcheon trim.

1. Where specified, electric locks shall be ML20906-SEC

B. Where Unit Locks are specified, supply UT5200 Series x ESE trim.

C. Where Cylindrical Locks are specified, supply the following:

1. CL3300 Series x NZD trim x 2 3/4” backset at 1 3/4 inch doors.
2. CL3600 Series x NZD trim x 2 3/8” backset at 1 3/8 inch doors.

D. Furnish ANSI Strikes at all hollow metal frames and Curved Lip Box strikes at pre-hung wood doors.

2.04 DEADLOCKS

A. Deadlocks (when specified) shall be supplied as follows:

1. Corbin Russwin DL4000 series at 1 3/4” hollow metal or wood doors.
2. Lori 45-x-3-4-xx series at 1 3/8” pre-hung wood doors.
3. Adams Rite MS1850 series at narrow stile aluminum or wood doors.

2.05 EXIT DEVICES

A. Exit Devices shall be Sargent 80 series as follows:

1. Rim panic 8800 at single doors.
2. Pairs of doors to receive Rim panic 8800 x removable mullion. Vertical rods not acceptable.
3. Provide 55-56 (prefix) option where electrical option is required.

B. Exit Device Trim shall be ETL x required function, unless otherwise noted.

C. UL listed for fire exit hardware, 3-hour rating is required at all fire rated openings.

D. Electrical rooms - Without limitation, all doors serving electrical rooms, data centers, transformer vaults, battery storage rooms, etc. shall have hardware as required by the latest version of the National Electrical Code (NFPA 70).

2.06 ACCESS CONTROL

A. S2 Access control readers and power supplies shall be supplied by Williams College.

1. Identify location and provide infrastructure (backing, conduit, and cabling) for future cameras at each exterior card reader.
2. Identify location and provide infrastructure (backing, conduit, and cabling) for future card readers at each interior door for student rooms, classrooms, and offices.

B. Wireless locks shall be Corbin Russwin ML20735-TCPWi1-NSA-626-M808-C6 Access 700.

1. Wireless locks shall be furnished by an ACP certified hardware supplier.
2. Installation of the wireless locks shall be by pre-approved integrator.

C. PoE locks shall be Corbin Russwin ML20736-TCPIP1-NSA-626-IKMPS-C6 Access 700.

1. PoE locks shall be furnished by an ACP certified hardware supplier.
2. Installation of the PoE locks shall be by pre-approved integrator.

2.07 DOOR CLOSERS

A. Overhead Surface Door Closers shall be Corbin Russwin, ADA approved, as noted below.

1. Exterior Doors: DC6210-A11 or A12 (as detailed).
2. Interior Doors: DC6210-M71 (arms as detailed).

B. Supply drop plates where door and/or frame conditions require them for proper installation.

C. Unless specified otherwise, closers shall be mounted on the room side and/or the side of the opening least objectionable to the public view. Provide parallel arm type at reverse bevel conditions.
Door closers mounted on the corridor side of any room will NOT be accepted.

2.08 DOOR PULLS

A. Straight Door Pulls shall be ¾” in diameter and 8” center-to-center distance.

1. Provide 2 ½” barrier free clearance where required by code.

2.09 PROTECTION PLATES

A. Push Plates shall be .050” thick and be sized 4” x 16”, stile permitting, otherwise, 3 ½” x 15”.

B. Kickplates shall be .050” thick and 8” in height. The width of the plate shall be 2” Less Width of Door on single doors and 1” LWOD on pairs of doors. Provide 6” height only where bottom rail will not accept the 8” plate.

C. Provide self-drilling TEK screws for all push and kickplates installed on metal doors.

2.10 DOOR STOPS

A. Wall stops shall be provided at 90-degree openings.

1. Wall stops shall be Rockwood 409.

B. Floor stops shall be provided where applicable and where conditions allow.

1. Floor stops shall be Rockwood 441CU typically.
2. Floor stops shall be Rockwood 486 in high traffic areas.

C. Where neither wall stops nor floor stops can be used, furnish an Overhead Stop.

1. Surface mounted Overhead Stops shall be Rixon 10 Series.

2.11 FLUSH BOLTS AND COORDINATORS

A. Flush bolts shall be Rockwood as noted below.

1. 555 manual flush bolts at non-UL and UL doors.
2. 557 manual flush bolts at UL wood doors.
3. 1842 automatic flush bolts at UL hollow metal doors (where required).
4. 1942 automatic flush bolts at UL wood doors (where required).

F. Door Coordinators shall be Rockwood 1600 Series (where required).

1. Supply filler bars and/or mounting brackets for complete and proper installation.

2.12 THRESHOLDS (exterior)

A Typical thresholds shall be ½” high, saddle type x proper width (coordinate w/frame depth).

B. Supply Pemko 2005_T series thresholds where vertical rod exit devices are supplied.

2.13 DOOR BOTTOMS, GASKETING AND ASTRAGALS

A. Door Bottoms at exterior out-swing doors shall be Pemko 315_N series.

B. Perimeter Gasketing at exterior openings shall be Pemko 303_PK series.

C. Astragals at exterior pairs of doors shall be Pemko 18061_NB series.

2.14 MISCELLANEOUS ITEMS

A. Door Silencers shall be Rockwood 608 at hollow metal frames and 609 at wood frames.

B. Door Viewers shall be Rockwood 622 (where required).

C. Roller Latches shall be Rockwood 590 at pre-hung wood, double closet doors (where required).

D. Pocket Door Pulls shall be Rockwood 890 (where required).

2.15 FINISHES

A. Unless otherwise noted, finish of the hardware shall be as follows:

1. Interior hinges, locksets, latchsets, exit devices, deadlocks, floor stops, overhead stops, flush bolts, etc., shall be satin chrome, US26D, finish.

2. Exterior hinges, push plates, door pulls, kickplates and wall stops shall be satin stainless steel, US32D, finish.

3. Door closers shall be spayed finish, 689, to match other hardware.

4. Thresholds, door bottoms, gasketing and astragals shall be clear anodized aluminum.

PART 3 – EXECUTION

3.01 INSTALLATION OF HARDWARE

A. Preparation of hardware and installation of hardware is the work of other trades and is specified to be provided under other Sections. The Hardware Supplier shall provide instructions to the various other trades generally in accordance with the following.

B. Install hardware following manufacturer's instructions. Except as indicated or specified otherwise. Use fasteners furnished with hardware to fasten hardware in place. Failure to do so may result in voiding the manufacturer's warranty and will but the burden of replacement costs on the General Contractor.

C. Cores to be installed by the Contractor after the Certificate of Occupancy is obtained and the project is turned over to the Owner. The Owner will supply the core key for this installation.

3.02 RESPONSIBILITY

A. The General Contractor will be responsible for all hardware after delivery to the jobsite, until final completion and acceptance of the building.

B. All adjusting, cleaning and protection of the installed hardware is the responsibility of the GC.

C. The Hardware Supplier shall be responsible for the following:

1. Coordinating of hardware with material to which it is applied.
2. Coordinating of their material with other trades.
3. Obtaining shop drawings for materials to which hardware is applied.
4. Checking shop drawings and furnishing templates to other suppliers as needed.
5. Advise the GC and/or Architect of any and all hardware conflicts.

3.03 ADJUSTING, CLEANING AND PROTECTION

A. Adjust hardware items to work smoothly, easily and correctly.

B. Clean exposed surfaces using non-abrasive materials and methods recommended by the manufacturer of the hardware being cleaned. Remove and replace work which cannot be successfully cleaned, as judged solely by the Architect.

C. Provide temporary protection to ensure work is being done without damage or deterioration at the time of Final Acceptance. Levers shall be kept covered with heavy cloth, and other hardware shall be protected against damage until Substantial Completion of the Project. Remove protections and re-clean as necessary immediately prior to Final Acceptance.

3.04 COMPLETION AND CONTINUED MAINTENANCE

A. Before completion of work of this Section, inspect work with Architect and adjust and correct work to leave operating parts in perfect operating condition, jointing to adjacent material tight, surfaces without blemishes or stains, work properly executed and complete, and defects and damaged work shall be replaced or corrected.

END OF SECTION

SECTION 09 21 00
PLASTER AND GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Walls and ceilings: typically, 5/8”, Type X, fire-rated; level 4 finish typical

B. An add/alternate shall be provided for MR gypsum board throughout the building.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 09 60 00
FLOORING

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Public Areas

1. Stone or ceramic that does not require floor finish.
2. Carpet: carpet tile; no light or uniform colors. Squares preferred over planks.
3. Wood: Wood strip flooring, 2 coats Bona Traffic finish with Bonaseal or Bona Amberseal.
   a. Sand, vacuum and clean floor with a tack cloth before each coat
4. Hard Surface: Marmoleum or equivalent Industrial Grade flooring
   a. No wax flooring required

B. Student Rooms

1. Stone or ceramic that does not require floor finish.
2. Carpet: carpet tile; no light or uniform colors. Squares preferred over planks.
3. Wood: Wood strip flooring, 2 coats Bona Traffic finish with Bonaseal or Bona Amberseal.
   a. Sand, vacuum and clean floor with a tack cloth before each coat
4. Other non-allergenic hard surfaces as required on a project basis.

C. Bathrooms

1. Tile Flooring, porcelain preferred, with waterproof membrane that extends at least 6” up walls
   a. Industrial grade epoxy grout only
      1). Mapei Kerapoxy IEG CQ
      2). Laticrete Spectralock 2000 IG
      3). Or approved equal
      4). Darker colors strongly preferred

b. For concrete subfloors

1). 1 ¼" to 2" cement mortar bed with waterproof membrane that extends at least 6" up walls.

2). Industrial grade epoxy grout only

- Mapei Kerapoxy IEG CQ
- Laticrete Spectralock 2000 IG
- Or approved equal
- Darker colors strongly preferred

3). At post-tensioned or pre-stressed concrete floor systems, provide an anti-fracture membrane.

D. Hallways

1. Carpet: carpet tile; no light or uniform colors. Squares preferred over planks.

2. Tile Flooring, porcelain preferred, with waterproof membrane that extends at least 6" up walls

a. Epoxy grout only

1). Mapei Kerapoxy IEG CQ

2). Laticrete Spectralock 2000 IG

3). Or approved equal

4). Darker colors strongly preferred.

E. Elevator Floors

1. Solid surface, no wax requirement

F. Stairways

1. Hard surface or Rubber treads and risers. No carpet. Surface textures to be approved.

a. Hammered finish preferred.

G. Entrance Walk-Off Mats

1. 3M Nomad Carpet Matting 4000 System
2. Furnished and installed by Williams College.

H. Recessed Entrance Grilles

1. Stainless steel scraping grid

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Exterior Painting
   1. Woodwork – Primer plus 2 coats of finish
      - Primer: Benjamin Moore Exterior Alkyd All-Purpose primer #024 or approved equal
      - Finish: BM Aura (sheen to be confirmed with Williams College Arch. Trades Department)
   2. Metal
      - Rust-Oleum Classic Low Sheen Finish with Primer per manufacturer's instructions
   3. Decks
      - Cabot - Deck Correct

B. Ceilings
   1. Pratt & Lambert, flat finish, primer plus one coat
      - Color – Skylight White

C. Walls
   1. BM UltraSpec 500 or approved equal, eggshell finish, primer plus two coats
      - Color - Swiss Coffee or approved equal
   2. For ease of maintenance, no "accent" walls in dormitory rooms, suites, or hallways. Closets, bathrooms, hallways, dorm rooms, etc. are to remain consistent and uniform in color.

D. Exterior Parking Areas
   1. Yellow – SW Hotline TM2321
   2. Blue – SW Hotline TM2224
   3. White – SW Hotline TM2320
   4. Green – SW Hotline TM2226

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Marker boards for teaching and administrative areas

1. White dry-erase type; Glass Whiteboard Company, 2453 American Lane, Elk Grove Village, IL 60007, info@glasswhiteboard.com, (877) 793-1011 or approved equal

2. Marker boards for other uses when approved by the Williams College project manager: as manufactured by Claridge, or approved equal.

B. Chalkboards

1. Black color, not green

C. Tackboards and tacking surfaces

1. Forbo Bulletin Board pin board surfaces or approved equal

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

B. All signage, including construction site signage, building signage, and permanent site signage should be fully gender-neutral to the extent permitted by codes, regulations, or law.

PART 2 PRODUCTS

A. See Appendix III for signage requirements.

B. All **interior** building signage by:

Poblocki Sign Company, LLC
4 Industrial Park Road
Medway, MA 02053
(508) 533-9000

C. All **exterior** building signage by:

GPP Charleston Industries, LLC
101 Industrial Drive
Charleston, MS 38921
https://www.charlestonmanufacturingllc.com/company/
(800) 647-2384

- Signs must be **325 Series Components**
- Sizing of these signs must be less than 148" square, as any bigger is subject to the town sign commission's approval.

PART 3 EXECUTION

A. Floor Labels

1. L2 – 3 levels below grade
2. L1 – 2 levels below grade
3. B - Basement (1 level below grade)
4. G – Ground floor (May be more than one floor per building, please follow design team designation of Ground)
5. Mezzanines – M + the number of the floor directly below it.
6. 1 – First floor
7. 2 – Second floor (and continuing in ascending order)

8. A – Attic
9. R – Roof
10. P - Penthouse

B. Room Numbering

1. Subject to final approval by Williams College.
2. Numbering on construction documents shall match final approved numbering.
3. Room numbering to be coordinated with addressable fire alarm system.
4. Buildings with one main corridor - In a building with one main corridor room numbers should start at the main entrance and increase as you move away from the entrance.
5. Buildings with multiple corridors - In a building with more than one corridor, numbers should follow in an ascending order in a clockwise direction from the main entrance as shown in the image to the left. This should be done in a manner that helps to ensure the logical flow of room numbers for the floor for way finding purposes. Use even numbers on the left side of the corridor and odd numbers on the right as shown in the image on the right.
6. Suites - Suites are spaces that generally have one entrance with one primary room and one to many sub-rooms within. The entrance room to a suite area gets a typical room number while sub-rooms within the suite are numbered beginning with the main suite room number followed by a letter moving in a clock-wise direction.

C. Gender Neutral Signage – Confirm current signage and wording with College Project Manager. Please note that the Executive Director of the MAAB recommends, “single-user restroom” or “single-user bathroom” to avoid gender issues altogether.

D. Emergency Fire Evacuation Signage

1. On lower corner of kick plates.

E. Sleeping Rooms Evacuation Signage

1. All sleeping rooms must be provided with evacuation plans.
2. Plans to be framed and mounted on the inside of the sleeping room door.
3. See Appendix IV for sample plan

END OF SECTION

SECTION 10 21 13
TOILET COMPARTMENTS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Partitions: Hiny Hiders by Scranton Products, high-density polyethylene (HDPE) toilet partitions, or approved equal.
   - In dormitories these partitions must not be full height – 12” floor clearance.

B. Mounting: Floor-mounted, overhead braced.

C. Hardware: Aluminum brackets, strikes, stirrups, head rail. Stainless steel latches and shoes.

D. Fire Resistance: ASTM E84 Class A.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Bathroom Accessories:

1. Shower Rods: Plastic shower curtains and hooks, chrome-plated rods.
2. Toilet Paper Dispensers: Williams College-furnished, contractor installed.
3. Paper Towel Dispensers: Sheet paper, Williams College-furnished, contractor installed.
4. Soap Dispensers: Liquid soap, wall mounted, Williams College-furnished, contractor installed.
5. Hand Dryers: XLERATOR warm air hand dryer by EXCEL Dryer, Inc., with anti-microbial wall guard. Use ADA-compliant recess kit as required.
6. Shelving: One stainless steel shelf under the mirror; no cubbies or other shelving.
7. Tampon Dispensers: Not required.
8. Sanitary waste receptacles – Verify on a per-project basis.
9. Shower seats – Verify on a per-project basis.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 10 41 16
EMERGENCY KEY CABINETS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

B. First-responder key lock boxes (KnoxBox)

1. Installed at main door(s) of building where fire alarm annunciator panel is located.
    a. Normally installed at primary door corresponding to building address.
2. Coordinate quantity and location with College project manager.
3. OFCI

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Provide fire extinguishers throughout in quantity, type, and location as required by NFPA 10.

B. Unless directed otherwise, all fire extinguishers to be 10lb Amerex B456 with bracket.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 11 11 36
VEHICLE CHARGING EQUIPMENT

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

B. All projects should review the potential need or requirement for vehicle charging facilities.

PART 2 PRODUCTS

A. Review equipment specifics and requirements with Williams College Facilities Operations Group and the Zilkha Center for Environmental Initiatives.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 11 21 73.33
LAUNDRY EQUIPMENT

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

B. Card-operated laundry equipment is provided and installed by the College's contract vendor.

C. Design team to provide design of all utilities (including exhaust and waste routings and cleanouts), connections (including data), infrastructure, and accommodation in coordination with the College's laundry vendor and the College's project manager.

PART 2 PRODUCTS

A. Review equipment specifics and requirements with Williams College Facilities Operations Group and the Zilkha Center for Environmental Initiatives.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 11 30 13
APPLIANCES

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Kitchen Stoves: Electric glass top preferred.

1. Please note that the local AHJ requires a commercial ventilation hood and fire suppression system for all cooktop/stove installations, other than in single-family residential units.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 12 20 00
WINDOW TREATMENTS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Dormitory Window Treatments

1. Clutch-type Roller Shade with side tracks and room-darkening vinyl fabric

   a. Gordon’s Window Décor EcoSmart Roller Shade 502, Skyline Clutch Roller, or approved equal.

2. Mini-Blinds: Not acceptable.

3. Draperies: Not acceptable

B. Window Treatments in other buildings

1. No motorized shades unless approved by Project Manager.

PART 3 EXECUTION

A. Follow manufacturers’ requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 12 56 43
DORMITORY FURNITURE

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Dormitory student room furniture shall be by:

New England Woodcraft
Forest Dale, VT 05745
https://newenglandwoodcraft.com/

B. Each student shall be provided with one each – bed, desk, desk chair, 5-drawer chest, and bookcase in solid, natural red oak.

Single E-Z Lock Bed
E-Z lock metal spring
36" x 80"

Pedestal Desk
Solid oak w/ laminate top
Computer keyboard drawer
2 medium drawers
1 file drawer
42" x 24" x 30"

Two Position Chair
Solid Oak seat and back

Five Drawer Chest
Solid oak w/laminate top
32" x 24" x 47"H

Floor Bookcase
Solid oak with 1 shelf
32" x 12" x 30"H

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 12 93 13
BIKE RACKS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

B. Provide space for interior storage of student bicycles in all residence halls.

PART 2 PRODUCTS

A. Bicycle racks

1. Global Industrial #652771 or approved equal.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 12 93 23
TRASH AND LITTER RECEPTACLES

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

B. Design Requirements:

1. One trash and one recycling container per dorm room or per office in E&G buildings.

PART 2 PRODUCTS

A. Recycling Bins: Public Square by Bright Settings; 800-233-3360 or approved equal.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 13 00 10
DORMITORY SYSTEMS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 DESIGN REQUIREMENTS

A. Trash/Recycling room

1. Provide a minimum of one trash recycling room per building to be coordinated with WC Custodial Dept.
2. Provide monolithic flooring (epoxy-coated concrete, ceramic tile, sheet goods, etc.)
3. Provide floor drain
4. Wainscot shall be provided and shall be light colored, 4.25 inch x 4.25 inch glazed ceramic tile and/or fiberglass reinforced plastic (FRP). Wainscot shall extend 4 feet from finish floor.

B. Dormitory Bathing and Toilet Rooms

1. Shower and toilet stall doors shall be partial-height; not extending all the way to the floor. This requirement aids in locating “nonresponsive” students who may be in the stalls.

C. Dormitory Showers

1. Site-Fabricated Shower Walls and Ceilings: Full width/height light colored solid surfacing.
2. Site-Fabricated Shower Floors: Slip-resistant porcelain or ceramic tiles, 2x2 or larger size, white color tile not allowed, slope to drain.
3. Prefabricated Shower Stalls: Fiberglass.
4. Provide towel hooks, but no cubbies.

D. Dormitory Plumbing Fixtures:

1. Toilets: Automatic flushing.
2. Sinks: Automatic water dispensing.
3. Hose Bibb: Locate under sinks with snap-on adapters, cold-water connection.
4. Urinals: Remove urinals and install toilets; no new urinals in dormitories.
5. Drinking Fountains: Bottle fill option.

E. Dormitory Bathroom Mechanical:

1. Exhaust Fans: Required.

F. Dormitory Bathroom Electrical:

1. Lighting diffusers: Plastic only, not glass.

G. Dormitory Bedroom Electrical:

1. Dorm rooms shall be equipped with (1) 20A circuit per student (i.e. Double room = (2) 20A circuits.)

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 13 00 20
GENDER NEUTRAL BATHROOMS

PART 1 GENERAL

A. SUMMARY

1. This section defines the implementation guidelines for providing gender neutral bathrooms on campus.

2. General Requirements for gender neutral bathrooms.

   a. Meet the minimum requirements of the Massachusetts Plumbing Code

   b. Meet the minimum requirements the Americans with Disabilities Act, ADAAG, and 521 CMR, Architectural Access Board

   c. Compliance with Williams College Committee on Undergraduate Life LGBTQ Life Policy.

B. QUALITY ASSURANCE

1. Comply with governing codes and regulations.

PART 2 PRODUCTS- NOT USED

PART 3 EXECUTION

A. LOCATION AND NUMBER OF FACILITIES

1. New construction and major renovations shall include gender-neutral bathrooms.

2. Provide equal distribution of facilities throughout the floors of a building.

3. Separate facilities are currently required by the Massachusetts Plumbing Code. To address a policy that requires gender neutral toilets, additional facilities, above plumbing code required count, must be provided.

4. Configuration cannot interfere with plumbing code or Accessibility requirements. Provide as additional toilets to the number minimum number required by all other regulations, if interferences occur in the comingling of fixtures to meet regulatory and gender neutral requirements.

B. TYPE AND LAYOUT OF FACILITIES

1. Type 1 Layout- Consists of a typical single stall accessible bathroom

2. Type 2 Layout, provides a neutral entry alcove, open to the public corridor served, with lavatories and mirrors. Doors lead from the alcove into traditional public bathrooms providing the code required number of fixtures for each sex. This should be used only in renovations where space and funding create hardship in providing totally neutral facilities.

Figure A

Type 2 Layout with gender neutral alcove equipped with sinks and mirrors. Code required facilities still remain in the project.

3. Type 3 Layout: Bathrooms in Figure B provide for accessibility, and feature lockable doors for single occupant privacy and security. The open corridor access accommodates surveillance in the common access way. Hence, a sense of security is maintained.

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Figure B

To address a policy that requires gender neutral toilets, additional facilities, above plumbing code-required count, can be provided. The bathrooms in Figure B provide for accessibility, and feature lockable doors for single unit privacy and security. The open corridor access accommodates surveillance in the common access way. Hence, a sense of security is maintained.

END OF SECTION

SECTION 13 00 30
CUSTODIAL CLOSETS

PART 1 GENERAL REQUIREMENTS

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

B. Remodeling activities are not to result in the reduction of available custodial space. Remodeling projects shall be viewed as opportunities to improve substandard facilities.

C. No sharing of program is allowed. Custodial Closets or custodial storage areas may not double as a storage closet for non-custodial materials. Do not locate building support systems such as electrical, telephone, HVAC controls, or computer network within custodial closets or storerooms.

D. Buildings must have at least one 150 square foot room for custodial supply and equipment storage with 72 linear feet of shelving.

E. Every occupied floor of every building must have a minimum of one custodial closet, with dimensions of at least 4’ x 6’.

1. A minimum of one custodial closet shall be located within 50 feet of the primary rest room area.

2. Locate custodial closets to avoid exiting into carpeted hallways whenever feasible.

3. A minimum of 36-inch-wide door that opens into a hallway shall be provided. Automatic closures are not permitted.

4. Tall ceilings, 10 feet or higher, are needed for ladders and extension poles.

PART 2 PRODUCTS

A. CLOSET SHELVING, HANGERS, & ACCESSORIES

1. Minimum five (5) each adjustable shelves shall be provided per closet. Shelves shall measure a minimum of six (6) feet long x 16 inches wide and shall support a minimum of 50 lbs. per sq. ft. Shelves shall be a minimum of 3/4 inch thick and shall be supported by double standards. The maximum shelf height shall be 6 feet as measured from the floor.

2. Each shelf is to a allow 12 inches clear height to next shelf.

3. Two mop hangers at 6 feet off finish floor shall be located over the floor / mop sink.

4. Four (4) additional mop hangers shall be provided at 6 feet off finish floor within the room.

B. CLOSET PLUMBING

1. A floor drain is required in each closet; to be installed at the lowest point of sloped flooring.

2. One floor type mop sink with a stainless-steel strainer, anti-siphon valve, and clean out shall be provided in each closet. Provide a floor sink with a permanently attached, waterproofed splash protection at a minimum of 2 feet above sink on both walls

3. Faucet:

    a. 40 inches from finish floor and centered over mop sink.

    b. Wall mounted service type.

    c. 6-inch spout with integral vacuum breaker.

    d. 3/4-inch brass coupling and stainless-steel hose bracket shall be provided; Fiat 889-CC or Fiat 832-AA.

    e. 1/2-inch isolation ball valves are required on hot and cold water.

    f. Adjustable centers.

    g. Integral check arms.

    h. Chrome plated.

C. CLOSET ELECTRICAL

1. Each closet shall be provided with two (2) 20-amp electrical outlets on two (2) separate walls. All outlets must have GFCI protection.

2. Lighting shall be controlled by occupancy sensor.

3. Lighting is to be placed in an area where it will not be hit with mop handles when using the sink and is to have a protective lens or plastic / wire cover to protect bulbs from accidental contact with mop handles.

D. CLOSET HVAC

1. Closet exhaust and ventilation shall be provided to custodial closets in accordance with ASHRAE 62.1.

E. CLOSET FINISHES

1. Flooring - acceptable flooring materials are:

   a. Resilient, seamless safety flooring.

   b. Light colored 8 inch x 8 inch non-glazed quarry tile.

   c. Sealed concrete.

2. All flooring and base coving shall be fully sealed and floor shall be properly sloped to floor drain.

3. Wainscot shall be provided and shall be light colored, glazed ceramic tile and/or fiberglass reinforced plastic (FRP). Wainscot shall extend 4 feet from finish floor.

4. Paint shall be light colored, semi-gloss exterior enamel.

5. Wall assemblies are to use appropriate materials for wet conditions such as cementicious backer board, etc.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 14 20 00
ELEVATORS

PART 1 GENERAL

B. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

C. Design teams shall coordinate with WC Project Manager and WC preferred vendor.

PART 2 PRODUCTS

A. Manufacturer: Thyssenkrupp or approved equal

B. Type: Machine-room-less traction elevators.

C. Entrances: Stainless steel surrounds.

D. Sump Pits: Pump with oil sensors.

E. Keys – All keys must be cut to Chicago Locks #2252.

F. Emergency alarm must call to Campus Safety & Security.

G. Provide two (2) separate category 6 cables from the elevator machine room to the elevator car. (Refer to 27 00 00 Communications standards for current requirements.)

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 14 42 00
WHEELCHAIR LIFTS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Manufacturer: Garaventa or approved equal

B. Operation: Massachusetts Code requirements.

C. Keys – All keys must be cut to Chicago Locks #2252.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 21 00 00
FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

A. Provide fire suppression systems including sprinklers, standpipes and accessories.

1) Requirements in this document are mandatory. No substitutions are permitted for manufacturers or products. No bids for substitute products will be considered

B. All equipment and system components to be furnished and installed shall be new of first quality, and be listed by (UL) Underwriters Laboratories, and approved by (FM) Factory Mutual for their intended use. All equipment and components shall be installed in accordance with their listings or approvals.

1.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. Sprinkler and standpipe system design shall meet the requirements of NFPA 13, NFPA 14, NFPA 20 and other applicable NFPA standards. Unless otherwise stated, the sprinkler design shall provide for 100 percent coverage as defined by NFPA 13

B. The design shall comply with all requirements of the current edition of the Massachusetts State Building Code, requirements of the Williamstown Fire and Building Departments, Williams College's Insurance Underwriter and the specific project requirements.

C. The system design shall be coordinated with the end building use as included in the Owner's information certificate.

D. The Designer shall run a hydrant flow test for the project and shall pay all associated costs. The test much be completed within 6 months of the submittal date of the shop drawings. If flow tests are performed when freezing conditions may occur, take measures to prevent icing of roadways or walkways. Hydrant flow test shall be witnessed by designated Williams College personnel or their authorized agent.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction. Shop drawings shall be fully coordinated with the building structure and all mechanical and electrical systems.

C. Shop drawings shall be prepared and stamped by a qualified engineer licensed in the Commonwealth of Massachusetts.

D. Provide hydraulic calculations for pipe sizing certified by a qualified engineer licensed in the Commonwealth of Massachusetts.

E. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, including operating instructions, list of spare parts and maintenance schedule.

1.4 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers licensed in the Commonwealth of Massachusetts. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Coordinate location of systems to avoid interference with location of structure and other building systems. Notify Williams College Project Manager prior to construction of conflicts which cannot be resolved

C. Local Fire Department Requirements: Comply with requirements of the local Fire Department pertaining to sprinkler systems and standpipes. Obtain approval from local Fire Marshall, in writing, of proposed fire-protection system before proceeding with installation

D. Compliance: NFPA 13 for sprinkler system, NFPA 14 for standpipes, NFPA 20 for Fire Pumps. Material and equipment shall be UL listed and FM Global approved.

E. Origin of Materials and Equipment: Manufactured in USA. No substitutions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pipe and Fittings - General:

1. Pressure ratings of all fittings shall meet or exceed the maximum working pressure available within the system.

2. All piping, fittings, and hangers where exposed to the weather or installed in a corrosive environment shall be hot-dip galvanized.
3. All piping and fittings on dry pipe systems and pre-action systems to be Schedule 40; internally/externally galvanized.

4. All drain piping and fittings to be galvanized.

5. All piping system components shall be of American manufacture.

6. All grooved fittings and couplings to be manufacture by Victaulic, no substitute.

7. Grooved couplings on a dry pipe and pre-action system to have FlushSeal Gaskets.

8. Piping shall not be joined by welding or weld fittings.

9. CPVC pipe and fittings shall not be used, unless approved by Williams College Facilities Operations Group.

10. Press Type Fittings for Piping: Viega ProPress and Viega MegaPress fittings are acceptable for use on fire sprinkler piping systems if they have been verified by the manufacturer for the intended use. System applications shall conform to manufacturer's published applications and parameters. Installation shall conform to manufacturer's instructions.

B. Piping Components - Underground:

1. Shall meet the requirements of NFPA 13, NFPA 24 and the local water provider.

2. New fire services shall be fully restrained in accordance with NFPA 13 and NFPA 24.

C. Piping Components - Above Ground Piping

1. Piping up to and including 2" shall be Standard Weight Schedule 40 Steel pipe, with factory or field formed threaded or roll grooved ends.

   a. Cast Iron Threaded Flanges Class 125 and 250: ANSI B16.1

   b. Cast Iron Threaded Fittings Class 125 and 250: ANSI B16.4

   c. Malleable-Iron Threaded Fittings Class 150 and 300: ANSI B16.3

   d. Grooved End Fittings: ASTM A 536, ductile-iron casting with OD matching steel pipe OD, and orange enamel housing coating.

   e. Grooved End Pipe Couplings: ASTM A 536 ductile-iron casting coupling, orange enamel housing coating, with Grade "E" EPDM type A Vic Plus gasket system, and heat-treated carbon steel bolts and nuts

2. Piping 2-1/2" and larger shall be Standard Weight Schedule 40 or Schedule 10 Steel pipe with factory or field formed threaded or roll grooved ends. Schedule 10 pipe shall not be threaded.

   a. Cast Iron Threaded Flanges Class 125 and 250: ANSI B16.1

   b. Cast Iron Threaded Fittings Class 125 and 250: ANSI B16.4

c. Malleable-Iron Threaded Fittings Class 150 and 300: ANSI B16.3

d. Grooved End Fittings: ASTM A 536, ductile-iron casting with OD matching steel pipe OD, and orange enamel housing coating.

3. Pipe with wall thickness less than Schedule 10 shall not be used. Fittings intended for use on pipe systems of Schedule 5 and 7-1/2 shall not be used.

D. Sprinkler Specialty Fittings:

1. Sprinkler Drain and Alarm Test Device: Cast or ductile-iron body, with threaded or grooved ends, test valve and orifice and sight glass. Manufacturers: Victaulic, AFG, Suretest.

a. Sprinkler drain to be sized for full-flow draining of sprinkler system.

b. Sprinkler drain location to be coordinated with plumbing drawings.

c. Floor drain diameter shall be 2" larger than sprinkler pipe diameter.

2. Adjustable Drop Nipple: Adjustable with threaded inlet and outlet, and seals. Manufacturers: Merit or approved equal.

E. Pipe Hangers and Supports: Pipe hangers and supports shall be listed by (UL) Underwriters Laboratories, and approved by (FM) Factory Mutual for their intended use

F. Valves:

1. Minimum 175 PSI non-shock working pressure rating unless higher pressure required by application. Valves for grooved end piping may be furnished with grooved ends instead of flanged ends.

2. Indicating Valves 2" and smaller: UL 1091, butterfly or ball type, bronze body with threaded or grooved ends, and integral indicating device and prewired supervisory switch. Manufacturers: Nibco, Victaulic, Milwaukee, Mueller, or Kennedy

3. Indicating Valves 2 ½" and larger: UL 1091, OS&Y with flanged ends or butterfly type with grooved ends, and integral indicating device and prewired supervisory switch. Manufacturers: Nibco, Victaulic, Milwaukee, Mueller, or Kennedy.

4. Swing Check Valves 2" and smaller: UL 312, cast-bronze, threaded ends. Manufacturers: Nibco, United Brass, Apollo or approved equal.

5. Swing Check Valves 2 1/2” and larger: UL 312, swing type, cast-iron body with flanged or grooved ends. Manufacturers: Nibco, Victaulic, Kennedy or approved equal.

6. Riser Check Valves and Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin and latch design. Including trim for bypass, drain, electrical alarm switch, pressure gauges, retarding chamber and fill-line attachment with strainer. Manufacturer: Reliable Sprinkler Company.

7. Dry Pipe Valves: UL 260, differential type, with bronze seats with O-ring seals, single hinge pin and latch design. Including trim for air supply, drain, priming level, electrical alarm switch, electrical switch to monitor High/Low pressure condition, pressure gauges, retarding chamber and fill-line attachment with strainer. Valve shall be provided with an accelerator if necessary to meet the 60 seconds or less discharge time to the remote head requirement of NFPA 13. Manufacturer: Reliable Sprinkler Company.

8. Air Pressure Maintenance Device: A pressure regulator that automatically reduces the supply air pressure to a preset requirement when connected to a constantly maintained air supply. Include shut off valves to permit servicing without shutting down sprinkler piping, and by-pass for quick filling. Manufacturer: Gast or Viking

9. Air compressor: Tank mounted and sized to meet the requirements of NFPA 13 for filling the system within 30 minutes. Oiless non-tank riser mount compressor is acceptable for systems with less than 100 gallons’ volume. Oiless compressors will be mounted with vibration dampening mounts in a manner that provides exceptional access for future service of the unit. Manufacturers: Gast or General Air Products.

G. Sprinklers:

1. Sprinkler heads shall be UL listed and FM approved. Manufacturer: Reliable Sprinkler Company.

2. The Owner will select the type and finishes for all automatic sprinklers and escutcheons.

3. Temperature Ratings: It shall be the contractor’s responsibility to install sprinklers of the proper temperature rating as required by NFPA 13.

4. Sprinkler Escutcheons: Escutcheons shall be metal and be listed for use with the sprinkler head. Manufacturer: Reliable Sprinkler Company.

5. All sprinklers in finished areas shall be center of tile.

6. Sprinkler guards shall be provided where the sprinklers are subject to damage, lower than eight feet above finish floor in mechanical rooms, and under low ceilings.

H. Hose Connections:

1. Hose connections, UL 668, brass or bronze, 300 PSI minimum pressure rating, hose valve for fire department use, angle pattern, female NPS inlet and male hose outlet, including 2-1/2 " NST x 1-1/2" NPSH reducer, with cap and chain. Hose threads to match local fire department sizes and threads. Finish to be determined by Owner.

2. Manufacturers: Fire-End and Croker Corp. or Potter-Roemer.

I. Fire Department Connections:

1. Fire Department Connections UL 405, 300 PSI minimum pressure rating, with corrosion resistant metal body inlets, brass wall escutcheon plate, lugged cap with gasket, chains, and lugged swivel connections. Connection to be 4" Storz-type at 22.5 degrees downward fitting to meet fire department requirements. Escutcheon plate to be provided with appropriate branding.

2. Manufacturers: Fire-End and Croker Corp. or Potter-Roemer.

3. Connections to be minimum 36" and maximum 42" to center above surface.

J. Alarm Devices:

1. Alarm-device shall be manufactured by Potter Electric or System Sensor.

2. All alarm devices shall be provided with a means to test meeting requirements of NFPA 13.

3. Water-Flow Switch: UL 346, Potter Model VSR or System Sensor Model WFD paddle operated water flow detector, 250 PSI pressure rating, designed for horizontal or vertical installation, two single-pole double throw circuit switches for isolated alarm and auxiliary contacts, field adjustable retard element and tamper proof cover.

4. Pressure Switch: UL 753, Potter Model PS10-2 or System Sensor Model EPS10-2 pressure actuated switch, with two single-pole double throw circuit switches, normally closed contacts that operate on rising pressure.

5. Low Pressure Supervisory Switch: Potter Model PS40-2 or System Sensor Model EPS40-2 pressure actuated switch to detect an increase and or decrease from normal pressure.

6. Valve Supervisory Switch: Potter Model OSYSU-2 or System Sensor Model OSY2, two single-pole double throw circuit switches, normally closed contacts, to signal controlled valve is in other than fully open position

K. Backflow Assembly: Reduced pressure zone type. The manufacturer shall be Watts. Acceptable model is #909. All units to be factory fitted with two OS&Y gate valves. Valved connections are to be provided to flow test this assembly per NFPA 13 requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials in proper relation with adjacent construction and with uniform appearance for exposed work. Coordinate with work of other sections. Comply with applicable regulations and code requirements. Provide proper clearances for servicing.

B. Support piping properly. Pitch to drain points. Install with pipe expansion loops, mechanical expansion joints, and anchors, and properly seismically braced.

C. Conceal piping to the greatest extent practical.

D. Center ceiling mounted elements in center of ceiling tiles as applicable.

E. Clearly label and tag all components.

F. Test and balance all systems for proper operation.

G. Restore damaged finishes. Clean and protect work from damage.

H. Instruct Owner's personnel in proper operation of systems

3.2 CLOSEOUT REQUIREMENTS

A. Provide/perform the following prior to project closeout:

1. As-built drawings in .dwg and PDF file formats.
2. Final system testing as required by the Massachusetts Building Code, NFPA 13, NFPA 14, NFPA 20 and the Town of Williamstown Building and Fire Departments.
3. Spare sprinkler heads, wrenches, and box per NFPA 13.
4. Proof of adequate underground main flushing. Must be witnessed by College personnel or their assignee.
5. Underground and aboveground Contractor’s Materials and Test Certificates.
6. One electronic copy of operations and maintenance manuals.
7. Hydraulic design placards.

8. Flow and flushing of backflow assembly.
9. Hydrostatic test of underground and aboveground piping.
10. Training of College personnel.

END OF SECTION

SECTION 21 11 16
FACILITY FIRE HYDRANTS

PART 1 GENERAL

1.1 DESCRIPTION

A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing fire hydrant assemblies, including the hydrant leg, auxiliary gate valve, valve box, electrical thaw wire and continuity straps, tie rods, and fire hydrants; for installing guard posts to protect fire hydrants; for installing the hydrant access pads; for furnishing and installing barrel extensions on existing fire hydrants and for removing, inspecting, salvaging, and delivering existing fire hydrant assemblies to the Owner.

1.2 SUBMITTALS

A. Fire Hydrants: Catalogue cuts.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

A. Hydrants shall conform to the standards of the American Water Works Association, AWWA Standard for Dry-Barrel Fire Hydrants for Ordinary Water Works Service, AWWA C502, latest revision.

1. Hydrants shall be Mueller Super Centurion or approved equal.

B. Hydrants shall be of a two-piece design with a breaking ring located approximately 3-inches above the ground line.

C. Hydrants shall be provided with a standpipe with an 8-inch ID, and 6-inch diameter mechanical joint connection and shall be for a typical trench depth of five (5) feet. Extension collars should be provided as required for proper setting of hydrants.

D. Hydrants shall have compression type valve with 5¼-inch diameter opening, two (2) 2½ inch hose connections (with thread size 3.06-inch O.D. and 7 threads per inch), and one (1) 4½ inch steamer nozzle (with thread size 5.251 inch O.D and 5 threads per inch).

E. Hydrants shall have o-ring seals and the main valve shall open clockwise with a 19/16 inch to ¾ inch pentagon nut.

F. Hydrants shall be prepped and primed as required and painted using Pratt & Lambert Industrial Techgard Maintenance Gloss Enamel Safety Yellow S4540, or approved equal.

G. All parts of hydrants shall be interchangeable with similar parts of hydrants of the same size and type.

H. All bolt holes shall be accurately drilled from templates.

I. All joints shall be faced smooth, so as to make a perfectly watertight joint.

J. Hydrants shall be provided with “breakable ring” traffic flange and breakable coupling stem. The traffic flange shall have 360 degrees adjustment facilities.

K. Each hydrant shall be shop tested under 300 psi applied hydrostatic pressure above and below the compression valve. Any hydrant showing sweating of metal or leaking or other defect shall be rejected. All tests shall be made at the expense of the supplier.

2.2 BARREL EXTENSION

A. Barrel extensions shall conform to the requirements of AWWA C502 for Dry Barrel Fire Hydrants and shall include barrel extension, steel stem coupling, stainless steel clevis and cotter pins, solid flange, gasket, bolts and nuts, stem extension and lubricant.

PART 3 EXECUTION

3.1 FIRE HYDRANTS

A. The Contractor shall install the fire hydrant assemblies in accordance with applicable AWWA Standards, and the manufacturer’s recommendations. The interior components of the fire hydrant shall be cleaned of all foreign matter prior to installation. Fire hydrant legs shall be installed level and the barrel shall be installed plumb. Any adjustments to the traffic flange shall be accomplished with barrel extensions, in accordance with the fire hydrant manufacturer’s recommendations. The extensions shall be made between existing barrel and hydrant. Fire hydrants shall be tied back to the water pipe using tie rods. Stuffing boxes shall be tightened and the fire hydrants shall be opened and closed in the presence of the Architect to see that all parts are in working condition.

B. Hydrant drain plugs, if any, shall not be removed.

C. The top cap on fire hydrants serviced from the high-pressure system shall be painted yellow.

D. Fire hydrants installed, but not available for use, shall be covered with burlap or heavy plastic and securely tied.

E. Electrical continuity is required for fire hydrant assemblies. Electrical continuity tests shall be performed by the contractor and witnessed by the College’s project manager or assignee.

F. After installation, all fire hydrant assemblies shall be flushed, field-tested, and disinfected. Each hydrant shall then be winterized by removing the water in the hydrant and barrel.

3.2 GUARD POSTS

A. Guard posts shall be installed where directed by the Architect in accordance with drawings and specifications. Guard posts shall not be installed in public road right-of-ways.

3.3 HYDRANT ACCESS PADS

A. A. Hydrant access pads shall be installed where directed by the Architect in accordance with drawings and specifications. Culvert size shall be noted on the Drawings.

3.4 GRADE ADJUST EXISTING FIRE HYDRANTS

A. Grade adjustments to existing fire hydrants shall be accomplished with barrel extensions, in accordance with the fire hydrant manufacturer's recommendations. In addition, the existing fire hydrant shall be connected to the mainline water pipe with all necessary materials, including the tee at the mainline water pipe, thrust blocks, six inch gate valve, valve box, joint restraints, continuity wires, thaw wires, warning tapes, and any other required fittings, including pipe, to connect the hydrant leg to the mainline water pipe. After installation, the adjusted fire hydrant shall be flushed, field-tested, and disinfected.

3.5 SALVAGE EXISTING FIRE HYDRANTS.

A. The Contractor shall contact the Owner at least 72 hours prior to removing or interrupting service to existing fire hydrants.

B. The components of the existing fire hydrant assemblies shall be carefully removed. Damage to the fire hydrant, valve, valve box, or barrel impairing re-use shall be determined by the Architect. Damaged components shall be replaced by the Contractor using factory-supplied parts from the same manufacturer.

C. The Architect will determine the usefulness of the removed fire hydrant assembly components. The Contractor shall deliver the useful components to the Owner. The remaining components shall be disposed of by the CONTRACTOR.

D. If an existing fire hydrant assembly is removed at the tee, the tee shall be plugged in accordance with plans and specifications, and the existing water main shall be disinfected between isolating valves as specified in Section 22 01 10.51.

E. At the discretion of the Architect, a hydrostatic pressure test shall be conducted between isolating valves along the existing water main.

F. The Contractor shall restore all surface features to preconstruction condition or better, including, but not limited to, sidewalks, curbs, gutters, mailboxes, culverts, and other facilities disturbed by the construction.

3.6 RELOCATE EXISTING FIRE HYDRANT

A. A. Relocation of existing fire hydrant shall conform to the requirements of Article 3.5 in this Section, except the fire hydrant piping shall be connected to the existing water valve, or to the piping on the street side of the water valve. If the fire hydrant is connected to the existing valve, this valve shall be fully opened with the existing valve box removed.

END OF SECTION

SECTION 22 00 00
PLUMBING

PART 1 GENERAL

1.1 SUMMARY

A. Provide all labor and materials necessary to install, complete and ready for continuous operation, the plumbing systems, apparatus and equipment.

B. Plumbing system selection, components, materials and requirements shall be appropriate in materials, function and quality for the intended application. Offices, classrooms and general purpose space requirements will differ from laboratory, utility, and construction spaces.. The design consultant shall make any recommendations, challenge these guidelines and/or defend deviations from them as their experience dictates.

C. These guidelines are intended to convey both general and specific requirements but in brief terms. The design consultant shall prepare full detailed contract specifications appropriate to the contract taking the specifics into account.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Materials and characteristics specific to the project shall be delineated for ease of future reference.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

1. Shop drawings shall be prepared by the contractor for review by the design engineering firm. Reviewed shop drawings shall be stamped including clear disposition of the review by an engineer licensed in the Commonwealth of Massachusetts.

C. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, including operating instructions, list of spare parts and maintenance schedule. Pertinent data to the installed equipment shall be shown and all other data that does not apply shall be removed or crossed out.

1.3 QUALITY ASSURANCE

A. Comply with governing codes, standards and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for at least three years. Use experienced installers with specific certifications as applicable. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Systems shall be designed based on verifiable calculations and supporting documentation by or under the supervision of Massachusetts-licensed Professional Engineers in their respective disciplines and areas of expertise.

C. Coordinate location of systems to avoid interference with location of structure and other building systems. Notify Owner prior to construction of conflicts which cannot be resolved.

D. Coordinate and work with the owners commissioning agent from preliminary design through post acceptance phase.

E. This specification includes the Williams College standards for plumbing. In the design phase of the project, a meeting shall be held with the Williams College Facilities Operations Group, and any other utility-related groups.

F. General: The work covered consists of furnishing all labor and materials necessary to install, complete and ready for continuous operation, the plumbing systems, apparatus and equipment.

G. Shop Drawings: Shop drawings of all specified fixtures, equipment and apparatus shall be submitted to the Architect for approval.

H. Codes: All equipment and materials furnished under the Plumbing Sub-Contract and labor and testing performed herein shall be in complete accordance with the following and with Local Ordinances and Regulations of Williamstown, National Fire Protection Association and insurance regulations and requirements governing such work.

1. 780 CMR Massachusetts State Building Code.
2. 248 CMR Massachusetts State Plumbing & Fuel Gas Code.
3. ANSI Standard A117.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People."
4. 521 CMR MAAB: Massachusetts Architectural Access Board.

I. Permits: Any and all permits required for installation of any material shall be obtained as part of the work including all fees or expenses incurred.

J. Instructions: During the assembly and installation of all plumbing systems, the Owner's operating personnel shall be instructed regarding its operation and maintenance. A two (2) week instruction period shall be provided after completion of project. Operation and maintenance manuals shall be required.

K. Guarantee: All materials and equipment furnished and installed shall be guaranteed in writing for a minimum of one year from the date of acceptance of the building by the Owner.

L. Inspection: All work shall be subject to the inspection of the Owner, the Architect and such other inspectors having jurisdiction. A properly executed certificate of inspection shall be provided.

M. Examination of Site: The Contractor, before submitting prices or beginning work, shall thoroughly examine the site and Contract Documents. No claim for extra compensation will be recognized if difficulties which an examination of site conditions and Contract Documents prior to executing Contract would have revealed.

N. Coordination: Coordinate all work installed with that of all other trades.

O. Protection of Property: Protect all new and existing work before, during and after installation.

P. Disinfection: All domestic water systems shall be disinfected in accordance with the local, state and national health and plumbing code requirements.

Q. Tests: The Plumbing Subcontractor shall perform all tests at the completion of the work, and the results furnished to the Owner and Architect in writing.

R. Certificates of Approval: Upon completion of all work, the Contractor shall furnish, in duplicate, certificates of inspections from all inspectors and authorities having jurisdiction, notarized letters from the manufacturers stating that authorized factory engineers have inspected and tested the installation of their respective systems and found same to be in perfect operation condition.

S. Contract Drawings: The Contract Drawings are diagrammatic and indicate only the general arrangements of work. It is not the intent of these Drawings to show every pipe, rise, drop, elbow, etc. Any additional work not shown and required to install the plumbing systems shall be included as part of this Contract.

T. Removal Work: Particular care shall be taken to avoid creating hazards on the site or causing disruption of service in the building. All existing equipment to be removed shall be done in a neat and workmanlike manner. All existing equipment to be turned over to the Owner shall be presented to the Owner in good condition at a location designated by the Owner. All other equipment shall be removed from the premises. Remove all abandoned piping and equipment not built into building construction. Where ceiling or walls are removed, all abandoned piping shall be removed and ends of live services capped. Abandoned elements built into walls or located above existing inaccessible ceilings shall remain and ends capped and marked abandoned.

U. Continuity of Services: Services shall be maintained in all areas which will be occupied during the construction period. If an interruption of service becomes necessary, such shall be made only upon consent of the Owner at a time outside normal working hours as the Owner shall designate. Refer to the overall scheduling of the work of the project. Schedule work to conform to this schedule and install work to not delay nor interfere with the progress of the project.

V. Asbestos Removal: Should the Contractor or any of its Subcontractors encounter any asbestos and/or asbestos related products of materials (the "asbestos materials") during the performance of its work, the Contractor shall stop work immediately and so inform the General Contractor and the Owner of the presence of asbestos.

1.4 SCOPE

A. The work of this section consists of all labor, materials and equipment required to provide all Plumbing work complete, in place, as shown on the Drawings, specified herein, and as necessary for a proper installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:

1. Each material, device and equipment item will have a range of common manufacturers and model numbers preferred by Williams College. See Preferred Manufacturers Table for specific preferred manufacturers and state those to be used at the beginning of the Schematic Design period. Submit alternative suggestions during this discussion.

2. Generic and sundry materials such as piping, fittings, hangers, supports, insulation, labels, etc. shall have conforming certifications such as ANSI, ASTM, ASME, NSF. Those items are noted below as minimum default standards. All shall conform to the application.

B. Plumbing System Common Materials:

1. Steel Piping: Schedule 40 or standard weight is the default on facility water service or distribution systems. Conform to ASTM A53/A53M for water service.

2. Steel Pipe Fittings: Butt-welded standard. Conform to ASME/ANSI B16.9.

3. Copper Tubing: Conform to ASTM B88. Type “L” shall be the default minimum thickness, with Type K for buried service, oil service and limited instrumentation service (final connections to panel-mounted devices). Refrigerant service shall be ACR grade, washed, dried and capped. Type M or DWV weight will not be used. Fittings shall be wrought copper conforming to ANSI/ASME B16.18.

4. Sleeves, Hangers and Supports: Products by listed manufacturers in accordance with their listings. Refer to the table of manufacturers. Structural angles, channels and steel fabrications sized per ANSI/ASTM standards for pipe supports per size. All exterior devices to be hot-dipped galvanized, conforming to ANSI/ASTM A 123.

5. Identification Systems: Reference latest Williams College BIM standards and requirements.

6. Pipe Insulation: Comply with the Massachusetts State Energy Code 780 CMR-13 minimum per pipe size and temperature. Do not use less than 1.0-inch thickness without direction from the Williams College Project Manager. Pipe insulation shall be color-coded as follows:
    - Lab hot water ***- Dark green***
    - Lab hot water recirc ***- Dark green***
    - Lab cold water ***- Light blue***
    - Storm ***– Light green***
    - Steam generator vent ***– Grey***
    - Condensate receiver vent ***– Grey***
    - Emergency tempered water ***– Purple***
    - Condensate drains (gravity) ***– Grey***
    - Clean Steam ***– Orange***
    - Steam and Pumped Condensate ***- Gray***
    - All Chilled Water loops ***- Dark Blue***
    - All Heating Hot Water Systems ***- Red***
    - Domestic hot water incl. Recirc lines ***- Dark Green***
    - Non-potable heating systems ***- Red***
    - Steam ***- Orange***
    - Condensate ***- Gray***
    - Hot water supply - ***Red***
    - Domestic hot water - ***Dark Green***
    - Domestic cold water ***- Light Blue***

Approved Manufacturers, Equipment and Materials Table	
Items	**Manufacturer**
Access panels/doors	Milcor
Water hammer arresters	Sioux Chief

Cleanouts	No hub: Josam Copper: Nibco Polyproylene: Fuseal Flush floor: Josam Wall and concealed: Josam Or pre-approved equal

Backflow preventers/RPZ’s	Watts 909
Pressure reducing valves	Watts
Pressure gauges	Trerice
Valves	Domestic water ¾” to 2”: Apollo Domestic water 2” and greater: Quadax Balancing valves: Apollo Check valves: Nibco Drain valves: Apollo Shut-off valves: Apollo Tempering valves: Lawler or approved equal Or pre-approved equal
Pipe, valve, and fittings covers	Johns Manville Zeston Hi-Lo, Truebro, or Brocar
Propress Type Fittings	Press Type Fittings for Piping: Viega ProPress and Viega MegaPress fittings are acceptable for use on piping systems if they have been verified by the manufacturer for the intended use. System applications shall conform to manufacturer’s published applications and parameters. Installation shall conform to manufacturer’s instructions. Applicable service types include chilled water, hydronic heating, fire sprinkler, low pressure steam, natural gas, LP gas, compressed air, and vacuum.
Wall hydrants	Wade Or pre-approved equal
Toilet room hose bib	Chicago Or pre-approved equal
Floor drains	Jay R. Smith or pre-approved equal Use Sioux Chief trap primers where applicable and required by code
Tankless water heaters	Navien Or pre-approved equal

Water closet	Wall mount: Kohler Kingston Floor mount: Kohler Or pre-approved equal No pressure-assisted flush valves
Waterless urinal	Kohler Or pre-approved equal
Lavs	Kohler vitreous china; 4" centers Or pre-approved equal
Lav faucets	Moen
Shower faucet	Moen
Mop receptor	Fiat; molded stone
Mop receptor utility faucet	Moen
Drinking fountain	Elkay bottle filler/water cooler combo
Shower basin	Panned with Choroloy and tiled Wedi system

C. Pipe and Fittings

1. Pipe and fittings shall be in accordance with the following:

   a. Exterior Water Service Type A

   b. Cold Water Type B

   c. Hot Water Supply and Recirculation Type B

   d. Sanitary Waste and Vent Inside Buried Type E

   e. Sanitary Waste and Vent Type D

   f. Waste and Vent Smaller than 2" Type G

   g. Gas 2" and smaller Type H

   h. Gas larger than 2" Type I

i. Water Heater Safe Pan Discharge Type B

j. Sanitary from Last Building Cleanout to 10'-0" beyond Foundation Wall - Type F

k. Indirect Waste Piping smaller than 1-1/4" Type B

l. Indirect Waste Piping 1-1/4" and larger Type G

m. Gas vents from regulators Type H

n. Sprinkler Piping Type C

2. All piping shall conform with the Massachusetts State Plumbing Code
   a. Type A: Cement lined ductile iron, Class 52, mechanical joint ductile iron fittings conforming. Pipe and fittings shall be 350 psi rated. Pipe and fittings shall be cement lined on the inside and bituminous coated on the outside. Changes in direction shall have tie rods anchored to concrete thrust blocks.

   b. Type B: Type L hard drawn copper tubing with wrought copper sweat fittings joined with approved lead free solder.

   c. Type C: Type L hard drawn copper tubing with Victaulic copper fittings to match.

   d. Type D: No hub cast iron soil pipe and fittings joined with approved stainless steel mechanical couplings with neoprene gaskets.

   e. Type E: (below grade only): Service weight bell and spigot cast iron soil pipe and fittings joined with neoprene resilient gaskets.

   f. Type F: (4" and above and first five fittings inside the building): Extra heavy bell and spigot cast iron soil pipe and fittings joined with oil free oakum and lead.

   g. Type G: Type L hard drawn seamless copper tubing with wrought copper drainage fittings joined with lead free solder.

   h. Type H: Schedule 40 black steel pipe with standard weight malleable iron fittings joined with threaded connections.

   i. Type I: Schedule 40 black steel pipe with beveled ends with standard weight carbon steel beveled end fittings joined by welding in accordance with local codes.

   j. Steam condensate – Schedule 80

   k. Urinal branch and fixtures wastes shall be of extra heavy or service weight cast iron soil pipe and fittings with caulked joints, threaded cast iron pipe with cast iron drainage fittings, or iron size copper or brass pipe with cast brass drainage fittings. Resilient gaskets shall not be used on urinal wastes.

3. Pipe and fittings shall be in accordance with the following:
   a. Exterior Water Service Type A

   b. Cold Water Type B

   c. Hot Water Supply and Recirculation Type B

d. Sanitary Waste and Vent Inside Buried Type E

e. Sanitary Waste and Vent Type D

f. Waste and Vent Smaller than 2" Type G

g. Gas 2" and smaller Type H

h. Gas larger than 2" Type I

i. Water Heater Safe Pan Discharge Type B

j. Sanitary from Last Building Cleanout to 10'-0" beyond Foundation Wall Type F

k. Indirect Waste Piping smaller than 1-1/4" Type B

l. Indirect Waste Piping 1-1/4" and larger Type G

m. Gas Vents Type H

n. Sprinkler Piping Type C

4. Press Type Fittings for Piping: Viega ProPress and Viega MegaPress fittings are acceptable for use on piping systems if they have been verified by the manufacturer for the intended use. System applications shall conform to manufacturer's published applications and parameters. Installation shall conform to manufacturer's instructions. Applicable service types include chilled water, hydronic heating, fire sprinkler, low pressure steam, natural gas, LP gas, compressed air, and vacuum.

D. Insulation

1. Comply with the Massachusetts State Energy Code 780 CMR-13 minimum per pipe size and temperature. Do not use less than 1.0-inch thickness without direction from the Williams College Project Manager.
2. All domestic cold and hot water supply and recirculation pipe, fittings and valves shall be insulated with heavy density rigid fiberglass with a vapor barrier and all purpose jacket with self-sealing lap joint. Valves and fittings shall be insulated with Zeston Hi-Lo insulation and covered with 25/50 rated PVC covers secured with vapor retarder mastic.
3. Waste, cold water and hot water beneath handicapped lavatories shall be preferably protected by a physical cover or alternately insulated with Truebro Handi-Lav-Guard or Brocar Products insulation kit, 3-piece interlocking for "P" trap assembly and 2-piece interlocking for cold water and hot water angle valve assembly. Kit shall be white flexible vinyl insulation secured with nylon fasteners supplied.

E. Pipe Sleeves, Hangers and Supports

1. All piping shall be properly supported from the building structure in accordance with Local Codes and manufacturer's recommendations. Hangers for insulated piping shall be oversized and furnished with a sheetmetal insulation shield to allow the insulation to pass through uncut. Provide Schedule 40 pipe sleeves, extend 1" above floor, make watertight and pack with material that shall maintain fire rating. Provide core drilling where required and provide fire rated link seal penetration closures.

F. Valves

1. Fixture shut-offs shall NOT be key-stop.

2. Triple-duty valves shall not be used as isolations valves. A separate isolation valve shall be installed shall be installed after all triple-duty valves.
3. All shut off valves on cold water, hot water, and hot water recirculation piping from 3/4" up to and including 2 inch shall be Apollo Series 77-200 or pre-approved equal, solder end, bronze body ball valve, chrome plated bronze ball, 600 psi WOG, full port ball valve.
4. All shut off valves on cold water, hot water, and hot water recirculation piping larger than 2" shall be manufactured by Quadax or pre-approved equal.
5. All check valves on cold water, hot water and hot water recirculation piping three inches and less in size shall be Nibco Figure No. S-413-W, solder end, bronze body swing check, bronze disc, 200 psi WOG.
6. All drain valves shall be 1/2 inch Apollo Model 78-103 with Watts No. 8A hose connection vacuum breaker, cap with chain of length as required.
7. All balancing valves for hot water recirculation shall be the same as specified for shut off valves and shall be modified to include balancing stop plate.
8. All shut-off valves on gas system 2" and smaller shall be Apollo Series 70-100-07 Massachusetts approved, threaded bronze ball valve, 600 psi Wog. All shutoff valves on natural gas systems 2-1/2" and larger shall be Rockwell Fig. 143, semi-steel, lubricated plug valves, flanged ends, wrench operated, 200 psi Wog.
9. All ball valves for installation in insulated piping shall have valve extensions to suit insulation thickness.
10. Backflow preventers 2" and smaller shall be reduced pressure principle, all bronze, Watts Series U-909-QTS for cold water and hot water including bronze strainer, valves, air gap fittings test cocks and spare parts kit. Each backflow preventer and shut off valves shall be installed between 3 and 4 feet above the floor and a minimum of 12" from any wall. Support the assembly from the floor or the wall. Run vent to nearest floor drain or similar open receptor. Pressure gauges shall be installed on the supply and discharge side of each backflow preventer assembly. Each pressure gauge assembly shall include TRERICE 600-C gauge, 0-160 psi dial range, 735-2 valve and 872-1 snubber. Furnish to the Owner one Watts TK-9 Model "A" Test Kit. This Contractor shall act as the Owner's agent in seeking approval from the Department of Environmental Protection or their designee.. This Contractor shall submit all plans, specifications, and applications required for approval and shall pay all fees. Approvals shall be secured prior to the purchase and installation of backflow preventers. Test and certify backflow preventer.

G. Floor Drains

1. Floor drains shall be cast iron body with weepholes and flashing collar. Grates shall be polished chrome plated brass in finished areas and coated cast iron in unfinished areas. Trap primers required for all floor drains. In concrete slabs include integral clean out.

   a. Type "A" Jay R. Smith Fig. No. 2005-Y-B-4 or 2010-C-B-U.

   b. Type "B" Jay R. Smith Fig. No. Same as "A" except with trap primer.

   c. Type "C" Jay R. Smith Fig. No. 2030-G-H half grate.

   d. Type "D" Jay R. Smith Fig. No. 2010-C-B-F25

   e. Type "E" Jay R. Smith Fig. No. 2030-G

2. Provide extra deep seal "P" traps on floor drain in the lowest floor slab.

H. Water Heaters

1. Water heaters shall be Navien premium condensing tankless natural gas units or pre-approved equal.
2. Furnish and install as shown on plans and in specs, and in accordance with all codes, manufacturer's requirements and instructions, and authorities having jurisdiction.

I. Wall Hydrants

1. Wall hydrants shall be all bronze, non-freeze type, polished brass face, loose key operated with integral vacuum breaker backflow preventer Wade # 8625
2. Hydrants shall be set a minimum of 18" above outside grade and not more than 100' apart.

J. Plumbing Fixtures (Coordinate with table above.)

1. In general, all plumbing fixtures shall be wall hung, white vitreous china with chrome plated faucets, stops and traps. Special attention shall be paid to the ensure that the specified carrier system shall be suitable for the intended application (i.e. wood frame, vs. steel and concrete construction.) All supply stop valves shall have threaded or sweat solder inlet. No loose key stops permitted. Fixtures and trim shall be of the same manufacturer.

    a. P-1 Water Closets (Regular): Kohler Kingston Ultra-Low-Flush (1.28 gallon per flush) white vitreous china siphon jet elongated bowl with 2-1/4 inch passageway and-1 1/2 inch top spud. Kohler solid plastic white seat with check hinge.

        1). Toto Eco Flush flush valve assembly.

        2). Combination drainage carrier fitting with supply pipe support.

        3). Install to meet handicapped requirements, where required.

    b. P-1A Water Closet (Handicapped Accessible): Fixture same as P-1 except for mounting.

    c. P-1B Water Closet: (Existing to remain). Provide all new piping services from below to these fixtures.

    d. P-2 Urinal (Regular): Kohler Steward waterless and cartridge-less

        1). Concealed arm carrier with foot support and supply support to suit. Install to meet handicapped requirements, where required.

    e. P-2A Urinal (Handicapped Accessible): Fixture same as P-2 except mounting.

    f. P-3 Lavatory: Kohler vitreous china; 4" centers; Moen metering faucet with temperature selection and with perforated grid drain and 1-1/4" tailpiece.

    g. P-3A Lavatory (Handicapped Accessible): Kohler white vitreous china flat slab wall mounted lavatory with 4" faucet centers; Moen metering faucet with temperature selection and barrier free operation with perforated grid drain and 1-1/4" tailpiece. Provide 1-1/4" x 1-1/2" c.p. brass "P" trap with cleanout, angle stop with risers to suit. Provide concealed armed carrier.

    h. P-4 Mop Receptor: Fiat molded stone mop service basis with integral 3 inch stainless steel drain body and strainer.

        1). Vinyl bumper guards on exposed sides. (Floor Mounted)

2). Moen rough plated faucet with vacuum breaker, threaded spout with pail hook and integral stop sand 3 inch "P" trap.

i. P-5 Water Cooler: Combination drinking fountain/bottle filler by Elkay. Finish shall be all stainless steel.

j. P-6 Shower (Regular) Moen shower assembly, shower stall walls, shower shelf, drain pan, floor, soap dish and curtain rod shall be by the Contractor. If required, soap dispenser to be OFCI. Panned and tiled with Choroloy a minimum of 6” up on walls.

k. P-6A Shower:

l. Moen shower assembly, shower stall walls, shower shelf, drain pan, floor, soap dish and curtain rod shall be by the Contractor. If required, soap dispenser to be OFCI. Panned and tiled with Choroloy a minimum of 6” up on walls.

m. P-7 Toilet Room Hose Bibb: Chicago No. 952 polished chrome plated hose bib with hose connection and vacuum breaker. Cold water only.

2. Fixtures designated for handicapped use shall be mounted in accordance with the Americans with Disabilities Act (ADA) as well as State and Local Codes. Manual water closet flush valves shall be mounted on the wide side of the toilet areas.
3. All lavatory controls, where applicable, shall be adjusted by installing Plumber prior to the final inspection. Controls shall be set to deliver water at a maximum temperature of 110 degrees F.

K. Pipe Identification and Valve Tags

1. All plumbing systems shall be labeled at each valve, at each branch, at each pipe passage through wall and at intervals of not more than 20' with color coded semi-rigid Setmark pipe markers with arrows indicating the direction of flow. All valves shall be tagged with 1-1/2 inch diameter brass or laminated tags and numbered in sequence from point of origin. Valve charts shall be placed under glass, framed and presented to the Owner. Reference latest Williams College BIM standards and requirements.

L. Cleanouts

1. Cleanouts shall be iron body with heavy brass plug and raised nut, same size as pipe for piping up to four inches and not less than four inches in size for piping larger than four inches and closed gas tight. Floor cleanouts in carpeted areas shall have carpet cleanout markets. Floor cleanouts shall not be located beneath partitions, casework, non-portable equipment or similar installation conditions. End cleanouts on no hub cast iron shall be Josam Series 58900-20. End cleanouts on copper waste shall be Nibco 816. Flush floor cleanouts shall be Josam Series 56000-2-22-41 in concrete floors. Exposed dandy cleanouts on no hub cast iron shall be Josam Series 58910-20. Wall cleanouts and concealed dandy cleanouts on no hub cast iron shall be Josam Series 58910-19 with Series 58890 cleanout plug with center screw length as required. End cleanouts on polypropylene piping shall be Fuseal fitting cleanout adapter with threaded plug.
2. Cleanouts shall be provided above any fitting classified as a "Double T-Wye" and/or equal. This standard would be followed in these situations: Lavs, urinals etc. that are piped together in an arrangement where a "Double T Wye" is used.

M. Water Hammer Arrestors (Shock Absorbers)

1. Maintenance-free water hammer arrestors shall be furnished and installed in accessible locations at all locations in the water systems where quick acting valves are installed as well

as wherever hammer may occur.

2. Water hammer arrestors shall be Sioux Chief or approved equal. Sizing and placement shall be in accordance with the manufacturer's recommendations.

N. Access Panels

1. Per Section 08 31 00, furnish access doors and panels for access to all concealed parts of the plumbing systems that require accessibility for the proper operation and maintenance of the system. Size shall be sufficient for the purpose, but no less than 12 inches by 18 inches. Provide screwdriver-operated latches only; no keyed latches.

END OF SECTION

SECTION 22 01 10.51
PLUMBING PIPE CLEANING

PART 1 GENERAL

A. Scope

1. Provide for flushing and disinfection of domestic water systems.
2. Isolate and bypass equipment listed in Clause 3.1.

B. Quality Assurance

1. Provide chemical treatment, chemicals and equipment by an agency that specializes in this type of work. This work shall be directed by the water treatment agency who, upon completion, shall certify that the process is satisfactory and submit a report outlining the cleaning operation and the treatment process.
2. Provide chemical treatment as specified herein and provide written reports. Reports shall be signed by the chemical treatment agency, mechanical contractor and commissioning agent.
3. Include for the costs of an independent testing agency, selected by the Owner, to take samples of domestic water, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should the lab results prove that standards for drinking water quality have not been met, the Contractor shall correct the deficiency and cover the costs of the independent testing agency to take additional samples and tests.
4. Water must be handled in accordance with Hoosic Water Quality District standards
5. All equipment, service and chemicals shall be from one supplier.

C. Submittals

1. Submit shop drawings including proposed chemicals, quantities, procedures and analysis reports to be used on this project. Provide written operating instructions and system schematics.
2. Provide written reports containing log and procedure of system cleaning and degreasing, giving times, dates, conditions of water and problems and actions encountered.
3. Submit a written report on system operations.

PART 2 PRODUCTS

A. Materials

1. Provide sufficient chemicals to treat domestic water systems and test the systems from the time of activation and acceptance of the building.

2. Chemicals used must comply with environmental and health standards applicable to the usage on this project.

3. Domestic Water System: Sodium hypochlorite conforms to ANSI/AWWA B301.

PART 3 EXECUTION

A. Piping General

1. Ensure reasonable care is exercised to prevent debris, dirt and other foreign material from entering the pipe during construction. This is to include proper protection of piping on site prior to installation, temporary caps on partial systems, and complete evacuation of moisture within systems being hydrostatically pressure tested.

2. Chemical treatment agency shall, in conjunction with the mechanical contractor, review connections for complete draining and venting of the systems. The mechanical contractor shall provide adequate drain connections to completely drain the systems within one hour.

3. Protect and/or remove control devices from systems during cleaning. All terminal control valves shall be in open position during cleaning. Particular attention is to be made to control valves which have a normally closed position.

4. Make systems completely operational, totally filled, thoroughly vented, and completely started.

B. System Cleaning

1. Pipes intended to carry potable water shall be disinfected before being placed in service. Disinfection procedures shall conform to AWWA C651 as hereinafter modified or expanded, and the requirements of any governing agency having jurisdiction.

2. Flushing

a. Before disinfecting, the mechanical contractor shall flush all foreign matter from the pipeline. He/she shall provide hoses, pumps, temporary pipes, ditches, etc., as required to dispose of flushing water without causing damage to adjacent properties. The flushing velocities shall be at least 2.5 FPS. For large diameter pipe, where it is impractical or impossible to flush the pipe at 2.5 FPS velocity, the pipeline shall be cleaned in place from the inside by brushing and sweeping, then flushing the line at a lower velocity.

3. Disinfection Mixture

   a. The mechanical contractor shall prepare the disinfection mixture with a chlorinewater solution having a free chlorine residual of 40 - 50 PPM. The disinfection mixture shall be prepared by injecting calcium or sodium hypochlorite and water into the piping and allowing it to flow at a measured rate so that water-chlorine solution is of the specified strength.

   b. If the calcium hypochlorite procedure is used, first mix the dry powder with water to make a thick paste, then thin to approximately a one percent solution (10,000 PPM Chlorine). If the sodium hypochlorite procedure is used, dilute the liquid with water to obtain a one percent solution.

4. Point of Application

   a. The chlorine mixture shall be injected into the piping to be treated at the beginning of the line, and through a corporation stop or suitable tap in the top of the line. Water from the existing system or other approved sources shall be controlled so as to flow slowly into the newly installed pipe during the application of chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the combined mixture shall contain 40-50 PPM of free available chlorine. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves shall be used if deemed necessary. The water treatment representative shall analyze and record the free chlorine residual at the farthest fixtures from the injection point.

5. Retention Period

   a. Treated water shall be retained in the pipeline long enough to destroy all nonspore-forming bacteria. With proper flushing and the specified solution strength, 24 hours is adequate. At the end of the 24-hour period, the disinfection mixture shall have a strength of at least 25 PPM of chlorine.

6. The above procedure shall be repeated at the mechanical contractor’s expense if the free chlorine level drops below the minimum requirements.

7. All valves, fixtures and other appurtenances shall be operated during disinfection to ensure that the disinfection mixture is dispersed into all parts of the line, including dead ends, new services and similar areas that otherwise may not receive the treated water. The water treatment representative shall analyze and record the free chlorine residual at the farthest fixtures from the injection point.

8. After chlorination, the water from the line shall be flushed until it meets health department requirements.

9. Disposal of Disinfection Water

    a. Disposal of disinfecting water shall be done in an approved manner. Disinfecting water should not be allowed to flow into a waterway without adequate dilution or other satisfactory method of reducing chlorine concentrations.

END OF SECTION

SECTION 23 00 00
HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 SUMMARY

A. Provide heat transfer equipment and distribution networks for building HVAC systems.

B. HVAC system selection, components, materials and requirements shall be appropriate in materials, function and quality for the intended application. Offices, classrooms and general purpose space requirements will differ from laboratory, utility and construction spaces including specific requirements of each campus. The design consultant shall make any recommendations, challenge these guidelines and/or defend deviations from them as their experience dictates.

C. These guidelines are intended to convey both general and specific requirements but in brief terms. The design consultant shall prepare full detailed contract specifications appropriate to the contract taking the specifics into account.

D. Meetings shall be held with the Williams College Facilities Group, utility related personnel/groups and appropriate authorities early in the DD process and at appropriate stages thereafter, scheduled through the assigned Williams College Project Manager.

1.2 RELATED SECTIONS (Included without Limitation)

A. 01 90 00 Commissioning
B. 33 61 00 Chilled Water Distribution
C. 23 11 00 Mechanical Piping
D. 23 22 00 Steam Distribution System
E. 11 60 10 Laboratory Fume Hoods

1.3 SUBMITTALS

A. All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College PMIS.

B. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Materials and characteristics specific to the project shall be delineated for ease of future reference.

C. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

   1. Shop drawings shall be prepared by the contractor for review by the design engineering firm. Reviewed shop drawings shall be stamped including clear disposition of the review by an engineer licensed in the Commonwealth of Massachusetts.

D. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, including operating instructions, list of spare parts and maintenance schedule. Pertinent data to the installed equipment shall be shown and all other data that does not apply shall be removed or crossed out.

1.4 QUALITY ASSURANCE

A. Comply with governing codes, standards and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for at least three years. Use experienced installers with specific certifications as applicable. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Systems shall be designed based on verifiable calculations and supporting documentation by or under the supervision of Massachusetts-licensed Professional Engineers in their respective disciplines and areas of expertise.

C. Coordinate location of systems to avoid interference with location of structure and other building systems. Notify Owner prior to construction of conflicts which cannot be resolved.

D. Coordinate and work with the Owners Commissioning Agent from Preliminary design through Post Acceptance phase.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:

   1. Each material, device and equipment item will have a range of common manufacturers and model numbers preferred by Williams College. See Preferred Manufacturers Table for specific preferred manufacturers and state those to be used at the beginning of the Schematic Design period. Submit alternative suggestions during this discussion.

   2. Generic and sundry materials such as piping, fittings, hangers, supports, insulation, labels, etc. shall have conforming certifications such as ANSI, ASTM, ASME, NSF. Those items are noted below as minimum default standards. All shall conform to the application.

B. Heating, Ventilating and Air-Conditioning System Common Materials:

   1. Steel Piping: Schedule 40 or standard weight is the default on water systems. Schedule 80 for steam condensate systems. Conform to ASTM A53/A53M for water service, A106 for steam service.

   2. Steel Pipe Fittings: Butt-welded standard. Conform to ASME/ANSI B16.9. Use socket-welded forged steel fittings for fuel oil, diesel fuel oil.

3. Copper Tubing: Conform to ASTM B88. Type “L” shall be the default minimum thickness, with Type K for buried service, oil service and limited instrumentation service (final connections to panel-mounted devices). Refrigerant service shall be ACR grade, washed, dried and capped. Type M or DWV weight will not be used. Fittings shall be wrought copper conforming to ANSI/ASME B16.18.

4. Red Brass Pipe and Fittings. Conform to ASTM B43-98(2004) for piping and ANSI/ASME B16.24-2001 for fittings. Use Sch. 40 or standard weight red brass pipe and fittings for mounting of gauges and instrumentation at pumps and motorized equipment. Soft copper is limited to final connections at panel-mounted devices. All steam devices shall have siphon loops/water seals. All devices shall be isolated with pet-cocks and impulse dampeners.

5. Sleeves, Hangers and Supports: Products by listed manufacturers in accordance with their listings. Refer to the table of manufacturers. Structural angles, channels and steel fabrications sized per ANSI/ASTM standards for pipe supports per size. All exterior devices to be hot-dipped galvanized, conforming to ANSI/ASTM A 123.

6. Identification Systems: Reference latest Williams College BIM standards and requirements.

7. Duct Liner/Wrap: Comply with the Massachusetts State Energy Code 780 CMR-13 minimum and not less than 1.5-inch thickness. Use rigid board type in finished spaces and mechanical rooms within eight (8) feet of the floor. Flexible wrap otherwise. Use UL Listed Fire Wrap systems where rigid rated enclosures are not practical.

C. Pipe Insulation: Comply with the Massachusetts State Energy Code 780 CMR-13 minimum per pipe size and temperature. Do not use less than 1.0-inch thickness without direction from the Williams College Project Manager. Pipe insulation shall be color-coded as follows:

- Lab hot water **- *Dark green***
- Lab hot water recirc **- *Dark green***
- Lab cold water **- *Light blue***
- Storm **– *Light green***
- Steam generator vent **– *Grey***
- Condensate receiver vent **– *Grey***
- Emergency tempered water **– *Purple***
- Condensate drains (gravity) **– *Grey***
- Clean Steam **– *Orange***
- Steam and Pumped Condensate ***- Gray***
- All Chilled Water loops **- *Dark Blue***
- All Heating Hot water Systems **- *Red***
- Domestic hot water incl. Recirc lines **- *Dark Green***
- Non-potable heating systems **- *Red***
- Steam **- *Orange***
- Condensate **- *Gray***
- Hot water supply - ***Red***
- Domestic hot water – ***Dark Green***
- Domestic cold water **– *Light Blue***

D. Applications-General

1. Application: Central heating systems.

a. Low-temperature hot water is preferred for new construction and renovations. Select emitters for supply hot water temperatures of not over 140 degrees F. and with as high a temperature drop as practical. The intent is to maximize efficiencies of all systems, especially condensing boilers and to make building systems compatible with their use, even if currently steam-source hot water or higher temperature hot water.

b. The use of District systems versus Local system shall be evaluated on a case-by-case basis. Each system shall be evaluated on its merits as a part of the basis of design.

c. Steam use for heating shall be consumed as efficiently as possible. The use of specific traps, details and applications to recover condensate shall be used.

d. The use of “district” systems takes priority over “local” systems. The sharing of capacity between adjacent or proximate buildings is encouraged over individual stand-alone plants. Each system shall be evaluated on its merits however.

2. Application: Central cooling systems.

    a. Chilled water is the preferred medium for comfort cooling where available and practical. The use of glycol, where unavoidable, shall be inhibited propylene glycol, pre-mixed to 30% by weight in water. Generally, this will be limited to systems relying on outdoor air-cooled chillers. Indoor-based systems shall use plain water with appropriate treatment.

    b. Depending on the capacity of each system, the descending preference for chilled water production shall be: Screw chillers with VFD-driven compressors, magnetic-bearing oil-free centrifugal compressors (“Carrier 23XRV”), variable-speed screw compressors, all water-cooled. Next tier would be air-cooled variable-speed magnetic-bearing oil-free centrifugal compressors, variable speed screw compressors, slide-valve screw compressors, digital scroll compressors, scroll compressors. An IPLV and LCC analysis based on estimated hours of operation is required to justify the selection.

    c. Special application cooling such as low-temperature or low-dewpoint systems shall be direct-expansion (DX) refrigerant or a combination of chilled water finished with a DX coil.

    d. The use of “district” systems takes priority over “local” systems. The sharing of capacity between adjacent or proximate buildings is encouraged over individual stand-alone plants. Each system shall be evaluated on its merits however.

3. Application: Central heating, ventilating and air-conditioning systems.

    a. Ideally, HVAC distribution using all air, variable air volume (VAV) is preferred in new construction. The use of static pressure reset, low coil and filter face velocities (400 fpm maximum), are desirable to minimize initial and operating power requirements.

4. Application: Decentralized heating, ventilating and air-conditioning systems.

    a. The use of decentralized HVAC systems is discouraged and not preferred. However, each system application shall rest on its own merits for quality and life-cycle cost.

5. Application: Modifications to existing heating, ventilating and air-conditioning systems.

    a. In general, a modification or renovation to a space within a larger building shall conform to the surrounding system standards. Extension from and re-use of existing sources shall be the default approach to ensure continuity of controls, servicing.

b. Exceptions: Consult with Williams College Facilities office for guidance. Some buildings may have long-range master plans which will trigger system upgrades and a decision will have to be made by Williams College.

6. Components: Suitable for Service:

a. Ground-mounted (as opposed to roof-mounted) equipment is preferred for service access whenever possible.

b. The following general points and criteria are typical guidelines and shall be reviewed at the beginning of each project between the Design Consultant and Williams College. Specific manufacturers, applications and project-specific requirements will govern. See Preferred Manufacturers Table for manufacturers or vendors.

1). Motors: EPACT or higher efficiency per Mass Energy Code. Use ECM motors for fractional motor applications where available. Premium high efficiency not required for emergency-duty motors.

2). Expansion fittings and loops: Use the natural bends and offsets where possible, constrained by guides and anchors. Use fabricated loops, guides and anchors where necessary. Use manufactured components, flexible joints only where the use of piping offsets and fabricated loops is impractical. Cycle life shall be not less than 50 years.

3). Meters and gages: Liquid-filled, Grade 1A conforming to ANSI/ASME B40.100-2005. 4-1/2" dial face. Install with petcocks and impulse dampeners, using red brass pipe.

4). General-duty valves. All valves shall be Quadax Valves manufactured by Co-Ax Valves, Inc., or an approved equal. Steam and condensate isolation: Gate valves, OS&Y pattern. Balancing: Multi-turn wye pattern with T/P ports. No ¼-turn balancing valves and no use of balancing valves for isolation.

5). Heat tracing: Limit use wherever possible. Thermostat control and alarmed failure. Connect make-up water within buildings and limit exposed piping to the weather.

6). Vibration and seismic controls: Per ANSI/ASTM B31E. Obtain current classification from structural engineer.

7). Identification devices: ANSI Standard A 13.1.

8). Anti-microbial coatings for HVAC ducts and equipment: Silver ion type. Confirm with Williams College Facilities Operations Group.

9). Anti-microbial ultraviolet emitters for HVAC ducts and equipment: UV-C emitters.

10). Testing, adjusting, and balancing devices. See respective valve and sheetmetal specialties.

11). Duct insulation. All duct insulation shall, at a minimum, meet standards set by all governing codes. See Preferred Manufacturers Table.

12). Piping insulation. All pipe insulation shall, at a minimum, meet standards set by all governing codes. See Preferred Manufacturers Table.

13). Instrumentation and control devices. See Preferred Manufacturers Table.

14). Facility fuel piping. Socket welded steel. Containment required for all buried and concealed piping, with leak detection.

15). Facility fuel pumps: Positive displacement gear-drive.

16). Facility fuel-storage tanks: Double-wall. Comply with NFPA-30, 527 CMR 4.00 and 9.00. UL-142 label. Facilitate all permits.

17). Hydronic Pumps: All hydronic pumps shall be Grundfos, or an approved equal. Demonstrate selections for lowest energy use for duty. Use VFD control responding to remote differential pressure for any variable flow closed systems. Use ECM wet rotor circulators for smaller duty pumps.

18). Steam and condensate piping and pumps: See Preferred Manufacturers Table.

19). Refrigerant piping: ACR grade, brazed under nitrogen purge.

20). Internal-combustion engine piping. Schedule 40 welded steel with Cal-Sil mineral insulation with cement finish.

21). HVAC water treatment: See Preferred Manufacturers Table for approved vendors. Also refer to 23 25 00 Water Treatment.

22). HVAC ducts and casings. Per SMACNA, galvanized G90 sheet metal as default standard. No gauge less than 24, no pressure class less than 2.0" WG. Higher pressures and different materials (e.g. Aluminum, stainless steel), as suitable to the installation and application.

23). Air plenums: Double-wall construction for ease of cleaning.

24). Air duct accessories. See Preferred Manufacturers Table.

25). HVAC fans. See Preferred Manufacturers Table. Select for optimum efficiency. Use variable speed or multi-speed fans as appropriate for lowest operating cost.

26). Special exhaust systems: As applicable to the installation.

a). Laboratory hoods to use 316 SS as a default minimum. Higher grades and finishes (e.g. 2B) shall be used where appropriate. Confer with user groups for all hoods. Comply with DEP reporting requirements. Also refer to 23 38 16 Fume Hoods.

b). Kitchen hood exhaust, comply with NFPA-96. Interlock fan to enable main cooking gas valve.

27). Air curtains: Full door coverage. Use sparingly in occupied spaces due to noise. Limit use to loading docks and similar back of house areas.

28). Air terminal units: Single-duct VAV with coils, access doors and integral attenuators, cleanable. DDC operation. Where night-time heating or constant volume is required, consider use of in-series fan powered boxes. Select for ultra-quiet operation. Use ECM motors where available.

29). Air outlets and inlets: See Preferred Manufacturers Table. Suitable to each application. For general use, "lay-in" type devices are preferred in grid ceilings.

30). Ventilation hoods: NSF listed for food preparation areas and are to be provided by others as Equipment Specialties. Ducting per NFPA-96. Laboratory hoods are to be provided by others as Equipment Specialties.

31). Particulate air filtration: MERV-8 minimum for any pre-filtration/first stage. MERV-8 combined with MERV-13 minimum is the default standard for any central air handling systems. Provide pressure drop monitoring for optimum change-out. Allow for filter loading in selection of air handling systems and state the assumed value. For medical, laboratory and other critical applications, MERV-17 or higher, including HEPA and ULPA filters may be required. Consult with User Groups.

32). Gas-phase air filtration: Activated carbon with MERV-8 minimum pre-filtration. Post-filtration dusting filters may be required.

33). Electronic air cleaners: Not recommended due to ozone generation.

34). Breechings, chimneys, and stacks: Conform to the appropriate appliance category I-IV. The use of UL-listed systems is preferred over field/shop fabricated systems. Use dual-wall insulated systems or dual-wall plus air space for higher temperature applications. Surface temperature shall not be more than 20 degrees above ambient when at full fire. Provide draft regulators as appropriate with spill switches to shut down appliances. See Preferred Manufacturers Table.

35). Heating boilers: Modulating/Condensing gas-fired low-temperature HW boilers at 95% efficiency are preferred. Use Category IV venting, AL29-4C. Avoid use of plastic venting unless a specifically engineered system provided by the manufacturer, (e.g. Polypropylene). Where impractical to use the preferred boilers and condensing is not practical, use the highest efficiency boiler in descending order of efficiency. Oil boilers (#2 oil), shall be multi-pass eutectic cast iron types with a minimum thermal efficiency of 87%. Use modulating burners wherever available for all boilers.

36). Heating boiler feedwater equipment: Limited to steam production. See Preferred Manufacturers Table. Use sparger pre-heating for high pressure steam. Include deaerators where make-up water exceeds 1% of through-put.

37). Furnaces: Limited use at Williams College. Confer with project manager.

38). Fuel-fired heaters. Limited use at Williams College. Confer with project manager.

39). Solar energy heating equipment: Collectors to be vacuum tube type, not flat plate. Consider multiple modalities such as domestic water, heating pre-heat, summer re-heat. Provide all controls. Collectors shall have SRCC OG100 certification and complete systems OG-300 certification to assure rebate collection and overall system quality control.

40). Heat exchangers: ASME stamped. Use plate and frame exchangers for water to water applications, shell and tube or plate and frame for steam to water applications. Select materials according to duty. At a minimum, plate exchangers shall be 316 stainless steel. Shell and tube shall be carbon steel shell and CuNi 90/10 tubes and sheets for longevity.

41). Refrigerant compressors: Avoid reciprocating compressors. Use the highest efficiency stock compressors, hermetic and semi-hermetic scrolls, digital scrolls or variable-speed inverter driven scrolls consistent with the application.

42). Packaged compressor and condenser units. See Preferred Manufacturers Table. Selections to be matched to the evaporator by the manufacturer and certified per ARI. Select at 95F ambient when on grade and 105F ambient when on roofs. Provide suitable bases and snow/wind baffles. Provide low-ambient controls to zero degrees F. where 24/7/365 cooling is required.

43). Refrigerant condensers. Typically packaged as part of condensing units. Limited application at Williams College. All used shall be ARI certified for capacity.

44). Refrigeration Specialties: See Preferred Manufacturers Table.

45). Packaged water chillers: See Preferred Manufacturers Table and Applications section above.

46). Cooling towers: Open towers, induced draft types are preferred for lower energy and noise. Use closed circuit evaporative towers only where necessary. Water basins to be 304 stainless steel as a minimum. Consider use of all stainless steel, coating upgrades, FRP construction, each as suitable to a given installation. All galvanized parts shall be G-235 minimum. Provide automated chemical treatment for open systems and keep make-up water fill point indoors within heated space. Protect storm systems from discharge. Use sanitary.

47). Thermal storage: Water tanks are preferred, stainless steel with 2" thick R-13 total minimum insulation. Limited use at Williams College.

48). Air-to-air energy recovery equipment: Total energy recovery (enthalpy recovery) wheel types are the default type. Use sensible-only where airstreams are contaminated. Enthalpy wheels shall be segmented for service, cleaning or replacement.

49). Cooling Coils-Chilled Water and DX: Stainless steel casings. Aluminum fins on copper tubes standard. Use heavy-weight (0.035" minimum) wall return bends on coils. ARI certified selections.

50). Heating Coils: Hot Water: Aluminum fins on copper tubes standard. Use heavy-weight (0.035" minimum) wall return bends on coils. ARI certified selections. Use stainless steel casings when coils are in the reheat position. Otherwise G120 16 GA galvanized casings.

51). Heating Coils: Steam: Vertical-tube integral face and bypass types preferred. Non-freeze type, tube in tube otherwise, where IFB will not fit. Use vacuum breaker. Provide sufficient height to allow trapping.

52). Indoor central-station air-handling units: Double-wall solid in/out. Stainless steel IAQ drain pans.

53). Packaged outdoor HVAC equipment: See Preferred Manufacturers Table. Use only where other systems are not practical, to reduce maintenance.

54). Custom-packaged indoor and outdoor HVAC equipment: See Preferred Manufacturers Table.

55). Evaporative air-cooling equipment: Stainless steel basins. See Preferred Manufacturers Table.

56). Decentralized unitary HVAC equipment. See Preferred Manufacturers Table. Limited application at Williams College, to replacements. Consider alternate means of serving space by central systems.

57). Radiation and Convectors: Select for low water temperatures (e.g. 140F supply) with average water temperatures of 130F or lower, consistent with long-term goals. See Preferred Manufacturers Table.

58). Radiant heating units. See Preferred Manufacturers Table. Limited application at Williams College.

59). Other Equipment Not Listed: Specific to the Application. The Design Consultant Shall Advise.

Preferred Manufacturers Table

Items	Manufacturer
Motors:	Baldor, Siemens, General Electric
Expansion fittings and loops:	MetraFlex, American Boa, Flexonics
Meters and gages:	Ashcroft, Trerice, Winter
General-duty valves.	• Ball valves (water duty): Conbraco/Apollo, Watts • Ball valves (steam duty): Quadax • Gate and globe valves (water, steam and condensate duty): Quadax • Natural gas 2-1/2” and larger: Rockwell
Heat tracing:	Thermon
Vibration and seismic controls:	Mason Industries, Kinetics Noise Control, Amber-Booth
Identification devices:	Seton, Atlantic Engraving, Brady, MSI
Anti-microbial coatings for HVAC ducts and equipment:	Ag-Ion
Anti-microbial ultraviolet emitters for HVAC ducts and equipment:	UVDI
Testing, adjusting, and balancing devices.	• Balancing Valves: Belimo PICCV • Balancing Dampers: Ruskin • Remote wireless or wired balancing dampers: United-Enertech, Metropolitan Damper
Duct insulation.	Manville, Certain-Teed, Knauf, Owens-Corning
Piping insulation.	Knauf, Certain-Teed

Instrumentation and control devices.	Setra, Mamac, various to application
Facility fuel piping specialties	Preferred Utilities, Kerotest, Hayes Pump
Facility fuel pumps:	Viking, Hayes Pump, Preferred Utilities
Refrigerant specialties:	
Hydronic Pumps:	• Horizontal Split Case: Grundfos or approved equal • Horizontal End-Suction: Grundfos or approved equal • Vertical Split Case: Grundfos or approved equal • In-Line, Coupled: Grundfos or approved equal • Small Wet-Rotor Multiple Speed: Grundfos or approved equal • Small Wet Rotor Variable Speed ECM: Grundfos or approved equal
Steam and condensate specialties	Spirax-Sarco, Tunstall, ITT Hoffman, Illinois
Refrigerant piping:	Mueller, Wolverine Brass; NIBCO fittings,
Water piping, copper	Mueller, Wolverine, NIBCO fittings
Water & Steam pipe & fittings, steel	U.S. Pipe, Wheatland, Hackney-Ladish, Ward
Air duct accessories.	Hardcast sealants. Ductmate, Ruskin
Exhaust/return fans	Loren Cook, Twin City, Carnes
Special exhaust systems (labs)	Tec Air, Phoenix Valves (laboratories)
Air curtains:	Mars, DynaForce
Air terminal units:	EnviroTec, Price, Tuttle and Bailey, Titus
Air outlets and inlets:	Tuttle and Bailey, Price, Seiho, Air Concepts
Sound Attenuators	Vibro-Acoustics, IAC, Price Noise Control
Particulate air filtration:	Flanders, Cam-Farr, Purolator
Gas-phase air filtration:	Flanders, Cam-Farr
Breechings, chimneys, and stacks:	Van Packer, Selkirk-Metalbestos, Security Chimney
Heating boilers: Modulating/Condensing gas-fired Oil boilers (#2 oil),	Depending on capacity: Viessmann, Triangle-Tube, Buderus, Lochinvar, Aerco. Oil: Viessmann, DeDietrich, Buderus, Burnham MPO.
Heating boiler feedwater equipment:	Skidmore, Shipco, Flotronics
Air elimination	Spirovent
Furnaces:	Reznor, Cambridge Engineering
Fuel-fired heaters.	Reznor, Cambridge Engineering
Solar energy heating equipment:	Oventrop, Caleffi, Viessman
Heat exchangers:	Shell and Tube: Taco, B&G, John Wood Co. Plate and Frame: Alfa-Laval, B&G
Refrigerant compressors:	Copland, Tecumseh, Mitsubishi
Packaged compressor and condenser units.	Match to evaporators by manufacturer: York, McQuay, Carrier
Refrigerant condensers.	Larkin
Refrigeration Specialties:	Sporlan, Mueller, Rawal APR
Packaged water chillers:	York, Smardt, McQuay, Carrier
Cooling towers:	BAC, Marley, Frick, Recold

Thermal storage:	Heat Transfer Products, Taco
Air-to-air energy recovery equipment:.	Venmar, Air-X-Change, Novell-Aire, Wing
Cooling Coils-Chilled Water and DX:	Heatcraft, Aerofin, Precision Coil or by AHU manufacturer.
Heating Coils: Hot Water in unit	Heatcraft, Aerofin, Precision Coil or by AHU manufacturer.
Heating Coils; Hot Water in duct	TSI, Heatcraft, Precision Coil, McQuay
Indoor central-station air-handling units:	York Solution, McQuay Vision, Trane MCC, Carrier
Packaged outdoor HVAC equipment:	Trane, Carrier, York Solution, McQuay Vision
Custom indoor and outdoor HVAC equipment:	Cambridgeport Air Systems, Custom Air Solutions
~~Evaporative air-cooling equipment:~~	
Decentralized unitary HVAC equipment.	To be reviewed and approved by Williams College Facilities Operations Group.
Radiation and Convectors:	Vulcan, Rittling, Stirling, Runtal, Buderus with Oventrop thermostatic control valves, or approved equal
Radiant heating units.	Co-Ray-Vac, Detroit Radiant
Propress Type Fittings	Press Type Fittings for Piping: Viega ProPress and Viega MegaPress fittings are acceptable for use on piping systems if they have been verified by the manufacturer for the intended use. System applications shall conform to manufacturer's published applications and parameters. Installation shall conform to manufacturer's instructions. Applicable service types include chilled water, hydronic heating, fire sprinkler, low pressure steam, natural gas, LP gas, compressed air, and vacuum.
Other Equipment Not Listed:	Specific to the Application. The Design Consultant Shall Advise. Approval by Williams College Facilities Operations Group required.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials in proper relation with adjacent construction and with uniform appearance for exposed work. Coordinate with work of other sections. Comply with applicable regulations and code requirements. Provide proper clearances for servicing.

B. Support piping properly. Pitch to drain points. Install with pipe expansion loops, mechanical expansion joints, and anchors.

C. Install shutoff valves, vents and drain valves plus unions or flanges on each piece of equipment on both return supply. Include appropriate "hook-up" valve trains for each.

D. Install ductwork in accordance with SMACNA recommendations as appropriate to each application. No pressure class shall be less than 2.0 inches W.G. and shall have greater pressure classes as appropriate to the systems. No sheet metal gauge shall be less than 24 gauge. Seal duct seams with sealer to "Seal Class A./Leakage Class 3" as a default standard. Higher standards may apply per the application. Provide balancing dampers in all low-velocity branches and in all branches of open systems. Provide fire dampers and automatic smoke and fire dampers where required. Provide flexible connectors and inlet and discharge connections. Duct systems shall be “fabricated cleanly”, conforming to SMACNA standards for IAQ management and including shrink-wrapping of ductwork pending installation.

E. Clearly label and tag all components with permanent engraved tags and labels conforming to ANSI standards.

F. Test, adjust and balance (TAB) all systems for proper operation. TAB contractors shall be members in good standing of NEBB, AABC, SMACNA or other approved certification organizations, employing standard forms and procedures from those organizations. All TAB contractors shall report directly to the Commissioning Agent assigned to a given project.

G. Restore damaged finishes. Clean and protect work from damage.

H. Instruct Owner's personnel in proper operation of systems and provide Operations and Maintenance Manuals (O&M’s) on flash drive in searchable PDF format.

END OF SECTION

SECTION 23 01 30.51
HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

B. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

PART 3 EXECUTION

A. All newly installed ductwork, altered ductwork, or ductwork contaminated by maintenance, construction, or alterations, new installations, or alterations shall be inspected and cleaned per the National Air Duct Cleaning Association (NADCA)'s standard, "Assessment, Cleaning and Restoration of HVAC System – ACR2013"

B. Follow manufacturers' or associations' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

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Note to designer:

INTRODUCTORY INFORMATION
The purpose of this standard is to assist the specifier in correctly specifying Mechanical System Testing Adjusting and Balancing.

The term “Architect” is used throughout these guide specifications only as a guide and may be edited to read “Design Professional”, “Engineer”, “Owner”, or other appropriate designations as required for the specific project.

COORDINATION WITH DIVISION 01: Specifier should coordinate work of this section with each Division 01 – General Requirement Sections that address testing. In cases where the Division 01 – General Requirements are not provided by the Specifier editing this Section, ensure coordination is addressed by requesting a copy of the Division 01 documents edited for the project from the provider. Sections that may include conflicting information are as follows:

Section 00 02 00 – Sustainability Goals
Section 01 10 00 – General Requirements
Section 01 90 00 – Commissioning

Additionally, the Specifier needs to be aware that the above listed section numbers and titles are generic in nature, as well as in the best interest of the project to review all project-specific Procurement and Contracting Requirements and General Requirements.

Specifier should consider including the following language in the Quality Requirements Specification Section of Division 01. Language may also be appropriate for inclusion in the other Division 01 Sections as “Starting and Adjusting,” and the “HVAC Commissioning Requirements.”

“Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy the qualification requirements indicated. Specialists and related requirement shall include:

1. All Certification programs must be endorsed by a nationally recognized organization.”

****

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, Adjusting, and Balancing of:

1. Air condition equipment including air distribution devices, supply ducts, air handling units, condensing, units, fans, coils, and related equipment.
2. Hydronic systems including pumps water distribution systems, chillers, boilers, heat exchangers coils and related equipment.

1.02 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 111 – Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
B. Testing, Adjusting, and Balancing Bureau (TABB) - International Standards for Environmental Systems Balance
C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) HVAC Systems - Testing, Adjusting, and Balancing.
D. Associated Air Balance Council (AABC) – National Standards for Total System Balance.
E. National Environmental Balancing Bureau (NEBB) – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.03 DEFINITIONS

A. Adjusting: Varying of system flow by modifying settings of dampers and valves, in combination with varying fan speeds to obtain optimum operating conditions for the entire system.
B. Balancing: Proportioning of air and hydronic flows through system mains, branches, and terminal devices using standardized procedures to obtain specified air or hydronic flow while imposing the least amount of restriction on the HVAC system.
C. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristic, air and hydronic flow in velocities or quantities used in evaluating the performance of a HVAC system.

1.04 SUBMITTALS

A. All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College PMIS.
B. Qualification Statements
    1. All technicians must be TABB certified. Submit companies' certification documents including
        i. Contractor Certification
        ii. Supervisor Certification
        iii. Technician Certification
    2. Submit name of testing agency to Owner within 30 days of Notice to Proceed.
    3. Submit list of projects completed by testing agency of similar size, scope, and equipment.
    4. Include name of Contractor and Building Owner contacts.

C. Reports
   1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting, and balancing of systems and equipment to meet specified performance.
   2. TAB Report: Submit one hard copy and one electronic copy of the complete testing, adjusting and balancing report, including any drawings indicating air outlets, thermostats, and equipment identified to correspond with data sheets.
      i. Reports shall be on TABB/SMACNA, NEBB, or AABC, forms that indicate information addressing each of the testing methods, readings, and adjustments.

D. Closeout Submittals
   1. Provide complete copy of testing, adjusting, and balancing report. (Include report in Operation and Maintenance Manual submitted through Williams College PMIS.)

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Testing and Balancing shall be performed by a testing agency who specializes in testing, adjusting, and balancing of heating, ventilating, air-moving equipment, air conditioning systems and hydronic systems and has a minimum of one-year experience.
   2. Testing agency shall have successfully completed a minimum of five projects, similar in size and scope.
   3. Testing agency shall be a certified member of TABB, AABC, and/or NEEB.

B. Maintain a copy of applicable standards at the project site.

C. Certifications
   1. TAB Technician shall be certified by a nationally recognized certifying agency.

D. Perform total system balance in accordance with Testing, Adjusting, and Balancing Bureau (TABB) – Quality Assurance Program for Environmental Systems Balance, AABC National Standards for Field Measurement and Instrumentation and/or Total System Balance and/or NEBB Quality Assurance Program – Conformance Certification).

1.06 PROJECT CONDITIONS

A. Testing, adjusting, and balancing shall commence after HVAC systems installation is complete and in working order. Associated areas of general construction shall be in place including interior and exterior doors, windows, walls, and ceilings.

1.07 SPECIAL WARRANTY

A. Provide warranty for period of 180 days following submission of completed report, during which time, Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.

B. Warranty shall meet the requirements of the following program(s):
   1. TABB – International Quality Assurance Program
   2. AABC – National Project Performance Guarantee
   3. NEBB – Conformance Certification

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to commencing the testing, adjusting, and balancing of environmental system(s), verify the following conditions without limitation:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed, complete, and operable.
   3. Automatic and manual dampers are operable and fully open.
   4. Thermal overload protection is in place for fans, pumps, chillers, and other equipment.
   5. Startup air filters are removed
   6. Final filters are clean and properly installed.
   7. Duct and fan systems are clean.
   8. Fans are rotating correctly.
   9. Fire and volume dampers are in place and open.
   10. Air coil fins are cleaned and combed.
   11. Access doors are closed and duct end caps are in place.
   12. Air outlets are installed and connected.
   13. Hydronic systems are pressure tested, flushed, filled, and properly vented.
   14. Leak testing on duct system has been performed in accordance with SMACNA standards or as specified.
   15. Pumps are rotating correctly.
   16. Start-up/construction strainers have been removed and all permanent strainers are clean and in place.
   17. Gauges and/or test ports are properly located for balancing.
   18. Service and balance valves are fully open.

B. If deficiencies are evident, submit Deficiency Report to Commissioning Agent, Architect/Engineer, and Owner. Do not begin testing, adjusting, and balancing of environmental systems until deficiencies have been remedied.

3.02 SITE TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate.
B. Air Outlets and Inlets: Adjust total to within plus 10 percent or minus 10 percent of design for the space.
C. Hydronic Systems: Adjust to within 10 percent of design flow.
D. Hydronic terminal devices: Adjust to within plus or minus 10 percent of design flow.

3.03 AIR SYSTEMS PROCEDURE

A. Adhere to the follow procedure:
   1. TABB – HVAC Testing, Adjusting, and Balancing International Standards; with particular focus on the following chapters:
      a. Preliminary TAB procedures
      b. General air systems TAB procedures
      c. TABB procedures for specific VAV, CAV, Multizone, Dual duct, and other air systems
   2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) HVAC Systems - Testing, Adjusting, and Balancing.
   3. NEBB – Procedural standards for TAB of environmental systems.
   4. AABC – National standards for total systems balance.

B. Minimum air procedures should include without limitation the following:
   1. Test and adjust fan RPM to design requirements.
   2. Test and record motor full load nameplate rating and actual ampere draw.
   3. Test and record system static pressures, fan suction, and discharge.
   4. Adjust all main supply and return air duct to within tolerances of proper design CFM.
   5. Test and adjust each diffuser, grille, and register. Reading and tests of diffusers, grilles, and registers shall include design velocity (FPM) and adjusted velocity, design CFM, and adjusted CFM.
   6. Test and record outside, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
   7. In coordination with the ATC contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
   8. Test and adjust air handling and distribution systems to provide required or design supply, return, outside, and exhaust air quantities within design tolerance.
   9. Make air velocity measurements in ducts by Pitot tube traverse entire cross sectional area of duct in accordance with SMACNA equal area method or Log Linear method.
   10. Measure air quantities at all air inlets and outlets.
   11. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels.
   12. Vary total system air quantities by adjustment of fan speeds. Provide drive changes recommendations. Vary branch air quantities by damper regulation.
   13. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for loading of filters and coils.
   14. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances.
   15. Where modulating dampers or economizers are provided, take measurement at full return air, minimum outside air, and100 percent outside air mode of operation.

3.04 HYDRONIC SYSTEM PROCEDURE

A. Adhere to the follow procedure:
   1. Testing, Adjusting, and Balancing Bureau (TABB) - International Standards for Environmental Systems Balance
   2. SMACNA – HVAC Testing, Adjusting, and Balancing International Standards; with particular focus on the following chapter:
      a. Hydronic TAB procedures
   3. NEBB – Procedural standards for TAB of environmental systems.
   4. AABC – National standards for total systems balance.

B. Hydronic balancing shall include the following minimum data:
   1. Prepare itemized equipment schedules listing all heating and/or cooling elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating and/or cooling elements, all zone balancing valves, and circuit pumps, ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions, and measured conditions. Prepare individual pump report sheets for each zone or circuit.
   2. Adjust hydronic systems to provide plus or minus 10 percent of required design quantities.

3. Use calibrated Venturi tubes, orifices, metered fittings, pressure gages, and direct reading instrumentation to determine flow rates for system balance. Where flowmetering devices are not installed, flow balance on temperature difference across various heat transfer elements in the system is acceptable.
4. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
5. Effect system balance with automatic control valves fully open to heat or cooling transfer elements.
6. Adjust hydronic distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point. See Appendix II
7. Test pumps and adjust flow. Record the following on pump report sheets:
    a. suction and discharge pressure;
    b. running amps and brake horsepower of pump motor under full flow and no flow conditions; and
    c. pressure drop across pump in feet of water and total GMP pump is handling under full flow conditions.
    d. Verify pump operation on pump curve – perform dead head test and full flow test.
8. Where available pump capacity is less than total flow requirements or individual system parts, proportional balancing must be performed.

3.05 ADJUSTING

A. Recorded data shall represent actual measured or observed conditions.
B. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
C. Leave systems in proper working, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

END OF SECTION

SECTION 23 22 00
STEAM AND CONDENSATE PIPING AND PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. Provide low and medium pressure steam distribution equipment for use on the campus steam distribution system.

B. Operating Standards:
1. Heat for Williams Campus buildings shall be provided from the central steam distribution system, unless an alternate heating source is specifically approved by Williams Facilities Operations.
2. Low Pressure is 15 psig or less. Medium pressure is 15-75 psig. High pressure is 75 or greater.
3. Steam distribution pressure is variable throughout the school year. When generating, pressures will range between 15 psig and 18 psig. When not generating, pressures will range between 6 psig and 18 psig. Building steam pressure should be verified and may or may not be regulated.
4. Normal operation- Availability of steam from the Central Plant should be confirmed with Williams College Facilities Operations.
5. Other means for hot water generation during summer season must be provided if required.
6. Piping design shall be sized, sloped, and trapped for saturated steam.
7. Appliances that use steam directly such as ovens or humidifiers shall be indirect type (steam to steam). Manufacturer and model to be reviewed and approved by Williams College Facilities Operations.
8. Steam Distribution piping is to be installed in tunnels, trenches, or direct bury (with approval of Williams Facilities Operations).
9. Loops are the preferred method of expansion compensation. Where space constraints dictate otherwise, use package slip type or ball type with approval of the Williams Facilities department).
10. Changes in direction of underground piping and trenches shall be performing utilizing a pre-cast structure with a H-20 manhole cover to grade. Manhole cover shall be a 36" Fiberlite cover. All manholes shall have a 4" drain to the nearest drain line and shall be vented. The gravity drain shall have an inline check valve: 4" rectorseal clean check backwater valve. Regardless of a new tunnel, pre-cast trench or direct burial - there should be a 4" perforated drain line that is installed beneath to drain water away from the buried system.

PART 2 PRODUCTS

1.1 MATERIALS

A. Equipment Standards:

1. Shutoff valves on steam mains 2" and larger shall be Quadax butterfly valve; double flange and wheel operator, brass packing adapter, steel packing gland adapter, malleable iron bonnet, stainless steel non rising stem, alloy steel cap screws, soft iron bonnet gasket, and ASTM A-216 steel body.
2. A warm-up bypass shall be installed on all medium-and high pressure steam shutoff valves, using two properly sized (½" to 1 ½") high-pressure ball valves in series, two unions, and an expansion offset. Each valve shall have a blow down on either side for

use during warm up.

3. Pipe:
   a. 2½ inches and Smaller:
      1) 1. Pipe: ASTM A312, 304L, Schedule 40S, seamless stainless steel.
      2) 2. Fittings: ASTM 182, Gr. F304, ASME B16.11, 3000 lb socket-weld.
      3) 3. Unions: 3000 lb socket-weld, stainless steel ground joint.
   b. 3 inches and Larger:
      1) 1. Pipe: ASTM A312, 304L, Schedule 40S, seamless stainless steel.
      2) 2. Fittings: ASTM A403, Gr. WP, Class S or Class W, ASME 16.9.
      3) 3. Flanges: ASTM A182, GR. F304, ASME B16.5, 150 lb std. with 1/16” raised face, serrated face finish and welding neck.
      4) 4. Bolts: Stud bolts, ASTM A193, Gr. B7.
      5) 5. Nuts: ASTM A194, Gr. 2H.
4. Pipe Insulation:
   a. Install with materials, thickness, and jacketing per the following. Mineral wool or calcium silicate must be used where flooding is possible.
      1) Low Pressure Service (Less than 15 Psig): 2-1/2 inch and smaller pipe size, use 1-1/2-inch fiberglass, white ASJ jacket.
      2) Low Pressure Service (Less than 15 Psig): 3 inch and large pipe size, use 2-inch fiberglass, white ASJ jacket.
      3) Medium Pressure Service (18-22 Psig): 2 inch and smaller pipe size, use 2-inch fiberglass, PVC or aluminum jacket.
      4) Medium Pressure Service (18-22 Psig): 2-1/2 inch to 4-inch pipe size, use 2-1/2-inch fiberglass, PVC or aluminum jacket.
      5) Medium Pressure Service (18-22 Psig): 6 inch and larger pipe size, use 3-inch fiberglass, PVC or aluminum jacket.
      6) Condensate: All pipe sizes, use 1-inch fiberglass, jacket same as steam pipe.
   b. Jacketing in high traffic areas shall be covered with aluminum or PVC. Install galvanized shields in tunnels and mechanical rooms where pipes may be walked on.
   c. Valves shall have extended handle stems so all operators or handles are outside of the insulation system.
   d. Serviceable valves and fittings shall have removable jacketed insulation with heat transfer properties equivalent to the adjoining insulation.
5. Precast Steam Trench: inverted design for H20 loading with minimum internal dimensions 30” wide by 24” high. Trench covers shall be 4000-psi concrete, precast in channel section with 5” walls and 6” roof, minimum. Trench bottom shall be continuous reinforced cast in place concrete. All joints (between covers and between covers and base) shall be gasketed with non-shrink grout cover.
6. Direct bury piping: factory fabricated pre-insulated piping system designed in accordance with ANSI B31.1. System shall be drainable and dryable, designed to minimize number of welds. Carrier pipe shall be Sch. 40 carbon steel for steam and Sch. 80 for condensate with welded joints. Insulation shall be mineral wool that has passed federal agency boiling test. Outer casing shall be urethane coated steel (10 gauge minimum). Fully sleeved internal pipe supports shall be 10’ on center minimum, designed for full air flow, drainage, and thermal/electrical isolation. Casing integrity shall be verified with 15 psig air test, pipe shall be tested to 150 psig or 1.5 times the operating pressure whichever is greater. Provide cathodic protection as required. Approved

Manufacturers are Perma-Pipe Multi- therm 500 or approved equal by Thermacor Duo-Therm 505.

   a. Provide an electronic leak detection system compatible with the piping system, and acceptable to Owner.
   b. Leak detection system must tie into the Williams College BMS.

7. Changes in direction of underground piping and trenches shall be performed utilizing a pre-cast structure with a H-20 manhole cover to grade. Manhole cover shall be a 36" Fiberlite cover. All manholes shall have a 4" drain to the nearest drainline and shall be vented. The gravity drain shall have an inline check valve: 4" rectorseal clean check backwater valve. Regardless of a new tunnel, pre-cast trench or direct burial - there should be a 4" perforated drainline that is installed beneath to drain water away from the buried system.
8. Traps in low pressure steam systems shall be float and thermostatic type: Sarco #FT-15 or approved equivalent by Illinois, Armstrong, or Hoffman.
9. Traps in medium pressure steam systems (15-75 psig) shall be inverted bucket type with internal check valve and thermostatic air vent. Illinois series G of equal by Armstrong, Hoffman and Sarco.
10. Press-type fittings for piping are not acceptable for steam distribution.

END OF SECTION

SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SUMMARY

A. Provide water treatment for new systems including the following:
   1. Water system pre-cleaning.
   2. Closed loop systems treatment.
   3. Condenser water systems treatment.
   4. Chiller testing and certification.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 WATER SYSTEM PRE-CLEANING

A. General: The contractor shall coordinate HVAC water treatment with the College's current water treatment contractor to provide chemicals and labor for the pre-operational cleaning of all condensers, chilled water, hot water and related equipment.

B. Preparation for clean-out: All systems must be prepared prior to the introduction of the chemical cleaner.
   1. All systems shall be flushed, including mud from drop legs prior to chemical cleaning. The cooling tower basin must be free of mud, silt and construction debris. Remove, clean and replace all strainers. All systems shall contain the highest quality of water available.
   2. Complete circulation must be achieved during the cleaning procedure. All manual, electrical, air and thermostatic operated valves must be open. All dead end runs must be looped together with piping not less than 1/3 the size of the run. This piping is to remain in place after cleaning.
   3. A minimum of 1-1/2" ball or gate valve is to be permanently installed in the low point of each system for the purpose of draining each system.
   4. The cleaner shall not require external heat to ensure its effectiveness.
   5. The cleaning solution shall be formulated to remove light grease, cutting oils, rust, loose mill scale, organics and extraneous construction debris. Please provide cleaning procedure. The treatment company must follow the tower manufacturer's recommendations for proper cleaning, passivation, and protection from white rust. If there are no manufacturer's recommendations, and a galvanized tower is installed; the cleaner will be of a neutral pH, and at no time should the tower water pH be greater than 8.0.
   6. Use the water meter to record the volume of each system during the first fill.

C. Pre-Cleaning:
   1. For a cooling tower, maintain the lowest level possible in cooling tower sump.
   2. Add recommended quantity of chemical directly to tower sump or closed system. Refer to MSDS sheets for safety information.
   3. Circulate system for 16-24 hours.
   4. Open and drain mud legs and low points periodically during the cleaning process.
   5. Drain system completely paying particular attention to mud from drop legs and all low points.
   6. Refill with clean, potable water, clean all strainers, circulate and drain completely. Repeat as

many times as necessary to remove all cleaner, oils, and iron. The system shall be considered clean when the water meets the following parameters with respect to the make-up water: Iron levels within 1ppm, conductivity within 10 mmhs, ortho-phosphate within 1 ppm, and turbidity within 1 FTU.

7. Refill system. Water treatment representative to test water prior to the addition of corrosion inhibitor. They are to confirm that cleaner has been removed and iron levels are below 1 ppm. The length of time between the completion of the cleaning procedure and corrosion inhibitor addition shall not exceed twenty-four (24) hours.
8. A document certifying that the systems have been cleaned in accordance with the above procedure shall be signed by the mechanical contractor representative and the water treatment representative. A copy of this "Certification of Cleaning" shall be forwarded to the owner.

3.2 CLOSED LOOP SYSTEMS TREATMENT

A. General: Contractor will furnish and install all equipment, chemicals and service necessary to provide a complete water treatment program. A single water treatment company shall provide all products and services for undivided responsibility throughout the warranty period. The water treatment company shall be a recognized specialist in the field of industrial water treatment for a minimum of ten (10) years. This company shall have a technical service representative located within a 2-hour drive of the job site.

B. Chemical Feeding Equipment (hot or chilled water): For each closed system the contractor shall provide and install the following apparatus (including isolation and drain valves).

1. One shot feeder/filter (combination unit), minimum five gallon capacity with quarter turn cap and 3-1/2" opening. The feeder shall be rated for at least 200-psi service. Provide a minimum of six, 20 micron filter bags. Filter/feeder will be installed with isolation valves and across the recirculating pumps for full flow. It will be positioned such that it has flow regardless of which recirculation pump is in operation. Use Neptune FTF-5 or equal. Neptune Pump Company (215) 699-8701
2. One water meter, dedicated to each closed system, positioned in a utility room, at height to allow easy access and for reading without a ladder.
3. One four-position corrosion coupon rack with coupon holders and flow meter.

C. Water Treatment Chemicals:

1. Furnish one year's supply of the recommended chemical formulas for control of scale, corrosion and biological growth in the closed recirculating systems. Materials must provide a corrosion rate of 0.5 mpy or less on mild steel, and 0.1 mpy on copper, or better. Biological populations must be maintained below 1000 organisms per ml.
2. If copper materials are present in the system, the treatment will include tolytriazole levels of at least 5 ppm for the first 6 months.
3. Formulations shall not contain any ingredients, which may be harmful to system materials of construction. Provide MSDS sheets on all chemical products.
4. No system shall be operated without the benefit of chemical protection. Once the recommended chemical residual is achieved, any additional chemicals required to re-treat the system due to water loss or to accomplish other work shall be provided by the Mechanical Contractor.

D. Test Equipment: Furnish basis water test equipment for maintaining control of the program standards in the closed loop system. Test kit will include reagents and apparatus for the determination of corrosion inhibitor level in the closed loop system. Furnish corrosion coupons to monitor program effectiveness. Corrosion coupons will be analyzed by water treatment company’s laboratory and reported at the recommended intervals.

E. Water Treatment Service Program: The water treatment program shall include all consulting services for a period of one year from start-up of the Closed Loop systems. The program shall include:

1. Installation and system start-up procedure recommendations.
2. Two sets of 60-day corrosion coupon data verifying that the specified corrosion coupon results have been met during the first year of operation. A set is defined as one coupon for each major metallurgy in the system.
3. Bi-monthly biological testing results verifying that the biological growth parameters have been met.
4. Training of operating personnel on proper feeding and control techniques.
5. Bi-monthly field testing, service and consultation meetings. A written report of each service visit is required. Monthly tests must include inhibitors, conductivity, pH, iron, copper, and bacteria.
6. Any necessary log sheets and record forms.
7. A copy of all MSDS sheets and all control limits for each system must be displayed at the chemical feed location. The limits must include the maximum and minimum LSI for products used.
8. Any required technical assistance
9. All services will be provided by a qualified, full-time representative.

3.3 CONDENSER WATER SYSTEMS TREATMENT

A. General: Contractor will furnish and install all equipment, chemicals and service necessary to provide a complete water treatment program. A single water treatment company shall provide all products and services for undivided responsibility throughout the warranty period. The water treatment company shall be a recognized specialist in the field of industrial water treatment for a minimum of ten years. This company shall have a technical service representative located within a 2-hour drive of the job site.

B. Chemical Feeding and Control Equipment – Condenser System: Contractor shall install the following apparatus (including all external piping and wiring).

1. One -- complete microprocessor-based conductivity controller designed to control conductivity and chemical feed in cooling towers. The unit will have the following features.
   a. Blowdown of system water by valve control based on Conductivity setpoint.
   b. Conductivity range should be 0 – 2,000 or greater.
   c. Rising or Falling conductivity trip points
   d. Feed of chemical (inhibitor) will be based on flow meter input.
   e. Dual biocide addition accomplished by the use of two (2) individually programmable relays.
   f. Biocide lockout timer.
   g. 28-DAY programmable timer (1, 2, 3, or 4 week selectable cycle) for biocide addition.
   h. Alarm indicators and relay outputs that are energized based on the following conditions: high conductivity set point is reached, low conductivity set point is reached, and “no flow” condition exists (flow switch must be installed).
   i. The display is a 16-character backlit LCD (liquid crystal display) which is visible in all light conditions.

j. 4-20 mA non-isolated recorder output.

k. The unit should be an LMI DC4500 or a (unit comparable) with option 34752 (that includes probe, assembly, manifold, flow switch, sample cock, and cable); or equal.

2. Three (3) -- chemical feed pumps of the positive displacement type, with ball-type check valves and necessary polyethylene discharge tubing for the feed of corrosion inhibitor and two biocides. Pump materials of construction shall be compatible with chemicals being used. Chemical pumps should be, solenoid driven and include pressure relief anti-siphon valve. Chemical pumps should be LMI P1-series or equal. The liquid bromine pump will be equipped with a de-gassifying head.
3. One -- water meter complete with dry contacting register sized to meter twice the volume of the maximum make-up of the system.
4. One -- pre-piped bleed-off piping assembly consisting of inlet shut-off valve, wye strainer, flush valve, throttling valve and O PSI differential brass solenoid valve. Bleed-off piping assembly shall be sized to bleed twice the maximum bleed-off rate of the system.
5. One -- Four-position corrosion coupon rack with coupon holders and flow meter.

C. Water Treatment Chemicals:

1. Furnish one year's supply of the recommended chemical formulas for control of scale, corrosion and biological growth in the closed recirculating systems. The treatment must provide a corrosion rate of 1.0 mpy or less on mild steel, and 0.1 mpy on copper, or better, with no pitting. Heat transfer surfaces must be must be maintained clean.
2. Biological populations must be maintained below 10,000 organisms per ml. No algae growth is permitted.
3. Formulations shall not contain any ingredients, which may be harmful to system materials of construction. Provide MSDS sheets on all chemical products.
4. No system shall be operated without the benefit of chemical protection.
5. If copper materials are present in the system, the treatment will include Azole levels of at least 5 ppm for the first 6 months.
6. Biocide products recommended shall be properly registered with the Environmental Protection Agency and EPA registration number shall be clearly shown on all product literature and drum labels.
7. A dual, alternating biocide system is required. The primary biocide shall be fed (twice or three times) per week. The secondary bioicide should be fed at least once per week. The following are the only biocides and minimum dosages that shall be accepted: · 120 ppm of 45% Glutaraldehyde; Liquid Bromine fed at 0.8 lbs. / 1,000 gallons
8. Free Halogen residuals must not exceed 1 ppm for more than 1 hr. If an oxidizing biocide is used, the alternate biocide must be a non-oxidizing biocide.
9. To ensure operator safety all chemical products shall be provided in liquid form for direct feed from shipping container to cooling system.

D. Testing Equipment:

1. Furnish basic water test equipment for maintaining control of program standards in the condenser water systems. Test kit will include reagents and apparatus for determination of corrosion inhibitor level in the condenser water systems. A hand held conductivity meter must be included.
2. Furnish corrosion coupons to monitor program effectiveness. Corrosion coupons will be analyzed by water treatment company's regional laboratory and provide test reports recommended intervals.

E. Water Treatment Service Program: The water treatment program shall include all consulting services for a period of one year from start-up of the Condenser systems. The program will include:

1. Installation and system start-up procedure recommendations.
2. Two sets of 30-day corrosion coupon data verifying that the specified corrosion coupon results have been met during the first year of operation. A set is defined as one coupon for each major metallurgy in the system.
3. Monthly biological testing results verifying that the biological growth parameters have been met.
4. Training of operating personnel on proper feeding and control techniques.
5. Monthly field testing, service and consultation meetings. A written report of each service visit is required. Monthly tests must include inhibitors, conductivity, pH, iron, copper, and bacteria.
6. A copy of all MSDS sheets and all control limits for each system must be displayed at the chemical feed location. The limits must include the maximum and minimum LSI for products used.
7. Any necessary log sheets and record forms.
8. Any required technical assistance.
9. A qualified, full-time representative will provide all services.

3.4 CHILLER TESTING AND CERTIFICATION

A. The mechanical contractor will perform an eddy current test and boroscope test on both the evaporator and condenser tubes prior to startup, but after the installation of each chiller. The written results of these tests must be presented to the owner prior to continuous operation of the equipment.

END OF SECTION

SECTION 23 38 16
FUME HOODS

PART 1 – GENERAL:

1.1 SUMMARY

A. This section contains general design criteria for laboratory fume hoods and biosafety cabinets.

1.2 RELATED SECTIONS:

A. 01 90 00 Commissioning

B. 23 00 00 Heating Ventilation and Air Conditioning

C. 25 00 00 Integrated Automation

1.3 SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. Fume hoods in research laboratories must conform to with American Industrial Hygiene Association (ANSI/AIHA) Z9.5 Class A performance standards.

B. NFPA 45- 2015 Standard on Fire Protection for Laboratories Using Chemicals

C. Laboratory fume hoods must conform to OSHA, 29 CFR Part 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories

1. Appendix A - National Research Council Recommendations Concerning Chemical Hygiene in Laboratories

D. Labs21 Environmental Performance Criteria 3.0

1. Monitoring and control of fume hoods and room air pressure
2. Laboratory air flow analysis
3. Containment device commissioning.

E. Laboratory design and fume hood provisions should fulfill the needs expressed by the Williams College project manager.

F. Laboratory design should be consistent with Williams College Division 23 – HVAC Design.

G. Noise from the laboratory ventilation system must not exceed NC 45 throughout the laboratory.

H. The average fume hood face velocity must be 100 fpm ± 10 fpm, with the vertical- sliding sash located (18"/27”) above the work surface.

I. Fume hoods must run continuously to minimize potential hazards when the fume hoods are switched to standby.

1.4 SUBMITTALS

A. During the program phase of the design process, review laboratory ventilation systems with the Office of Environmental Health and Safety and with the Facilities Department.

1.5 QUALITY CONTROL

A. Laboratory ventilation systems, including fume hoods, must be commissioned. See Section 01810: General Commissioning.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the design requirements, provide products by Kewaunee Scientific Equipment Corporation, Fisher Hamilton, or other manufacturer equivalent products approved by Williams College.

B. Exhaust air valves: TEK-Air is preferred, Titus style boxes acceptable, no bladders valves

2.2 DESIGN REQUIREMENTS:

A. Variable air volume/constant volume/two position fume hoods are preferred. Constant volume fume hoods are appropriate in some applications. Williams College will review fume hood system design on a case-by-case basis.

B. Offset airflow differential is preferred, as recommended by ANSI Z9.5 –1992, not pressure control.

C. Data readout of hood controls to be fully interfaced with Building Automation System for monitoring and/or alarm functions.

D. Alarms from hoods and other lab equipment to feed back to the building automation system.

E. Fume hood and biosafety cabinet monitoring requirements:

F. Audio-visual

G. Sash position

H. Face velocity constant air flow monitor

I. Local alarm (both audio & visual as required by OSHA) and LCD face velocity display should be sourced through the fume hood/BSC manufacturer to establish single-source responsibility.

J. General-purpose fume hood ductwork must be 316 stainless steel. The fan and housing must be corrosion resistant. Special-purpose hoods may be constructed of other materials only after a thorough review with the Office of Environmental Health and Safety.

K. Ductwork to be round to ensure uniform airflow.

L. (Optional: verify with Williams College project manager) Provide automatic sash closers on fume hoods.

****

Note to designer: A specific list of laboratory equipment requiring alarms is required, and must be integrated into the BAS sequence of operations/building alarm system.

****

END OF SECTION

SECTION 25 00 00
INTEGRATED AUTOMATION

PART 1 GENERAL

1.1 SUMMARY

A. Williams College currently contracts exclusively with Automated Logic or Johnson Controls Metasys for building automation systems. Consult with the Williams College Project Manager for specific requirements for each project.

B. Related Sections (included without limitation):

1. Section 01 81 00 – Sustainable Design Requirements
2. Section 01 90 00 – Commissioning
3. Section 27 00 00 - Communications

C. General Requirements for Building Automation and Control System:

1. Design, supply, install, and commission a complete microprocessor based automatic control system to achieve the performance specified in the following clauses hereafter called the BAS. Operator Interfaces and Controllers shall be connected directly through a BACnet communication internetwork. All communications across this internetwork shall conform to the most recent ASHRAE BACnet protocol Standard.
2. All products used in this project installation shall be currently under manufacture. This installation shall not be used as a test site for any new products unless explicitly approved by the Williams College Project Manager, in writing.
3. Spare parts shall be available for at least five years after project completion. The manufacturer shall have a stated policy of maintaining backward compatibility with previous versions of its products. Bidders shall provide a copy of this statement with their submission.
4. Protocol Implementation Conformance Statements (PICS) for each and every device shall be submitted as verification of compliance with the BACnet standard and a complete schedule of BACnet devices shall be supplied, and approved, prior to any works commencing onsite.
5. It is essential for bidders to visit the College site to become familiar with field conditions, existing equipment, communication arrangements and other matters impacting on the BAS works.
6. All mechanical equipment provided with factory installed controls shall use BACnet as the communication protocol. If BACnet is not available contractor shall submit a detailed description of how the equipment will communicate with the BAS prior to ordering equipment.
7. All new construction and renovated buildings shall have a minimum of one supervisory web-interfaced BAS controller, reporting to the respective BAS supervisory server. Smaller renovations may utilize existing BAS capacity to within 75% of any manufacturer-specified limit.
8. Spare communications ports – (i.e. Ethernet) – Shall be provided for future use.
9. All freeze stats or low-limit safety devices must have auto reset with the ability to be reset remotely with Williams College BMS.
10. During design review, a list of specific BMS alarms shall be integrated into the S2 system to provide EZM alarms as approved and coordinated by the college.
11. BMS requires set up and programming as needed to integrate with the college's demand response protocols as applicable and approved by the Owner.
12. All freeze stats or low-limit devices must have auto reset capability through the BMS system.

D. The BAS Architecture shall comprise the following:

1. Operator Interfaces comprising PC-based workstations.
2. Communications network with BACnet/IP connection to the Williams College network and conform with OIT standards. (Reports to campus network)

3. Integration with existing campus building automaton system.
4. Controllers with inputs and outputs (I/O) for controlling central plant and air handling systems with customable control sequences, data collection (metering/trending).
5. Application Specific Controllers with inputs and outputs (I/O) for controlling packaged systems, unitary equipment and terminal units.

E. System design and performance shall include the following:

1. Preparation of control shop drawings
   a. The controls contractor shall provide fully developed Control Drawings based upon the operational sequences of the Engineer of Record. Drawings shall be developed in Microsoft Visio or approved equal. These control drawings shall furnish at a minimum:

      1). A network riser diagram indicating supervisory controllers and relative addressing as well as field controllers, interconnections to packaged equipment control systems and respective network wiring.

      2). Schematic diagrams of all systems controlled or connected to the automation system in the format of the final graphical interface.

      3). Schematic diagrams of all electrical interface connections indicating device, voltage, and any relevant terminal numbers.

      4). A bill of material indicating for each component part furnished by contract or interfaced to and furnished by others:

      5). A narrative Sequence of Operation indicating: the operational timeline of the respective system, including all initial set points and the adjustability of same, as well as details of system operation for abnormal conditions, such as during and after a power outage.

      6). Detailed equipment and software data sheets.

      7). Valve and damper schedules with all control parameters listed.

      8). As applicable for the project, a schedule of rooms served by VAV boxes including:

         a). Room name relative to thermostat location.
         b). The air handler that the box is served from.
         c). Supervisory controller and field bus ID.
         d). Relative mechanical drawing number.
         e). Address.
         f). Associated equipment including sensors, reheat coils and radiation.
         g). Box size, inlet area, K factor, and all relative flow set points.

2. Provision of control components.
3. Provision of a network of BACnet Direct Digital Control Devices.
4. Provision of all necessary graphics software, system software, and third party software as specified.
5. Wiring of the BAS controls system.
6. Programming the sequence of operation.
   a. The project design professional shall provide an Operational Narrative on the proposed Sequences of Operation for the new BAS system by 60% Design Development (DD)

submittal, and detailed, written sequences of operation for the new BAS system, based on the Design Development Operational Narratives, for the final Design Documents. These detailed sequences shall provide at a minimum:

1). Sequences in all modes of normal operation: on, off, occupied, unoccupied, warm-up, cool-down, summer, winter, economizer, etc.

2). Organization into logical groupings including: run/stop, pressure, economizer, coils, discharge air, humidification, dehumidification, hydronic temperature, etc.

3). Fire/smoke control system interfaces and sequences.

4). Schedule of operation.

5). Details of system operation for abnormal conditions, such as during and after a power outage. Include details such that a loss of status associated with power outages are not indicated as failures with a subsequent alarm.

6). Specific direction on failure scenarios for loss of signal and all safety device trips.

7). Setpoints, trip points, and ranges. Initially these shall be the designer's intent, and eventually be the actual settings at the time of as-built submittal.

8). Communications protocol and available points list for BAS interface for large unitary equipment such as chiller control panels.

7. Preparing dynamic graphics screens (at least two audits to be allowed for during production). Final graphics screens to be approved by Owner.
8. Calibration and commissioning of the installed controls system in accordance with CIBSE Commissioning Code C: Automatic Controls.
9. Provision of maintenance manuals and as built drawings.
10. Provision of training of College's operators.
11. Demonstration and confirmation that all systems are programmed and operation correctly.
12. Submission of back-ups of up-to-date programs in each controller shall be submitted on flash drives and uploaded to Williams College PMIS. Provision of original program disks and documentation, proving registration for all software programs provided as a part of this contract, including: Windows, the BAS operator interface software, and the BAS site graphics.
13. Submission of one (1) printed copy and upload to Williams College PMIS the final programs and documented programmed sequences of operation.
14. Provide the necessary engineering, installation, supervision, commissioning and programming for a complete and fully operational system. Bidders shall include in their tender price, for as many trips to the job site for installation, supervision, and commissioning as are necessary to complete the project to the satisfaction of the College's representative.
15. The system shall consist of all operator interfaces, microprocessor based controllers, sensors, wells, automatic control valves, transducers, and relays, automatic control valves, damper actuators, meter interfaces etc, as detailed on the points schedules.
16. Provide all the necessary software and interface devices for all BAS-based systems.
17. At the completion of the installation and immediately following commissioning provide appropriate on-site training for a minimum of twelve (12) people nominated by the College. (Coordinate with Commissioning section.)
18. Check sensor calibration and control system twice during the first year (one check shall take place one (1) month prior to the expiration of the defects liability period). Following each visit: Printed graphs shall be provided of trend logs for all values that are being logged as specified. Update the printed and CD copies of any changes made to programs for any controller. Warranty all components supplied under this contract for a period of one year from practical

completion. Replace all controls equipment that fails during this period without cost to the College.

19. All control panels shall be labeled with engraved phenolic labels, mechanically secured, indicating components served.

1.2 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Coordinate location of systems to avoid interference with location of structure and other building systems. Notify Owner prior to construction of conflicts which cannot be resolved.

C. Coordinate and work with the Owners Commissioning Agent from Preliminary design through Post Acceptance phase for any automation system that is being commissioned.

D. The BAS contractor team members shall be factory trained on the specified product, and they shall furnish proof of training for each member upon request.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials: As selected based on system design.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials in proper relation with adjacent construction and with uniform appearance for exposed work. Coordinate with work of other sections. Provide proper clearances for servicing.

B. Test all systems for proper operation. Label circuits in electrical panels.

C. Restore damaged finishes. Clean and protect work from damage.

D. Instruct Owner's personnel in proper operation of systems.

3.2 TURNOVER PHASE:

A. Provide all software and hardware required to operationally program, control, maintain, balance, diagnose and replace any and all components installed. Include licensing information and serial numbers as well as installation compact discs.

B. Furnish final control programs and algorithms for all primary systems and representative samples of terminal equipment. All applications are to be written as self-documenting and shall include at a minimum or as comments in the code:

1. The originating author and the author of each revision.
2. The originating date and the date of each revision.
3. The building name.
4. The system name.
5. A description of the process.
6. Any calls to other processes in the same controller and or applications running at the supervisory level or in another controller.
7. All hardware inputs in list form.
8. All hardware outputs in list form.
9. All network inputs in list form.
10. All network outputs in list form.
11. Add a sequence of operations narrative to all new pieces of equipment in the BMS controls systems.

C. For projects that are renovations of existing systems and affect a portion of the building controls, the controls contractor shall furnish submittal shop drawings of project work that are consistent with existing drawings including compatible page numbers, a revised table of contents and revised schedules.

D. Operations and Maintenance (O&M) Manuals shall include a flash drive and uploaded to Williams College PMIS with complete Controls Drawings in editable Adobe PDF and Microsoft Visio format.

E. All software and hardware required to install, operate and maintain all components of the installed system shall be turned over to the Owner including, but not limited to, all operating discs, recovery discs, and system backup discs.

END OF SECTION

SECTION 26 00 00
ELECTRICAL

PART 1 GENERAL

A. References:

ADA	American with Disabilities Act
ANSI	American National Standard Institute
ASTM	American Society for Testing and Material
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
MAAB	Massachusetts Architectural Access Board
MEC	Massachusetts Electrical Code
NEMA	National Electrical Manufactures Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
MSBC	Massachusetts State Building Code
UL	Underwriters Laboratories, Inc.

B. Shop Drawings: All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College Project Management Information System (PMIS) web portal.

C. Codes: All labor, equipment, and materials furnished and/or installed shall comply with all local, state and national codes and regulations, including without limitation the National Electrical Code, the Massachusetts State Building Code, NFPA codes, and insurance regulations and requirements governing such work.

D. Permits: Any and all permits required for installation of any material shall be obtained as part of the work of the Specification including all fees or expenses incurred.

E. Instruction and documentation: During the assembly and installation of all electrical systems, the Owner's operating personnel shall be instructed regarding its operation and maintenance. An instruction period shall be provided after completion of project. The period needs to be appropriate considering the scope of project. All submission, distribution, review, comments and acceptance of operation and maintenance (O&M) manuals and as-builts will be done through the Williams College Project Management Information System (PMIS) web portal. O&M manuals shall include copies of all approved submittals. Electronic as-builts shall be provided in .dwg format for AutoCAD and PDF format.

F. Testing shall be performed by a third-party testing company (sub-contracted by the Electrical Contractor). The third-party testing company shall be approved by the owner and the electrical engineer. All tests shall be in accordance with the latest IEEE, NETA, ANSI, Owner's and utility standards pertaining to the same. Five days advanced notice shall be provided to the Engineer and Owner for witnessing of these tests at their discretion. (A) Submittals shall include one set of blank test forms indicating test voltages, values to be obtained, inspection check lists, etc. to the engineer for approval prior to testing. (B) Three sets of finalized typewritten test reports must be submitted to the Engineer for review and approval within ten days from the date of test. (C) Each item tested shall bear a label indicating the date; and testing company's name, address and phone number. Test reports shall indicate the last calibration date for the instruments used.

G. Tests shall include but not be limited to:

1. All systems test free of shorts or grounds,
2. Proper neutral connections, ground system resistance, secondary voltages at main distribution panel.
3. Emergency power/lighting shall pass a 90-minute pull-the-plug test.
4. Related Work.
   a. All Electrical Systems shall be complete
   b. All automatic temperature control system components, wiring and interlock wiring associated with the heating, ventilating and air conditioning system.
   c. Starters and control devices for other equipment.

H. Expansion fittings to be used in accordance with code for rigid and PVC:

1. Expansion fittings per article 300.5 for earth movement are required.

PART 2 PRODUCTS

A. Conduit and tubing systems

1. Galvanized rigid steel conduit shall be hot-dipped galvanized steel inside and outside comply with UL Standard 6. Galvanized rigid steel conduit shall be used for the following:

    a. Buried raceways in concrete slabs or in the ground. Where directly buried, two coats of asphaltic compound or epoxy coating shall be applied.

    b. Interior high voltage runs >600 volts – not allowed.

    c. Exposed exterior raceways.

    d. Any raceway in hazardous/industrial areas.

    e. Termination of duct bank runs through concrete and into equipment or indoor areas

    f. Exterior pole lights shall be constructed with rigid in base and extending 5’ from base. (Helps prevents damage due to frost heaves.)

        1. Terminations for pole lights shall be made in the pole light, rather than using a ground box. Use of ground box only allowed with owner approval.

2. Electro-Galvanized Steel Metallic Tubing (EMT) shall comply with all applicable codes. EMT shall be used for the following:

    a. Interior branch circuits exposed, concealed in hung ceilings and wall partitions, or masonry.

    b. Interior feeders exposed or concealed.

    c. Interior motor circuit wiring.

    d. Interior control, signal and sound wiring exposed, concealed in hung ceilings and wall partitions.

    e. All connectors and couplings shall be galvanized steel; no die cast allowed.

3. Flexible Metal Conduit (MC) with separate grounding conductor may be used as an alternate to EMT with the approval of Williams College. MC cable must have an aluminum or steel jacket with tracer wire.

4. Metal-clad cable type "MC' with THHN insulation rated 600 volts & with an insulated grounding conductor shall be permitted for branch circuits where concealed above hung ceilings or in furred partitions where permitted by code. Conductors shall be 12 AWG minimum.

5. Rigid Plastic Conduit, Schedule 40 PVC, conforming NEMA TC-2, shall be used for the following:

   a. Underground primary or secondary service duct bank encased in integral, red-dye concrete, rigid galvanized steel elbows shall be used where the conduit is run through concrete slab. In addition, a separate grounding conductor with green insulation shall be provided in these runs.

6. Underground duct bank runs shall be installed minimum of 30" below grade to top of bank, wherever possible. If 30" is not possible, concrete encased ducts must be installed to minimum burial depth stipulated in NEC. Underground runs cable markers shall be installed for all direct-buried cables and cables in non-metallic and metallic raceways. Marker shall be located directly over buried lines at 8 to 10 inches below finished grade. Marker tape shall be standard metallic lined, permanent, bright red colored continuous printed plastic tape for direct burial service, not less than 6 inches wide by 4 rails thick, and printed, "caution electric line buried below."

7. Liquid-Tight Flexible galvanized steel conduit with continuous copper bonding conductor shall be used for connection, not exceeding 36" in length, to all motors, heating and ventilating controls, and at other locations where vibration, movement, moisture, or oil-vapor atmosphere are encountered.

8. Rigid conduit shall be 3/4" size minimum. Flexible steel conduit of 1/2" diameter may be used for connections to recessed and chain hung lighting fixtures or other controls.

9. Where empty conduits are required to be installed, provide a continuous #12 nylon draw line with identification tag securely attached to both ends.

10. Suitable expansion and deflection fittings with grounding continuity shall be provided in each conduit run at each point where the conduit run crosses a building expansion joint.

11. All wiring shall be installed concealed in ceilings, walls, slabs, pipe chases and furred spaces whenever possible. Conduit may be installed exposed only in Mechanical Room, electrical Room and Custodial closets. Concealed conduit shall be installed in a direct line with bends as long as practicable. Exposed conduit shall be installed parallel to or at right angles with the lines of the Building, as closely as possible to walls, ceilings, columns and other structural parts, consistent with proper space for access to boxes and so as to occupy a minimum of space. Where exposed conduits are grouped, they shall be run parallel and equally spaced.

B. Electrical service and underground runs

1. Manholes: Use for all underground electrical duct line applications. Unit shall have the following features: Inside dimensions 7' H x 6' W x 14’ L, 36" manhole covers.

2. Drains: All manholes shall have a 4" drain to the nearest drainline. The gravity drain shall have an inline check valve: 4" rectorseal clean check backwater valve. Manholes shall be provided with a sump cast into the floor next to the ladder into which a portable sump pump can be installed. Floor shall slope to sump.

3. Covers: Manhole covers shall be round, having a standard manhole frame and cover.

   a. The cover shall be 36" in diameter and have the word ELECTRIC or COMMUNICATIONS, as appropriate, cast into it. Install frame and cover assembly on at least 4 courses of brick or precast concrete rings to allow adjustments to surrounding finish grade.

b. All Manhole Covers shall be minimum heavy-duty H-20 wheel loading. They shall be constructed of heavy-duty fiberglass Model FL90 manufactured by Fibrelite Corp. of Cresskill, NJ or equal approved by Owner.

4. Ground: A copperweld ground rod shall be installed in each manhole for bonding of hardware and cable sheaths.

C. Wires and cable

1. Secondary distribution

a. Wiring shall be a minimum of #12 AWG unless for HVAC Control, motor control circuit, or fire alarm system wiring which may be #14. Branch circuits longer than 75' for 120V and 175' for 277V shall be at least #10 from panel to load.

b. Wiring 600 Volt and below shall have Type THHN/THWN or XHHW Insulation.

c. Stranding –Wire sized #14 and larger shall be stranded soft drawn copper with conductivity of not less than 98%. Cable smaller than #14 shall be solid.

d. All conductors shall be color-coded throughout, numbered, and tagged to each junction box, pull box, panel and device with suitable fireproof tags or adhesive identification bands. All conductors shall be labeled at junction boxes with circuit and panel designation. Color-coding of conductors for power and branch circuits shall be as follows:

<u>For 120/208 & >600 Volt System</u>
Phase "A": Black
Phase "B": Red
Phase "C': Blue
Neutral: White
Ground: Green

<u>For 277/480 Volt System</u>
Phase "A": Brown
Phase "B": Orange
Phase "C': Yellow
Neutral: Gray
Ground: Green

e. System Identification-provide the following color codes to junction boxes 4" square and larger and their respective covers:

Fire Alarm-Red
Security-Blue
Voice /Data-Yellow
Power 120/208-Green
Power 277/480-Brown
Emergency 120/208-Orange
Emergency 277/480-Orange w/ Brown stripe
Lighting 120/208-White
Lighting 277/480 White w/ Brown Stripe

f. Branch Circuit Feeders: The design shall be for acceptable voltage drop and capacity for 20% load growth above initial design.

g. Branch Circuits: These circuits shall not be loaded to more than 80% of panel breaker ratings. Not more than six unassigned general use duplex convenience outlets shall be on any one 20 ampere branch circuit. Student rooms shall have a minimum 1-20A circuit for a single room, or 2-20A circuit for a double. Lighting circuits for student rooms shall be separate from outlet circuitry.

h. Feeder sizes and protections shall not be such a large percentage of the main that coordination of devices cannot be achieved.

2. Primary Distribution:

a. 15kV Distribution Switches: Used for all 4.16kV & 13.8kV distribution switch applications. Manufactured by G&W Electric. Unit shall have the following features: vacuum interrupters, 15kV Class, 12kA Interrupting, 600A bussing, 600A terminations (all ways), Type 3 Electronic trip unit (30-600A). Outdoor switches shall have trip units mounted in external low-voltage compartment.

b. 15kV Cable: Use for all 4.16kV & 13.8kV distribution system cable applications. Manufactured by Kerite or Okonite. Cable shall have the following features: EPR insulation, MV-105 rated, 133% insulation level, shielded, compact stranded, copper, parallel or triplexed with neutral. Main line duct line runs shall be no less than 500kCM with 1/0 Neutral. Taps to serve single transformers shall be no less than 4/0 with 1/0.' Neutral.

c. Fault Indicators: For use in appropriate locations to expedite cable or equipment fault locating. Units shall be manufactured by Eaton Electrical USA. Units shall be "Star Faulted Circuit Indicator", Current Reset type (2.4A minimum), High Trip rating (800A), Model# CA320008EN. Alternatives to be approved by Williams College.

D. Wiring devices

1. Local wall switches shall be heavy duty specification grade, toggle, quiet type, ivory, fully enclosed in composition cases, rated 20 amps. 120/277 volt A.C.; Hubbell #1221 Series, or approved equal. Substitution requires submission of a physical sample for review.

2. Receptacles generally shall be duplex, specification grade, 2 pole, 3 wire grounding type conforming to latest NEMA standards for 20 amp, 125 volt with back and side wiring, ivory, white or brown accepted; Hubbell #5362, or approved equal. Substitution requires submission of a physical sample for review.

3. Receptacles connected to emergency power shall have cover of steel with red baked enamel and word "EMERGENCY" engraved in white letters on cover.

4. Surface mounted multi-outlet system:

a. Multi-outlet systems shall consist of surface mounted metal raceways for use with number and type of wiring devices as required. Systems shall be complete with all fittings, etc. and shall be Wiremold 2000 and G-3000 or equal approved by Williams.

b. Systems requiring combination power and telephone/communication multi-outlet with divider shall be Wiremold G-4000 and G-6000 or equal approved by Williams.

5. Provide 20 amp duplex outlets at each floor landing of each stair. Provide at least one 20 amp duplex outlet in corridors and space such outlets at 75 feet on center in all corridors.

E. Unit substations

1. Buildings and their equipment shall be served by unit substations where applicable, as required for the load. Building service entrances shall consist of (1) stand-alone main disconnect with fully adjustable LSI(G) interrupting capabilities connected (generally) to (1) single-ended substation, and the secondary or building distribution system voltage shall be as follows:

   a. 480Y/277 volt 3 phase 4 wire 60 HZ for buildings with large power loads utilizing 277 volt for most lighting and small 480 to 120/208 volt transformer for receptacles, lighting and small equipment loads as required.

   b. 208Y/120 volt, 3 phase, 4 wire, 60 HZ for buildings with small power loads that can be readily served by this voltage.

2. Double-ended substations may be used to serve buildings and their equipment when associated with high technology research facilities. This should be established and discussed with Williams College.

3. Transformers:

   a. Oil-filled pad-mount Transformers: For all outdoor transformer applications. Manufactured by Eaton, Carte, ABB, Square D. Unit shall have the following features: 65°C rise at 40°C ambient, tamperproof, weatherproof, copper windings, dead-front, 200A feed-thru bushing to accept elbow arrestors, dual ratio primary (4.16kV/13.8kV), de-energized tap changer, liquid level gauge, no bayonet fuses allowed. Winding configurations to be confirmed by Williams College.

   b. 6kV Elbow Arrestors: Use on all 4.16kV pad-mount type transformers for surge protection. Manufactured by Eaton. Unit shall be a 200A Elbow Mount, VariGap MOV, 5.1kV MCOV.

   c. Dry Type Transformers: For use with indoor transformer vault applications. Manufactured by Square D, Eaton, Cutler Hammer, or GE. Unit shall have the following features: 150°C rise at 40°C ambient, 220°C insulation, copper windings, consider the cost of dual ratio primary (4. 16kV/13.8kV), de-energized tap changer, air terminal chamber for primary terminations.

4. Type and location of building substations:

   a. Outdoor compartmental type pad mounted, completely enclosed, liquid filled power transformer with load break primary disconnect, primary fuses and lightning arresters may be used to serve the building. This shall be located close to building electrical equipment room to keep secondary runs from outdoor transformer to indoor main distribution switchboard as short as possible. Main power distribution switchboard shall be located m building electrical room, NEMA 1 construction. The secondary power distribution switchboard shall be similar to that below for indoor units.

   b. Indoor unit substation shall consist of a load break primary disconnect, primary fuses, primary lightning arresters, dry type ventilated power transformer and a main secondary power distribution switchboard. Unit substations shall be provided as a completely enclosed, integrated and coordinated line-up by the manufacturer. Primary sections shall be equipped with copper ground bus. Incoming primary service shall be underground wherever possible. Primary fuses shall be disconnect type S & C type SM5, or approved equal. Dry-type ventilated transformer to have maximum temperature rise of 115°C above a 40°C. maximum ambient, to be equipped with provisions for forced cooling, to have 4 - 2-1/2 full capacity taps in high voltage winding 2 above and 2 below normal, and ground pad. Main secondary switchboard shall be front accessible, with vertical sections as required bolted together to form one metal enclosed rigid switchboard constructed to NEMA PB-2 and UL 891 standards. It shall be equipped with Owner's metering section with an ammeter and selector switch, voltmeter and selector switch and KWHR meter demand attachment. This shall be compatible with the building energy management system for pulse output. Unit shall have a main circuit breaker, and feeder branch circuit breakers as required to serve loads plus two spare feeder breakers. Rating of main bus, circuit breakers, etc. shall be determined based on building transformer rating and building distribution system to serve loads. Interrupting capacity shall be determined and noted on system one-line diagram main buses and equipment. Provide a ground copper bus in switchboard for its entire length firmly secured to each vertical section. Provide space for future breakers. Incoming secondary service shall be underground wherever possible. Breaker loading shall be a maximum of 80% of its rating unless breakers are specified and available as fully rated units for switchboard service. Each breaker on the switchboard assembly shall have an engraved lamacoid nameplate to designate load served.

c. Selection of a. or b. above will depend on site location of new facility, indoor space availability for mechanical and electrical equipment, etc. and shall be determined by discussions with Williams.

F. Grounding system

1. Drawings shall show ground systems, protective conduit sizes, and relative locations. Specifications and drawings shall include detailed requirements of the grounding system. A reference only to the National Electrical Code and/or specifying requirements only be referencing the code are not acceptable.

2. Service grounding system shall be in accordance with NEC and MEC. A reference only to the National Electrical Code and/or specifying requirements only by referencing the code is not acceptable.

3. Ground connections that are permanently concealed shall be made by either the exothermic process to form solid metal joints, or approved crimp connections. Accessible ground connections shall be made with mechanical pressure type connectors.

4. Provide an equipment-grounding conductor in each of the following conduits and connect to the grounding system at each end:

   a. In each run of non-metallic conduit.

   b. In each feeder from main panel board to each panel board.

   c. In each run of metallic conduit that includes a section of flexible or liquid-tight conduit.

5. Grounding conductor in metallic conduits shall be 600-volt green insulated copper conductor sized per NEC code. Where a shock hazard to personnel may exist by the frequent and continued contact with machines or equipment (fixed or portable), a wire equipment ground shall be installed in the branch circuit conduits and be grounded to the cabinet of the panel board by an un-insulated ground bus. The neutral bar of the panel shall not be used for equipment grounds.

6. The complete electrical installation shall be permanently and effectively grounded per code. This includes switchboards, panel boards, cabinets, transformer neutral, transformer ground

pad, motor frames, motor starters, lighting fixtures, lightning arresters, conduit systems, and all non-current carrying metal parts of electrical equipment. Steel frame buildings shall be grounded through a low resistance ground system.

7. Convenience outlets shall have a wired ground for continuity of ground path from the device grounding pole.

8. Provide a driven ground rod at outdoor lighting poles for equipment grounding, and provide an equipment ground wire in steel underground conduits to the poles.

G. Lighting, receptacle and power panelboards

1. All panel boards shall be rated for the intended voltage and shall be in accordance with Underwriter's Laboratories, Inc., standards for panel boards and standards for cabinets. Panel board boxes shall be so labeled.

2. Approved manufacturers are Square D or Siemens. No substitutions will be accepted.

3. Construction:

   a. Panels shall consist of factory completed dead-front assemblies of sheet steel cabinets, main buses, over-current and switching units and sheet steel trim. Boxes shall be 20 inches wide and fabricated from unpainted, galvanized code gauge sheet steel having multiple knockouts with lapped and screwed or welded corner construction.

   b. Boxes shall be of sufficient size to provide a minimum gutter space in accordance with NEC Tables 373-6(a) and (b), but not less than four inches at the side and six inches at top and bottom. Multi-section panel boards shall be provided with a minimum top and bottom gutter space of 8 inches. Where feeder cables supplying a panel are carried through its box to supply other panels the box shall be provided with a separate barriered side gutter. Cables shall be bundled, routed and supported within the gutters. This wiring space shall be in addition to the minimum gutter space specified above. A minimum of four interior mounting studs shall be provided.

   c. Trims shall be fabricated from code gauge galvanized sheet steel. Trims shall be fastened to cabinets by means of machine screws with captive nuts or clamps and shall be self-supporting on the cabinet after trim holding screws have been removed. Trim for flush panels shall overlap its perspective box by at least 3/4 inch all around. Surface trim shall have the same width and height as its respective box. Door-in-door trim shall be provided for all panels.

   d. Panel doors shall be fabricated from the same material as the panel trim and shall be fastened thereto by continuous concealed hinges. Doors shall be so installed that no live parts are exposed when the door is opened. Doors shall be complete with flush type combination lock and catch with keys. All panels shall be keyed alike. Doors shall be provided for access to contactors, time clocks, relays, and similar devices as required.

   e. Backbox interiors, inside trim, door and exterior shall be treated with a rust inhibiting phosphates coating after pickling and finished in ANSI-61 gray enamel. A typewritten directory, eight inches by ten inches, with metal frame and clear plastic face shall be furnished and installed upon the inside upon the inside of the door of each panel board, indicating the room or area and the service controlled by each circuit.

f. Bus bars shall be hard drawn copper and extend the full height of the panel without reduction. Buses shall be arranged for sequence phasing of branch circuits. Circuit loading shall be distributed evenly over all phases. The neutral bus shall have a suitable lug for each outgoing branch circuit requiring a neutral connection. Neutral bus shall be full size and electrically isolated from the cabinet. Ground bar shall be bare un-insulated and suitably bolted to the cabinet for equipment grounding. Busing s fall be braced throughout to conform to industry standard practice governing short circuit stresser in panel boards. Bracing shall be equivalent to, or compatible with, the rated interrupting capacity bf the smallest over current device in that panel board. Spaces for future devices shall be bussed for the maximum device that can be fitted into them with suitable insulation and bracing to maintain proper short circuit rating. All provisions shall be made for ready insertion of future protective devices. Provide an isolated ground bus where required by special sensitive equipment.

g. All interiors shall be completely factory assembled with switching and protective devices, connectors, etc. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping. Branch circuits shall be arranged using double row construction.

h. Multiple section panels shall have feed-thru lugs with full capacity taps to adjacent panel sections.

i. Lighting and power panels for 480Y/277 volt system and receptacle, appliance and power panels for 208Y/120 volt system shall be of the bolted circuit breaker type with single, two and three pole branches of quantity and trip setting as required. Panel boards shall be furnished with main over current interrupting devices consisting of circuit breakers of size and capacity as required

j. Multiple cable lugs for incoming feeder cables shall be furnished where required. Lugs shall be secured to bus by stud bolts. Where several panels are fed by one feeder, solid tap connections shall be made in separate side gutters as required with tap connectors. Suitable lugs or connectors shall be provided for connecting feeders. Tap connections to multiple lug feeders shall be made to all lugs at each tap joint.

k. When lighting circuits are switched in groups, these circuits shall be controlled by contactors mounted under a separate door in the lighting panel.

l. Phased rotation outlets to be installed for live verification.

4. Circuit Breakers:

a. Circuit breakers shall be of the molded case, bolted in type consisting of the number of poles and ampere ratings as required. Two and three pole breakers shall be of the common trip type. Handle extensions providing manual operation will not be accepted.

b. Circuit breakers shall be of the indicating type providing "on", "off' and "tripped" position of the operating handle. When the breaker is tripped, the handle shall assume a position between "on" and "off positions. Breakers shall be of the quick-make and quick-break type toggle mechanism with inverse time trip characteristics. Automatic release shall be secured by d` bimetallic thermal element releasing the mechanism latch. In addition, a magnetic armature shall be provided to trip the breaker instantaneously for short circuit currents above the overload range.

c. Circuit breakers shall be rated for the voltage of the circuit on which they are used. Circuit breakers with 225 ampere or larger frame sizes shall have interchangeable trips.

d. Circuit breakers between 100A and less than 200A shall be equipped with adjustable instantaneous protection settings. Circuit breakers 200A and greater shall be equipped with fully adjustable (i.e. pickup and delay settings) electronic Long Time, Short Time & Instantaneous protection (LSI).

e. Circuit breaker trip units shall be 100% visible and fully accessible for LSIG trip unit adjustments. Square D thermal magnetic breakers with basic trip units will require narrow side blank extensions (applies to Powerpact A1 trip units.)

f. Integral locking tabs or hardware shall be provided on all circuit breakers. Portable locking mechanisms that are intended for temporary applications are not acceptable.

g. Interrupting capacity of breakers shall be suitable for the power system. Available short circuit currents shall be noted on single line diagram on all major system buses and on panel schedules.

h. Circuit breakers feeding 120-volt lighting circuits that are not controlled by local wall switches shall be approved type "SWD" circuit breakers.

i. Arch-fault or GFCI breakers where required by the electrical code.

5. Panel boards shall be initially designed to that they are not loaded to more than 75% of breaker space capacity.
6. Dorm Rooms – Shall be equipped with (1) 20A circuit per student (i.e. Double room = (2) 20A circuits.)

H. Motor starters, motor control centers, and variable frequency drives

1. Motor voltages: Motors 1/2 HP and larger shall be 3 phase 60 Hz, 208 volt or 460 volt based on system secondary distribution. Motors under 1/2 HP shall be single phase 60 Hz, 115 volts or 208 volts.

2. Motor Control: A motor control center shall be provided to handle 3 phase motors in a given area. Single-phase motors can be fed from lighting and/or power panels. Motor control circuits shall be 120 volt 60 Hz.

3. Motor starters (Individual), Magnetic Type:

a. Starter units for three phase motors shall be the combination full voltage type, consisting of a magnetic starter containing three manual reset thermal bimetallic overloads and low voltage protection. Each Starter unit shall include a fused disconnect (plus three spare fuses) for short-circuit protection and provisions for locking switch, handle in the on" and "off" positions. Each starter unit shall be complete with 2 extra normally open interlock contacts. Starters shall be mounted in NEMA 1 enclosure indoors and NEMA 4 outdoors. Minimize size shall be NEMA 1.

b. Units shall be equipped with individual 120-volt secondary control transformers as required with two primary and one secondary control fuse. The other secondary lead shall be grounded. Where indicating lights, solenoid valves and additional control components are energized from the control transformer, the capacity of the control transformer shall be proportionally increased.

c. Starter shall have "Hand-Off-Auto" selector switches and indicating red "run" light mounted on the starter. Control units shall be of the heavy-duty oil tight type. Lights shall be LED type only.

4. Manual motor starters for single-phase motors shall be 2 pole, have a quick-break quick-make

toggle mechanism that can be locked in "off" position, with a neon pilot light to indicate when motor is running, with thermal overload units as required. Enclosure shall be NEMA 1 for indoors, NEMA 4 for outdoors, or NEMA 7-9 for hazardous areas.

a. Motor control centers shall be NEMA Class 1, Type B wiring. The 480V motor control centers shall consist of independent vertical sections, free standing on 4" channel iron sills with sections bolted together to make up the center. The section shall be 90" overall height, including the mounting sills. The width of each section shall be 20" (except large starters or other special panels, which may be 30" in width). Structure depth shall be 20" and designed to mount starters in the front only. A maximum of six starter units shall be stacked in one vertical section. Terminal blocks for wiring shall be mounted within each starter unit and shall be factory wired. Each section shall be dead front, and rear access shall not be necessary for connections. Removable rear plates shall, however, be employed on the rear of the structure. Pan type doors shall be used for all units and future spaces. Doors shall be hinged to the structure with a concealed hinge and fastened with pressure type fasteners. The top of each section shall have removable plates for access to the horizontal feeder bus and for conduit entry. A minimum of 12-gauge steel shall be used throughout the structure, including all doors and plates. All painted steelwork shall be treated with a primer coat and a finish coat.

b. The top of each section shall contain horizontal feeder bus bars of tin-plated aluminum or copper which shall run continuously through the center from section to section. Provisions shall be made for easy addition and connection to adjacent sections. The horizontal bus shall be sized as required by the load, but in no case less than 600 amperes. The horizontal bus shall be braced to withstand the maximum fault current available at that point. The bus supports shall be formed of high dielectric strength, low moisture absorbing, and high impact material with ample creepage distance between bus bars. Each section shall contain 3 vertical bus bars running the full working height of the section and connected to the horizontal feeder bus bars. The vertical bus bars shall be braced to withstand the maximum fault current available at that point. The bus support shall be formed of high dielectric strength, low moisture absorbing, and high impact material with ample creepage distance between bus bars. Vertical bus shall be sized as required by the load, but in no case less than 300 amps.

c. Each section shall have a top horizontal wiring trough in front of the main horizontal bus. This wiring trough shall be protected from the horizontal bus bars by means of a steel barrier plate. The wiring trough shall be equipped with cable supports and the structure shall have a cutout in the end for continuous cable runs through the motor control center. A vertical wiring trough shall run the full working height of each section and shall be equipped with cable tie clamps. This vertical wiring trough shall be designed so as to allow installation wiring to the units with the unit doors open, but with the units in place.

d. Motor starter units shall be of the combination type with motor circuit protectors coordinated with motor overload relays. The interrupting rating assigned to the complete combination motor starters shall exceed the system short circuit capacity at the starter terminals. Starter units shall meet the requirements specified above.

e. A fusible disconnect which will serve as a main disconnect shall be provided where required. A horizontal copper ground bus 1/4" x 1" shall be provided with lugs for termination of the feeder and branch circuit ground conductors.

f. Motor starter units shall connect to the vertical bus bar in each section with stab-on connectors shall be free-flowing silver-plated clips, self-aligning and backed up with steel springs. Units shall be capable of being withdrawn from the structure with minimum of difficulty. Unit support brackets shall be provided in the structure to properly align the units. Cam latch fasteners shall be employed on each unit to latch the unit in one of two positions on the structure

1. The engaged position - Stabbed on the vertical bus.
2. The test position -With units withdrawn from the vertical bus, but still supported by the structure. In the test position, the pull-apart terminal block must still be capable of being engaged for electrical testing purposes.

g. In either engaged or test positions, the cam latching mechanism on the unit must be capable of being padlocked to prevent unauthorized movement of the unit. Units shall have complete steel top and bottom plates to provide maximum isolation between units. Units shall be of modular dimensions so that it is possible to readily interchange units of the same size without modifications in the structure.

h. Motor disconnect switch operating handles shall be interlocked with the doors that the door cannot be opened with the switch into the "on" position, except through a hidden release mechanism. The operating handle shall be arranged for padlocking in the "off' position with up to three padlocks. Motor starters shall be built, tested, and sized in accordance with NEMA Standards for Industrial Control, except that no smaller than NEMA Size 1 starters shall be employed in any unit. Motor overload protection shall be affected by three element overload relays with adjustable heater element positions.

i. Engraved nameplates shall be provided for each unit of the motor control center as well as the assembly.

5. Motor Disconnect Switch: Provide a non-fusible motor disconnect switch for any motor located from its starter unit. Switch shall be horsepower rated, heavy duty type, switch blades fully visible in off position when door is open, quick-made and quick-break mechanism, handle positions shall indicate and be lockable in "on" and "off' positions. Enclosures shall be NEMA 1 indoors and NEMA 4 outdoors. All disconnect switches that are used with a VFD shall have an electrical interlock switch. The interlock switch shall be in the disconnect operated by the on/off handle to disable the output of the VFD.

6. Variable Frequency Drives:

a. VFD shall be a “Clean Power” series and have a minimum 18-pulse input or IGBT front end. Lower pulse drives with filters are not acceptable

b. Acceptable Manufacturers: Siemens, ABB, Toshiba, AC Tech and Square D.

c. Features and accessories (not limited to)

1. Power loss ride through power loss of minimum 5 cycles
2. Input efficiency: minimum .97% at full speed and full load
3. Input power factor: Minimum .95 at all speeds and loads
4. 115 VAC power supply for control wiring
5. Ambient Temp Range 0 to 40 deg C.
6. Ambient Humidity Range 0 to 95% non-condensing
7. Short Circuit Protection including instantaneous over current protection, ground fault protection, and current limiting input fuses.

8. Over voltage and under voltage protection +- 15% of rated input voltage.
9. Over Temperature protection.
10. Output over current protection to 110% rated current.
11. Automatic restart after trip condition. Shutdown after five failed attempts. Can be deactivated by programming.
12. Prewired hands–off-auto switch with speed control in hand mode.
13. Output contacts: indicate unit running
14. Output contacts indicate unit in fault mode
15. Line side manual disconnect.
16. Start stop by external input

d. Drives shall limit total harmonic distortion voltage and the current distortion by frequency band per tables 10.1 and 10.2 of IEEE Standard 519.

e. All drives shall have a manual bypass; electronic bypasses are not acceptable.

I. Lighting

1. The following illumination levels are recommended by Williams College. Illumination levels referenced are maintained levels measured at a 30" height from the floor or at an actual work surface and represent an average level for the area. Levels as given are a general guide only and deviations and special applications shall be discussed during program sessions, and shall comply with latest I.E.S. standards.

Area/Room Name	Maintained Foot-Candles
Offices & Secretarial Areas	55-60
Laboratories	75-80
Study Areas & Classrooms	50-60
Conference Rooms & Meeting Rooms	40-50
Lecture Hall, Auditorium/Multi-Purpose	35-50
Corridors & Stairwells	15-20
Reception/Lobby, Lounge	30-35
Mechanical, Electrical, Telephone & Elevator Machine Rooms	25
Receiving Areas	30
Storage Areas	10-15
Restrooms & Locker Rooms	25-30
Critical work areas such as tissue labs, culture plate areas, Instrument rooms, etc.	90-100
Temporary site lighting for security purposes	1-3
Walkways for pedestrian security	2-2.5
Parking Lots	1-1.5
Parking Decks	5

2. Interior Lighting:

    a. All lamps shall have a color temperature of 3500K.

    b. LED-based lighting is generally preferred. Fluorescent, incandescent, and other fixtures may be used only when approved by Williams College.

    c. Stairwells in buildings shall have sufficient fixtures so that loss of one lamp will not leave the area dark.

3. Exterior Lighting:

    a. Lighting for the entire site development of a building shall be included in the building contract documents.

    b. Lighting bollards shall be Philips Gardco 830 Series BRM830; 41W LED; 4000K; 42”, or approved equal.

    c. Light pole luminaries shall be KIM Archetype AR/SAR series, full cut-off LED, minimum CRI 70, 3000K or approved equal.

    d. Light pole luminaries shall be Spring City, Exton luminaire with Port Liberte arm and Harrisburg Baltimore base/pole, full cut-off LED, minimum CRI 70, 3000K or approved equal.

4. Lighting Control:

    a. All site and exterior building fixtures shall be tied to campus BMS. Any deviation from this standard must be requested in writing.

    b. Lighting control systems must be Acuity Controls nLight system or approved equal with Owner approval. Any deviation from this standard must be requested in writing.

    c. Occupancy sensors shall be utilized for interior lighting control for energy conservation. The designer shall review the application of the required sensors for the various areas throughout a facility with Williams College.

        1). Stand-alone occupancy sensors shall be Acuity Sensor Switch or approved equal.

    d. The use of multiple switching shall be evaluated for each space and condition.

    e. All exterior and security lighting shall be powered from one location in the building, namely the main electrical room.

    f. Remote switching by means of campus BMS shall be evaluated for special areas.

J. Special systems

1. Lightning Protection: Each building shall be considered individually to determine the necessity for lightning protection. The building location, height, proximity and height of surrounding facilities, etc. should be analyzed in determining the need for this protection. If lightning protection is to be provided, it shall be designed and specified to comply with NFPA #78 "Lightning Protection Code: and the completed system and its installation must have a U.L. master label.

2. Emergency Light and Power:

a. During the design development phase of any facility, the extent of emergency lighting and power required shall be determined in order to establish the alternate power source. The total requirement shall dictate the use of engine generator local battery or central battery stand-by sources. Location of exhaust outlet must not be located where it would affect building occupants.

b. Buildings requiring only emergency lighting should be handled through central battery system or emergency generator based on total load and economics of system.

c. Buildings requiring operation of motor driven equipment, and/or elevator as well as emergency lighting shall use engine generator unit as the standby source.

d. Emergency generator drives rated 100KW or less shall be natural gas fuel where available at site and be equipped with heat exchanger for city water-cooling. If natural gas is not already available near site, then diesel fueled type with minimum of 8-hour operation fuel tank built into base of unit wherever possible. Tank must be double walled with leak detection monitoring.

e. Emergency system wiring shall be in separate conduits, and its distribution through separate panel boards and motor control centers, etc. as required for a complete system to serve exit lights, safety lighting in corridors and stairwells, in general assembly areas, and mechanical equipment rooms and electrical rooms for essential loads, for security systems, fire alarm, and as required.

f. Emergency lighting shall be provided in toilet areas, outdoors at all egress doors to meet code requirements, in laboratory areas, and in all other areas required by code.

3. Electrical provisions for elevators:

a. Power wiring shall be run to the elevator line terminals and a circuit breaker line switch provided adjacent to elevator controller.

b. An emergency circuit to mid-point of the hoistway shall be provided in each elevator pit.

c. A light, light switch, and convenience duplex receptacle on GFI breaker shall be provided in each elevator pit.

4. Cathodic protection: When such protection is determined to be required for underground piping systems, see mechanical section for protection method.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

B. The contractor must provide proof (written documentation) that its employees working on the premises of Williams College have been properly trained in the use and application of personal protective equipment (PPE) and the hazards of working on or near energized equipment.

C. Safety practices that shall be followed include, but are not limited to, the following:

1. Occupational Safety and Health Act
2. Accident Prevention Manual for Industrial Operations, National Safety Council

3. Applicable state and local safety operating procedures
4. Owner's safety practices
5. Permit-required energized electrical work will not be allowed. Non-permit required energized electrical work shall not be performed without prior notification and approval from the WCEST (Williams College Electrical Safety Team). Contracted employers shall maintain all required documentation as required by the Williams College ESP and other safety requirements.

D. Perform all work in accordance with the applicable codes and standards (the latest of each in effect) of the following agencies except as provided otherwise herein:

1. NETA ATS latest Edition: Acceptance Testing Specifications, and/or NETA MTS latest Edition: Maintenance Testing Specifications.
2. 29 CFR
   a. 1910 Subpart S
   b. 1910.269 (where applicable)
   c. 1910.333
   d. 1926 Subpart K
   e. 1926.416
3. ANSI/NFPA 70: National Electrical Code
4. ANSI/NFPA 70B: Recommended Practice for Electrical Equipment Maintenance
5. NFPA 70E: Electrical Safety Requirements for Employee Workplaces

END OF SECTION

SECTION 26 05 73.19
ARC FLASH HAZARD ANALYSIS

PART 1 GENERAL

1.1 SUMMARY

A. The purpose of this project is to provide a complete arc flash program for Williams College to help protect individuals working on its premises from electrical arc flash hazards. These individuals may include any workers who inspect, maintain or operate energized electrical equipment.

B. The program shall bring Williams College into compliance with the applicable standards for new installations (NEC) and for worker safety in operating facilities (OSHA 29 CFR 1910, NFPA 70E).

C. The program shall assist Williams College with improving the reliable operation of the electrical system.

1.2 SYSTEM DATA

A. The engineer shall provide an up-to-date electrical system single-line diagram as required by NFPA 70E, “Standard for Electrical Safety in the Workplace”, as referenced in OSHA 29 CFR 1910 Subpart S, Appendix A. This information shall include nameplate data for electrical components (e.g. transformers, medium voltage switchgear, panelboards, switchboards, motor control centers, etc.) for all portions of the electrical system from the utility entry through the lowest rated panel.

B. Cable sizes, types and lengths between electrical equipment components and up to date utility source data shall be provided for an accurate single-line representation of the electrical system. Unique characteristics of the equipment installation shall be provided which may impact the magnitude of the potential hazard (e.g. open space versus enclosure). Overcurrent device settings shall be verified.

C. Data collection may require removal of barriers, opening of front panels, etc. while equipment is energized. The engineer must provide proof (written documentation) that its employees working on the premises of Williams College have been properly trained in the use and application of personal protective equipment (PPE) and the hazards of working on or near energized equipment. The engineer must provide its own PPE protection.

1.3 SYSTEM ANALYSIS

A. A Comprehensive analysis of Williams College’s electrical system shall be performed for all equipment based on the up to date single-line diagram provided from “Section A”. This analysis shall include the following:

1. Short Circuit Study – A short circuit analysis shall be performed in accordance with ANSI standard C37 and IEEE standard 141-1993 (Red Book) for each electrical component as defined in “Section A. “
2. Coordination Study – A coordination study shall be performed in accordance with IEEE 242-2001 “Buff” to determine the proper overcurrent device settings that will balance system

reliability through selective coordination while minimizing the magnitude of an electrical arc flash hazard incident.

3. Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584-2018, ”IEEE Guide for Performing Arc Flash Hazard Calculations” as referenced in NFPA 70, “Standard for Electrical Safety in the Workplace,” in order to minimize the need for personal protective equipment (PPE) in excess of Category 2. Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable.
4. New short circuit values shall be calculated when major electrical modifications are performed. Consult with Williams College about classification of major modifications.

1.4 DESIGN REVIEW

A. The engineer shall assist Williams College with system design adjustments to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, working distances, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 calories/cm2. A qualified engineer with power systems design experience shall provide this assistance.

1.5 STUDY REPORT

A. The engineer shall supply a comprehensive report that includes:
1. Report summary with analysis methodology, findings and recommendations
2. Summary of input data for utility source, equipment and cables
3. Available fault current at each equipment location with comparison to equipment rating
4. Overcurrent device settings (e.g. pick-up, time delay, curve), “as found” and “as recommended”
5. Incident energy level (calories/cm2) for each equipment location and recommended PPE
6. Overcurrent device coordination curves including related section of the single-line diagram
7. Complete system single-line diagram for the system analyze

1.6 LABELS

A. Based on the results of the incident energy study, the engineer shall produce and install a warning label (orange <40 cal/cm2) or danger label (red > 40 cal/cm2) for each piece of equipment as specified in “Section A” in accordance with ANSI Z535.4-2002. The label must be readable in both indoor and outdoor environments for at least 3 years and contain the following information:
1. Arc hazard boundary (inches)
2. Working distance (inches)
3. Arc flash incident energy at the working distance (calories/ cm2)
4. PPE category and description including the glove rating
5. Voltage rating of the equipment
6. Limited approach distance (inches)
7. Restricted approach distance (inches)
8. Prohibited approach distance (inches)
9. Equipment/bus name
10. Date prepared
11. Engineer name and address

1.7 EQUIPMENT VERIFICATION/OPERATION

A. The validity of the arc flash study and incident energy readings is in part based on proper setting of overcurrent device trip times and the proper operation of the overcurrent devices and breakers themselves. The engineer shall verify proper operation of overcurrent devices and breakers at the request of Williams College using InterNational Electrical Testing Association (NETA) qualified technicians.

B. The engineer shall be capable of adjustment, maintenance, repair or replacement of overcurrent devices or breakers as required to support the performance of the electrical system in line with the expectations of the system study.

1.8 SAFETY TRAINING

A. The engineer shall provide Williams College one day of arc flash safety training that contains the requirements referenced in OSHA 1910.269, OSHA 1910 Subpart S and NFPA 70E. This shall include:

1. Proper use of the system analysis data
2. Interpretation of hazard labels
3. Selection and utilization of personal protective equipment
4. Safe work practices and procedures

B. The engineer shall provide Williams College an outline of the one-day training course including training materials at time of quotation. Williams College at its discretion may require additional training customized to its specific needs. The engineer shall be capable of developing and presenting customized training for approval as required.

C. The engineer shall provide a training certificate to record satisfactory completion by Williams College employees for continuing education credits and re-licensing requirements. Satisfactory completion is defined as the student obtaining a minimum of 70% on the post training examination and the ability to work safely if a hands-on performance evaluation is provided.

1.9 SAFETY DOCUMENTATION/POLICY

A. At the request of Williams College, the engineer shall integrate the results of the system study and design review into the safety manual of Williams College in compliance with OSHA CFR 29 1910.333. The engineer shall assist Williams College at its request to develop a safety policy with corresponding documentation and procedures including information gained in the system analysis. This includes electrical safety, procedures for mitigation of arc hazards, PPE selection based on specific equipment of Williams College, task and training requirements.

1.10 QUALITY ASSURANCE

A. The engineer shall provide all necessary material, equipment, labor, and technical supervision to perform the arc flash hazard analysis as described herein.

B. The engineer shall utilize engineers and technicians that are experienced and regularly perform electrical power system testing.

C. Personnel performing the arc flash analysis shall be trained and experienced in accordance with NETA Training Specifications concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tasks of the analysis in a safe manner and with complete knowledge of the hazards involved.

1.11 SAFETY AND PROCEDURAL REQUIREMENTS

A. The engineer must provide proof (written documentation) that its employees working on the premises of Williams College have been properly trained in the use and application of personal protective equipment (PPE) and the hazards of working on or near energized equipment. The engineer must provide its own PPE protection.

B. Safety practices that shall be followed include, but are not limited to, the following:
1. Occupational Safety and Health Act
2. Accident Prevention Manual for Industrial Operations, National Safety Council
3. Applicable state and local safety operating procedures
4. Owner's safety practices
5. Permit-required energized electrical work will not be allowed. Non-permit required energized electrical work shall not be performed without prior notification and approval from the WCEST (Williams College Electrical Safety Team). Contracted employers shall maintain all required documentation as required by the Williams College ESP and other safety requirements.

C. Perform all work in accordance with the applicable codes and standards (the latest of each in effect) of the following agencies except as provided otherwise herein:
1. NETA ATS latest Edition: Acceptance Testing Specifications, and/or NETA MTS latest Edition: Maintenance Testing Specifications.
2. 29 CFR
   a. 1910 Subpart S
   b. 1910.269 (where applicable)
   c. 1910.333
   d. 1926 Subpart K
   e. 1926.416
3. ANSI/NFPA 70: National Electrical Code
4. ANSI/NFPA 70B: Recommended Practice for Electrical Equipment Maintenance
5. NFPA 70E: Electrical Safety Requirements for Employee Workplaces

END OF SECTION

SECTION 26 09 43 13
DIGITAL-NETWORK LIGHTING CONTROLS

PART 1 – GENERAL

1.1 Summary

A. Section includes a networked lighting control system comprised of the following components:
   1. System Software Interfaces
      a. Management and Visualization Interface
      b. Historical Database and Analytics Interface
      c. Personal Control Applications
      d. Smartphone Programming Interface for wired devices
   2. System Backbone and Integration Equipment
      a. System Controller
      b. OpenADR Interface
   3. Wired Networked Devices
      a. Wall Switches, Dimmers and Scene Controllers
      b. Graphic Wall Stations
      c. Auxiliary Input/Output Devices
      d. Occupancy and Photocell Sensors
      e. Power Packs and Secondary Packs
      f. Networked Luminaires
      g. Relay and Dimming Panel
      h. Sensor Interface
      i. Light Controllers
      j. Digital Sensor Attachments
      k. Networked Luminaires
      l. Communication Bridge

B. The networked lighting control system shall meet all of the characteristics and performance requirements specified herein.

C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 Submittals

A. Submittal shall be provided including the following items.
   1. Bill of Materials necessary to install the networked lighting control system.
   2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
   3. Riser Diagrams showing device wiring connections of system backbone and also typical per room/area type.
   4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.

5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s), including depiction of relay locations.
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
8. Hardware and Software Operation Manuals.

1.3 Approvals

A. Prior approval from Williams College is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

B. Any alternate product or system that has not received prior approval from Williams College at least 10 days prior to submission of a proposal package shall be rejected.

C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.

D. For any alternate system, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.4 Quality Assurance

A. Product Qualifications
   1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
   2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
   3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
   4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
   5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. Installation and Startup Qualifications
   1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements
   1. Phone Support: Toll free technical support shall be available.
   2. Remote Support: The bidder shall offer a remote support capability.
   3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
   4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.5 Warranty

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of substantial completion.

B. The hardware warranty shall cover repair or replacement of any defective products within the warranty period.

1.6 Maintenance & Sustainability

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 – EQUIPMENT

2.1 Manufacturers

A. System to be Acuity nLight system or approved equal.

B. Manufacturers that are listed with DesignLights Consortium Networked Lighting Control System Specification (latest version).

2.2 System Performance Requirements

A. System Architecture

1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) optional system backbone for remote, time based and global operation between control zones.

    a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

    b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wallstations without requiring connection to a higher level system backbone; this capability is referred to as “distributed intelligence.”

    c. System must be capable of interfacing directly with networked luminaires such that low voltage network cabling is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for wired network connection).

2. The system shall be capable of providing individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.

3. Lighting control zones shall be capable of being networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.
5. System shall be capable of "out of box" sequence of operation for each control zone. Standard sequence is:
    a. All switches control all fixtures in a zone
    b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.

B. Wired Networked Control Zone Characteristics

1. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The "out of box" default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
    a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
    b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
    c. Emergency egress devices shall be provided and UL labeled by the lighting control manufacturer.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols.

2.3 System Software Interfaces

A. Management Interface

1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.

2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.

3. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface

1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall optionally upload that data to a cloud based server.

C. Visualization Interfaces

1. System shall provide an optional web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

D. Portable Programming Interface for Standalone Control Zones

1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.

2. Programming capabilities through the application shall include, but not be limited to, the following:

   a. Switch/occupancy/photosensor group configuration

   b. Manual/automatic on modes

   c. Turn-on dim level

   d. Occupancy sensor time delays

   e. Dual technology occupancy sensors sensitivity

   f. Photosensor calibration adjustment and auto-setpoint

   g. Trim level settings

2.4 System Backbone and System Integration Equipment

A. System Controller

1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall perform the following functions:

   a. Facilitation of global network communication between different areas and control zones.

   b. Time-based control of downstream wired network devices.

   c. Linking into an Ethernet network.

   d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.

e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.

3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
4. Device shall automatically detect all networked devices connected to it, including those connected to wired communication bridges.
5. Device shall have a standard and astronomical internal time clock.
6. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.3 wired connection.
7. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
   a. BACnet/MSTP shall support a minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.
   b. BACnet/MSTP shall support 9600 to 115200 baud.
   c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
   d. System controller must support BACnet/IP Broadcast Management Device (BBMD) and Foreign Device Registration (FDR).

B. OpenADR Interface

1. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
2. OpenADR interface shall meet all of the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
   a. Programmable with the account information of the end-user's electrical utility DRAS account credentials.

2.5 Wired Networked Devices

A. Wired Networked Wall Switches, Dimmers, Scene Controllers

1. Wall switches & dimmers shall support the following device options:
   a. Number of control zones: 1, 2 or 4
   b. Control Types Supported: On/Off or On/Off/Dimming
2. Scene controllers shall support the following device options:
   a. Number of scenes: 1, 2 or 4
   b. Control Types Supported:
      1) On/Off or On/Off/Dimming
      2) Preset Level Scene Type
      3) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene
      4) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones

B. Wired Networked Graphic Wall Stations

1. Device shall have a full color touch screen.
2. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
3. Graphic wall stations shall support the following device options:
   a. Number of control zones: Minimum of 16
   b. Number of scenes: Minimum of 16
   c. Optional password protection for setup screens.

C. Wired Networked Auxiliary Input / Output (I/O) Devices

1. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
   a. Contact closure input
      1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
   b. 0-10V analog input
      1) Input shall be programmable to function as a daylight sensor.
   c. RS-232/RS-485 digital input
      1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
   d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current
      1) Output shall be programmable to support all standard sequence of operations supported by system.

D. Wired Networked Occupancy and Photosensors

1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
2. Sensing technologies that are acoustically passive, meaning they do not transmit sounds waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology, if factory required.
3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
4. Sensor mounting type shall match project design requirements as shown on plans.
   a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
2. The system shall support the following types of photocell-based control:
   a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.

b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

E. Wired Networked Wall Switch Sensors

1. Wall switches sensors shall support the following device options:

   a. User Input Control Types Supported: On/Off or On/Off/Dimming

   b. Occupancy Sensing Technology: PIR only or Dual Tech

   c. Daylight Sensing Option: Inhibit Photosensor

F. Wired Networked Embedded Sensors

1. Embedded sensors shall support the following device options:

   a. Occupancy Sensing technology: PIR only or Dual Tech

   b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor

G. Distributed System Power, Switching and Dimming Controls

1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.

2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
3. Device shall be plenum rated.
4. Devices shall be UL Listed for load and load type as specified on the plans.

H. Wired Networked Luminaires

1. Networked luminaire shall have a factory installed mechanically integrated control device and carry a UL Listing as required.

2. Networked LED luminaire shall provide low voltage power to other networked control devices.

3. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.

4. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.

5. Controls manufacturer is responsible for primary troubleshooting and tech support of complete fixture.

I. Wired Networked Relay and Dimming Panel

1. Relay and dimming panel(s) shall be capable of providing the required amount of relay capacity, as required per panel schedules shown on drawings, with an equal number of individual 0-10V dimming outputs.

2. Standard relays used shall have the following required properties:
   a. Configurable in the field to operate with normally closed or normally open behavior.
   b. Provides visual status of current state and manual override control of each relay.
   c. Be individually programmable
3. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
4. Panel shall be UL924 listed for control of emergency lighting circuits.

5. Panel shall provide a contact closure input that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel.

PART 3 – EXECUTION

3.1 Installation Requirements

A. Installation Procedures and Verification

1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
    a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
    b. Length
    c. Insertion Loss

B. Coordination with Owner's IT Network Infrastructure

1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
    a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
    b. The bidder shall provide, to the manufacturer's representative, all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Coordination with Mechanical Division

1. The successful bidder shall provide all integration equipment detailed in Division 260943.
2. The successful bidder to verify integration scope with the Mechanical Contractor prior to submittal phase and provide all necessary schedules to the Lighting Control manufacturer.

D. Documentation and Deliverables

1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device addresses corresponding to locations of installed equipment.
2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
    a. As-Built floor plan drawings showing wired network control zones outlined, in addition to device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
    b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.

1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
   Titleblock
   Text- Inclusive of room names and numbers, fixture tags and drawings notes
   Fixture wiring and homeruns
   Control devices
   Hatching or poché of light fixtures or architectural elements
2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 System Startup

A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
   1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.
B. System start-up and programming shall include:
   1. Verifying operational communication to all system devices.
   2. Programming the network devices into functional control zones to meet the required sequence of operation.
   3. Programming and verifying all sequence of operations.
   4. Customization of owner's software interfaces and applications.
C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

3.3 Project Turnover

A. System Documentation
   1. Submit software database file and any other files necessary to memorialize the existing building programming with desired device labels and notes completed.
B. Owner Training
   1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION

SECTION 26 10 00
MEDIUM-VOLTAGE DISTRIBUTION

PART 1 GENERAL

A. This section provides a guide for the selection of new equipment for use on the campus electrical distribution system. In general, this section covers medium-voltage equipment only.

PART 2 PRODUCT STANDARDS

A. 15kV distribution switches used for all 4.16kV & 13.8kV distribution switch applications.

1. Manufactured by G&W Electric
2. Unit shall have the following features:
   a. Vacuum fault interrupters,15kV Class 12 kA interrupting
   b. 600 A bussing
   c. 600 A terminations (all ways)
   d. Type 3 Electronic Trip unit (10-600 A).
   e. Outdoor switches shall have trip units mounted in external low-voltage compartment.

B. 15 kV cable used for all 4.16kV & 15 kV distribution system cable applications.

a. Manufactured by Kerite or Okonite. Cable shall have the following features: EPR insulation, MV-105 rated, 133% insulation level, shielded, compact stranded, copper, parallel or triplexed with neutral.
b. Main line ductline runs shall be no less than 500 KCM with 1/0 Neutral.
c. Taps to serve single transformers shall be no less than 4/0 with 1/0 Neutral.
d. Taps to serve building service transformers shall be independently run.

C. 6kV elbow arrestors for use on all 4.16 kV pad-mount transformers for surge protection.

a. Manufactured by Eaton Electrical USA.
b. Unit shall be a 200 A Elbow Mount, VariGap MOV,5.1Kv MCOV.

D. Dry-type transformers for use with indoor transformer vault applications.

a. Manufactured by Square D, Eaton, Cutler Hammer, or GE. Unit shall have the following features: 150 Deg. C. rise at 40 Deg. C ambient, 220 Deg C insulation, copper windings, dual ratio primary (4.16kV/13.8kV), denergized tap changer, air terminal chamber for primary terminations. Winding taps shall allow adjustment +/- of both 4.16kV & 13.8kV primary windings; whichever may be selected.
b. Provide all clearances as required by code, local utility, and the College.
c. Provide proximities to driveways/roadways as required by code, local utility, and the College.

d. Primary winding protection to be provided via G&W electronic trip device. No primary fuses (bayonet) allowed.

E. Oil-filled pad-mount transformers for all outdoor transformer applications.

a. Manufactured by Eaton, Carte, ABB, Square D. Unit shall have the following features: 65 deg C rise at 40 deg C ambient, tamperproof, weatherproof copper windings, dead front, 200 A feed through bushing to accept elbow arrestors, dual primary (4.16kV/13.8kV), denergized tap changer, liquid level gauge. Winding taps shall allow adjustment +/- of both 4.16kV & 13.8kV primary windings; whichever may be selected.

b. Provide all clearances as required by code, local utility, and the College.

c. Provide proximities to driveways/roadways as required by code, local utility, and the College.

d. Primary winding protection to be provided via G&W electronic trip device. No primary fuses (bayonet) allowed.

F. Manholes used for all underground electrical ductline applications. Unit shall have the following features:

a. Inside dimensions 7’H x 6’W x 14’L

b. 36” fiberglass manhole cover (by Fibrelite Corp.), labeled ELECTRIC

c. 32 wall mounted fiberglass cable racks (by Underground Devices Inc.)

d. Drains: All manholes shall have a 4" drain to the nearest drainline. The gravity drain shall have an inline check valve: 4" rectorseal clean check backwater valve. Manholes shall be provided with a sump cast into the floor next to the ladder into which a portable sump pump can be installed. Floor shall slope to sump.

PART 3 TESTING

A. Acceptance testing for the medium voltage cable and equipment must be done by an independent testing firm with a minimum experience of testing this equipment and cable of ten years. Testing shall be performed to the latest NETA or Manufacturing specifications; whichever exists or more acceptable.

END OF SECTION

SECTION 26 52 00
SAFETY LIGHTING

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Stairwells in buildings shall have sufficient fixtures so that loss of one lamp will not leave the area dark.

B. Exit signs shall be Exitronixs 600E, 900E, or CT900 series or approved equal and must satisfy MA state and Federal Code.

1. LED's only.

C. Emergency lights shall be Lithonia ELM2 LED, or approved equal.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS

Table of Contents

PART 1 GENERAL

A. This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings.

B. “OIT” refers to the Networking Group within the Williams College Office for Information Technology. Please refer questions and comments regarding the content and use of this document to the Williams College Project Manager.

1.1 - SUMMARY

A. Communications infrastructure must be designed to allow replacement of cable infrastructure during the life of the building. The life time of many new buildings on campus is over 100 years, and renovations can add 30 to 40 years to a building’s useful life. However, advances in technology requires communications cable to be replaced every 15 to 20 years. Pathways must be designed to allow for non-disruptive installation of new communications cabling without impact to architectural integrity or occupants use of the facility and must allow for growth in port density and cable sizes.

B. The system design must permit replacement and upgrade of system components while supporting present service. Technicians must be able to access the front and rear of electronics and network patch panels. They must be able to add new cable to existing drops without major disruption and expense. The design must anticipate growth by adding capacity for new communications outlets. This includes sizing of telecommunications rooms and raceway at 40% fill.

C. The communications system installed must function for current and near future communications standards for speed, reliability, and security. Transmission of information at higher speeds requires more energy closer to the consumer. The current generation of network equipment is hotter and larger than the previous generation.

D. The system must accommodate applications to new services such as intelligent building systems and video distribution. New services will likely require power and dta which necessitates increased power consumption in telecommunications rooms. Increased power will generate a corresponding amount of heat, which must be dissipated to maintain operation of the equipment.

1.2 - DESIGN ENGINEER AND ARCHITECT QUALIFICATIONS

A. The Construction and Design Engineer must have a BICSI (Building Industry Consulting Service International) Registered Communications Distribution Designer (RCDD) on staff that is thoroughly familiar with the cabling methods established by the current BCSI TDMM (Telecommunications Distribution Methods Manual).

B. The Design Engineer shall have at least 5 years’ experience designing telecommunications systems.

C. Contractor will supply name and qualifications of BICSI RCDD certified Design Engineer supporting the project to Williams project manager.

D. The RF Engineer designing WiFi installation shall have an active CWNP certification.

E. Contractor will supply name and qualifications of CWNP certified RF Engineer supporting the project to Williams project manager.

1.3 – INSTALLER QUALIFICATIONS

A. Fiber Installers must be covered by Sumitomo certification; contractor must be able to offer the Sumitomo 25 year premium warranty. Installers shall have an active BICSI Installer 2 – Fiber or BICSI Tech certification.

B. Horizontal cabling Installers must be covered by Hubbell certification; contractor must be able to offer the Hubbell 25 year Mission Critical warranty. Installers shall have an active BICSI Installer 2 – Copper or BICSI Tech certification.

1.4 - COMMUNICATION SYSTEM COMPONENT DEFINITIONS

A. Modern communication systems are complex and delicate. There are nine major components that make up a communications system within a building. Item 1-6 below are defined by BICSI and are designed, built, and funded by the construction project. Item 7 is specified, purchased, and installed by OIT but funded by the project. Item 8 is specified and purchased by OIT but funded and installed by the project. Finally, number 9 is the responsibility of the end- user and program requirements, which determine the quantity of components for items 1 through 8.

1. Building Entrance: The room or space inside a building where telecommunications cables enter and leave the building.

2. Server Room: An environmentally controlled centralized space for locating equipment that provides an essential service to multiple buildings or academic departments. Such equipment has special environmental and security requirements and must be identified early in the design process.

   Equipment manufacturers require temperature and humidity control for proper function of the tel/data equipment. Current industry standards must be followed when designing computing server rooms. Requirements must be addressed on a space-by-space basis, depending on the equipment being installed.

3. Backbone: A facility (e.g., pathway, cable, or conductors) between any of the following spaces: telecommunications rooms, entrance facilities, and server rooms.

4. Telecommunications Room (TR): An enclosed space for housing telecommunications equipment, cable terminations, and cross—connect cabling for central campus services.

5. Horizontal Cable: The part of the cabling system that extends from (and includes) the telecommunications outlet/connector to the horizontal cross-connects in the telecommunications room.

6. Telecommunications Outlet: A connecting device in the tenant work area on which horizontal cable terminates. Telecommunications outlets are also referred to as work area outlets, WAO's, or drops. Each WAO has one to six (keystone) jacks.

7. Network Electronics: Mounted in racks along with patch panels for horizontal data cable in the telecommunications room, each unit of electronics supports multiple data jacks and must be accessible from the front and rear. Adequate space should be provided for airflow on all sides of the electronics.

8. Wireless Distribution Electronics: Mounted throughout the project to provide wireless

access to data and voice services. Units are connected to Network Electronics via dedicated drops from the Telecommunications Room.

9. Work Area Equipment: Computers, printers, telephones, fax machines, copy machines, cash registers, time clocks, electric meters, lab freezers, vending machines, etc. All work area equipment is purchased and configured by the tenant or department service owner.

1.5 - TELECOMMUNICATIONS SERVICES AND SERVICE LOCATIONS

A. Work area outlets (WAO) must be named and labeled according to the labeling standards in Section 1.11. This is to identify locations for support and security for network traffic. The number of work area drops per floor determines the MEP (Mechanical Electric Plumbing) requirements of the telecommunication room.

B. Administrative Work Areas, Offices, and Work Partitions

1. Work areas that fit within a 10’ by 10’ perimeter and is expected to be occupied by one person.

    a. A minimum of one WAO and three UTP jacks are required. The building occupants should be consulted for additional outlet locations.

2. Work area that do not fit within a 10’ by 10’ perimeter or are expected to be occupied by more than one person.

    a. A minimum of (2UTP) per expected occupant.

    b. A minimum of one WAO (2UTP) is required for every 100 square feet of office space.

    c. No point on any wall will be more that 15’ away from a WAO when measured along continuous wall surface.

    d. WAOs should be located to allow maximum flexibility for change in the work area (i.e. on opposing walls).

    e. The building occupants should be consulted for additional WAO locations.

3. WAO’s should be located near an electrical outlet (within 3 ft.) and installed at the same height, if appropriate.

C. Conference Rooms

1. 3UTP at the table center

2. A minimum of two WAOs (2UTP) on opposing walls

3. No point on any wall will be more that 15’ away from a drop when measured along continuous wall surface.

4. Any additional drops required for projectors, display systems, or other audio-visual systems

D. Wireless Service

1. General Design

    a. Provide a radio frequency (RF) signal analysis in order to determine wireless access point (WAP) locations and quantities

    b. Consult with OIT on currently supported Wireless Access Point (WAP) models.

    c. Wireless service must cover all spaces including hallways, mechanical rooms, stairwells, and lounges.

    d. Access point placement must be determined using an RF study conducted by a CWNP certified RF Engineer. OIT and the PM(Project Manager) will jointly determine where WiFi coverage is required within the project and if there are any restrictions on where WAPs may be placed. Final WAP location and counts can't be determined until the survey is complete. Two considerations for locating APs are coverage and capacity

       Coverage — signal strength through the coverage area must be a minimum of -65 dBm using 5 GHz on 802.11ac.

       Capacity — Wireless APs must be placed at a density that anticipates the degree of utilization required to support the program in the space covered by the service. Classrooms require a denser coverage model.

2. Interior Wireless Installation

    a. Surface ceiling mount, is strongly preferred over wall mount or above ceiling mount. Wall mount and above ceiling mount are only permitted where surface ceiling mount is not feasible; written waiver by OIT is required.

    b. Surface ceiling mount:

        1. AP drops will be located above or within the finished ceiling, easily accessible from below the ceiling, and within 2' for the designated AP location.

        2. Mounting heights on exposed ceiling must be below any signal obstructing materials, such as metal ductwork.

    c. Wall mounted:

        1. 8" below ceiling and no higher than ten feet Above Finished Floor (AFF).

        2. WAP drops will be located 12" BFC (below finished ceiling).

        3. Proposed design must be sent to OIT for written approval.

    d. Above ceiling mount:

        1. Proposed design must be sent to OIT for written approval.

3. Exterior Wireless Installation

    a. If outdoor Wi-Fi is part of the project, consult with OIT to develop a design proposal.

b. Minimum conduit size for antennae cable – 1 ½"

c. The radio is mounted in the interior space on a small backboard (2'x2'). The radio must be accessible either above a drop ceiling or by way of an access hatch.

d. The distance between the antennae and WAP-radio matters — the shorter the distance the greater the signal. Minimum distance is one foot (12"); the maximum distance is five feet (60").

e. Proposed design must be sent to OIT for written approval.

E. DAS

1. Although a Distributed Antennae System (DAS) is not required at this time, adding raceway in new construction is recommended to accommodate any future DAS implementation. Architects/Designers should balance the use of low "E" glass with the need for cellular and 800MHz signals within the building.

F. Student Rooms

1. A minimum one drop (2UTP) per occupant.

2. A minimum of one drop (2UTP) is required for every 125 square feet of living space.

3. Wireless coverage in all spaces.

G. Classrooms

1. A minimum of one drop (2 UTP) in the front of the classroom

2. A minimum of one drop (2UTP) in the rear of the classroom

3. One drop (6UTP) in each teaching station

4. One wall phone jack (1 UTP) mounted in the vicinity of the teaching station

5. Wireless coverage in all spaces.

6. Additional drops may be requested by OIT for classrooms with occupancy greater than 30 students or non-rectangular spaces.

H. Laboratories

1. Proposed drop locations and counts must be reviewed with tenants and sent to OIT for written approval.

I. Reception and Waiting Areas, Study Spaces, Common Rooms and Lounges

1. A minimum of one drop (2UTP) is required for every 100 square feet of space.

J. Hall phones

1. One wall phone per floor in an accessible location.

K. Elevators

1. 2 UTP to the Elevator Machine Room. Elevator contractor will support 2 UTP CAT^ connection from the Elevator Machine Room to the Elevator Car. One UTP connection is for the VoIP Elevator phone. The second UTP is reserved for future use.

L. PoE Door Locks

a. New Construction and Major Renovation

i. One UTP per door lock plus a ground wire connected to a building ground

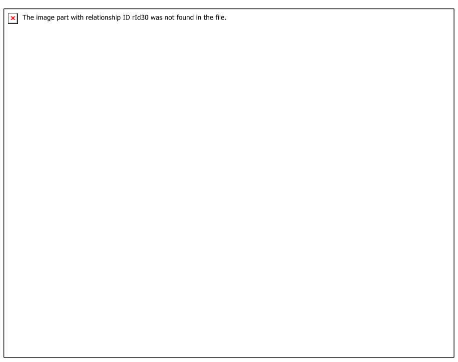
b. Minor Renovations and Isolated Installations

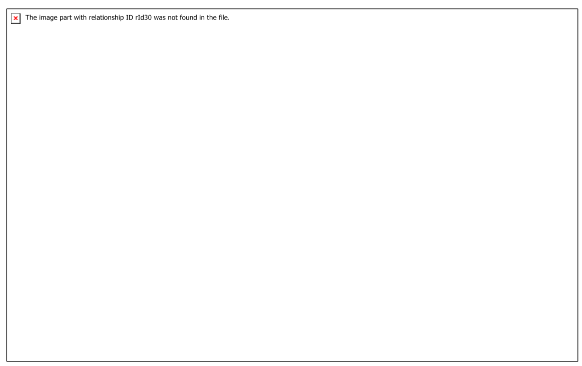
i. One UTP per door lock plus a ground wire connected to a building ground preferred

ii. When a building ground wire cannot be installed, STP with the shield acting as an electrical drain may be used with written OIT approval.

M. Special Use Outlets

Outlets for special devices require a demarcation point (location where operational responsibility changes) adjacent to the device. If device’s network interface is within a cabinet, an external demarcation point is required as shown below.





1. Energy management, HVAC (Heating Ventilation and Air Conditioning), BAS (Building Automation Systems) (2 UTP) per device

2. Emergency telephones mounted to a building (1 UTP). Emergency telephones remote from a building (2 UTP). Also known as “blue light” phones.

3. Wall phone (1 UTP). Typically used in laboratories and classrooms. These outlets are located 48” above the finished floor.

4. Networked Security Cameras (1D). Also known as IP cameras.

5. Point of Sale (Food Services cash registers) (2 UTP)

6. Time and Attendance (1 UTP). Also known as time clocks.

7. Card access panels (1 UTP)

8. Vending machines (1 UTP) per vending machine. These outlets must be located 76”

above the finished floor.

9. MFP (Multi-function printer, copier, fax machine, …) (2 UTP)
10. Power meters (1 UTP)
11. Gas meters (confirm with MEP design for building automation and metering)
12. Wireless access points (2 UTP)
13. Elevator rooms (2 UTP per car and 2UTP per machine room) — Communication outlet must be installed outside and adjacent to the elevator control enclosure.
14. Washer/dryer controller (1 UTP) per controller.
15. Keywatcher (1UTP). If located in a publicly accessible area, 1 UTP should be installed directly behind the Keywatcher unit, otherwise an external demarcation point is required.
16. Ceiling-mount projectors (2UTP above projector)
17. Wall-mount flat panel display (2 UTP, 1 coax optional) Install drops behind flat panel so that they are recessed within the wall so that they are not visible and to allow flush-mounting of the display.
18. Special event locations for commencement, conferences, or temporary set ups for registration and presentations. Review with tenant and OIT.

PART 2 APPLYING DESIGN GUIDELINES TO SYSTEM COMPONENTS

Any deviation from these guidelines must be approved in writing from OIT.

2.1 - BUILDING ENTRANCE

Connections between buildings are based on location and building size. OIT must be consulted for the quantity and location of the underground infrastructure.

2.2 - TELECOMMUNICATIONS ROOM

A. The room must be clean, secure, and permit maintenance without disruption of services. The number of work area drops per floor determines the MEP (Mechanical Electric Plumbing) requirements of each telecommunication room. In addition, TRs must meet the following requirements (Exceptions permitted by written waiver by OIT):

   1. Location

      a. There should be a minimum of one TR per floor serving a maximum cable length of 295 feet.

      b. The location should be selected so that the room may be expanded.

c. Locate as close as practical to the center core of the building to minimize horizontal cable distances (Maximum cable length is 295' (90m) from TR to drop location). In multiple floor buildings, TRs shall have all 4 walls vertically stacked.

d. TRs must be dedicated space. They may not be inside of or be part of a mechanical space, server room, washroom, storage area, janitor closet, public space, tenant office, closet or other space that is not a dedicated TR.

e. The TR must be accessible off a common public corridor.

2. Size

f. TR for new construction projects shall be sized based on the following table and diagram. Additional rooms should be added if the floor is over 20,000 square feet.

Building Area Served (gross square feet)	Maximum Jack Count	Minimum Room Size
< 7,500	384	10' x 8'
7,500 – 15,000	576	12' x 8'
> 15,000	768	14' x 8'

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3. Room Parameters

a. A minimum of two walls (a minimum of 12 linear feet on available interior walls) should be covered with AC grade or better, void-free fire rated plywood backboard, 8 ft. high with a minimum thickness of 3/4". The plywood should be installed with the grade "C" surface facing the wall, primed and painted with flame retardant paint. Securely fasten the plywood to wall-framing members to ensure that it can support attached equipment.

b. The height between the finished floor and the lowest point of the ceiling must be a minimum of 8'6". Equipment racks are 7', cable tray at 7'6", lighting at 8'6".

c. Cable tray is required inside a TR and must be accessible.

d. Floors, walls, and ceiling must be treated to eliminate dust.

e. Finishes shall be light in color to enhance room lighting.

f. Floor covering shall be an anti-static material and sealed to reduce dust.

g. The room must be secured and accessible only by authorized personnel. Access from the building exterior to all TRs must be permitted 24x7x365 to allow for maintenance and repairs.

h. All TRs shall be secured by card access.

i. Room shall not have a false ceiling to permit maximum use of cable pathways both vertically and horizontally. In such cases where fire-proofing may be sprayed onto the exposed ceiling, the fire-proofing shall be treated to mitigate airborne dust.

j. The TR shall be located on floor areas designed with a minimum floor loading of 2.4 kPa (50 lb/ft2).

k. Consideration should be given to the acoustic noise from OIT equipment fans and the proximity to building occupants.

l. Dedicated Equipment Space. The space equal to the width and depth of the telecommunications room and extending from the floor to a height of 6ft above the equipment racks or to the structural ceiling, whichever is lower, shall be dedicated to the networking equipment. No piping, ducts, leak protection apparatus, or other equipment foreign to the networking equipment shall be located in this zone.

m. The room must be free of piping such as water pipes, steam pipes, soil pipes, sanitary drains, storm drains, and other unrelated systems utilized for or containing liquids, or gases. Sprinkler piping serving the Telecommunications room is acceptable but piping shall not pass through the TR to serve other areas.

4. Mechanical — Heating, Ventilation and Air Conditioning (HVAC)

a. HVAC shall be available on a 24 hours-per-day, 365 days-per-year basis. A stand-alone unit should be considered for Telecommunications Rooms where central systems are not continuously available.

b. The temperature and humidity shall be controlled to provide continuous operating ranges of 18ºC (64ºF) to 24ºC (75ºF) with 30% to 55% relative humidity.

c. The ambient temperature and humidity shall be measured at a distance of 1.5 m (5 ft.) above the floor level, after the equipment is in operation, at any point along an equipment aisle center-line.

d. A positive pressure differential with respect to surrounding areas should be provided with a minimum of one air change per hour.

e. Pressurization can be achieved with transfer air and adequate air filters. Air filtration should be provided at MERV #7.

5. Electrical

a. All communications equipment must be supplied by generator stand by power where it is available for building use.

b. Some key network locations may require generator backup even if it is not provided for the building.

c. Building wide UPS

A building wide UPS (Uninterruptable Power Supply) is recommended for any building with three or more Telecommunications Rooms. Two 20A quad outlets are required per network equipment rack.

d. Rack mounted UPS

Branch circuits for equipment power must be protected and cabled for 20A capacity. Circuits must be dedicated to electronic equipment and must be isolated from cyclic power loads. Key network locations may require additional power capacity.

A minimum of two dedicated per network equipment rack (5-20P) on standby power, non-switched 3-cable 120-volt (V) alternating current (AC) electrical outlets for network equipment power, each on separate branch circuits.

e. UPS protection is required for all Telecommunications Rooms. (Exceptions permitted by written waiver by OIT)

f. Separate duplex 120 volt (V) alternating current (AC) convenience electrical outlets (for tools, field test instruments, etc.), must be placed at 1.8 m (6 ft.) intervals around perimeter walls.

g. All electrical outlets must be on non-switched circuits, not controlled by a wall switch or other device that may lead to inadvertent loss of service.

h. All electrical outlets must be identified as to the location of the upstream breaker panel.

i. Dedicated power distribution to TRs is recommended.

j. Distribution panels that serve telecommunications equipment should be separate from those that serve lighting fixtures or motors.

6. Lighting

a. Shall be a minimum of 500 lux (50 foot candles) measured 1 m (~3 ft.) above the finished floor, mounted 8.5 ft. minimum above the finished floor.

b. Both the front and rear of any network equipment rack must be illuminated.

c. Light fixtures must be independently supported from the ceiling to the building structure. Light fixtures shall not be mounted to, or supported by the cable tray.

d. A wall switch located at the room entrance shall control lights. Coordinate light placement with equipment rack and cable tray/ladder rack locations to maximize lighting and minimize Electro-Magnetic Interference.

7. Bonding and Grounding

a. The installation conforms with applicable practices and codes (in the United States, ANSI TIA-607-B, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, the NEC, and local building codes

2.3 - BACKBONE

A. Backbones must be designed in such a way to protect the cables from damage. Backbone capacity must be sufficient to connect each local telecommunication room in the project to remote network distribution equipment specified by OIT.

B. Backbone fiber installed will utilize the Sumitomo FutureFlex Air Blown Fiber (ABF) system.

C. Design team will collaborate with OIT to determine overall ABF backbone design, TDU(Tube Distribution Unit) locations, tube counts, and LIU (Light Interface Unit / fiber patch panel) locations, and installation procedures.

D. The capacity and destination for OSP (outside plant) backbone cable building fiber is determined by the location and purpose of the building, typically a minimum of 2 ABF tubes per Telecommunications Room and a 25 pair telephone backbone cable per building.

E. All telecommunications room in each building will require a minimum of 12 strands of single mode fiber. At least one telecommunications room in each building will require a minimum of 18 strands of single mode fiber. OIT will specify this location for each project.

F. All fiber splices will be performed using fusion splicing.

G. The minimum pair count for copper inside plant riser for telephone is 25 pair per Telecommunications Room.

H. All backbone cable must be protected and supported.

I. Maximum 40% fill for new raceway provides replacement during the lifetime of the renovation.

2.4 - HORIZONTAL CABLING

A. Horizontal cable must be protected from damage (crushing, twisting, or weather) during and after installation. Supporting raceway must accommodate for growth and maintenance of the cable as well as non-disruptive installation of replacement cabling as cable standards change.

B. The maximum fill is 40% fill for new pathway. This provides for replacement of cable without disruption to users. Cables that are anticipated to be added in the future, such as cabling for PoE door locks, should be included when calculating the fill rate.

C. All horizontal cabling shall be installed in a manor meeting requirements specified in American National Standards Institute/Telecommunications Industry Association/Electronic Industries

Alliance (ANSI/TIA/EIA)—569—D, Commercial Building Standard for Telecommunications Pathways and Spaces.

D. Horizontal cable must be accessible or in conduit over such areas as hard ceilings.

E. When designing a building, the layout and capacity of the horizontal pathway system must be thoroughly documented in floor plans and other building specifications. The designer is responsible for ensuring that these systems have built-in flexibility to accommodate tenant movement and expansion. In addition, the horizontal pathway system should be designed to make the maintenance and relocation of cabling as easy as possible.

F. All design and construction for pathway systems must meet or exceed national and local codes and standards.

G. When grounding telecommunications pathways, ensure that the installation conforms to ANSI TIA-607-C, Commercial Building Grounding (Earthen) and Bonding Requirements for Telecommunications, the NEC, and local building codes.

2.5 - RACK EQUIPMENT LAYOUT

A. Standard network equipment rack:

1. Standard network equipment rack shall be sized to hold:

   a. six (6) data patch panels (2U each)

   b. one (1) 1U fiber patch panel or one (1) 2U telephone patch panel

   c. seven (7) 2U cable managers

   d. six (6) 1U Edge Switches

   e. one (1) 2U rack-mounted UPS

   f. two (2) 2U Battery Packs.

2. The bottom of the fiber patch panel or telecom patch panel will be mounted at RU 42.

3. The data patch panels will be installed at RU 38-39, 30-31, 28-29, 20-21, 18-19, and 10-11 in descending order.

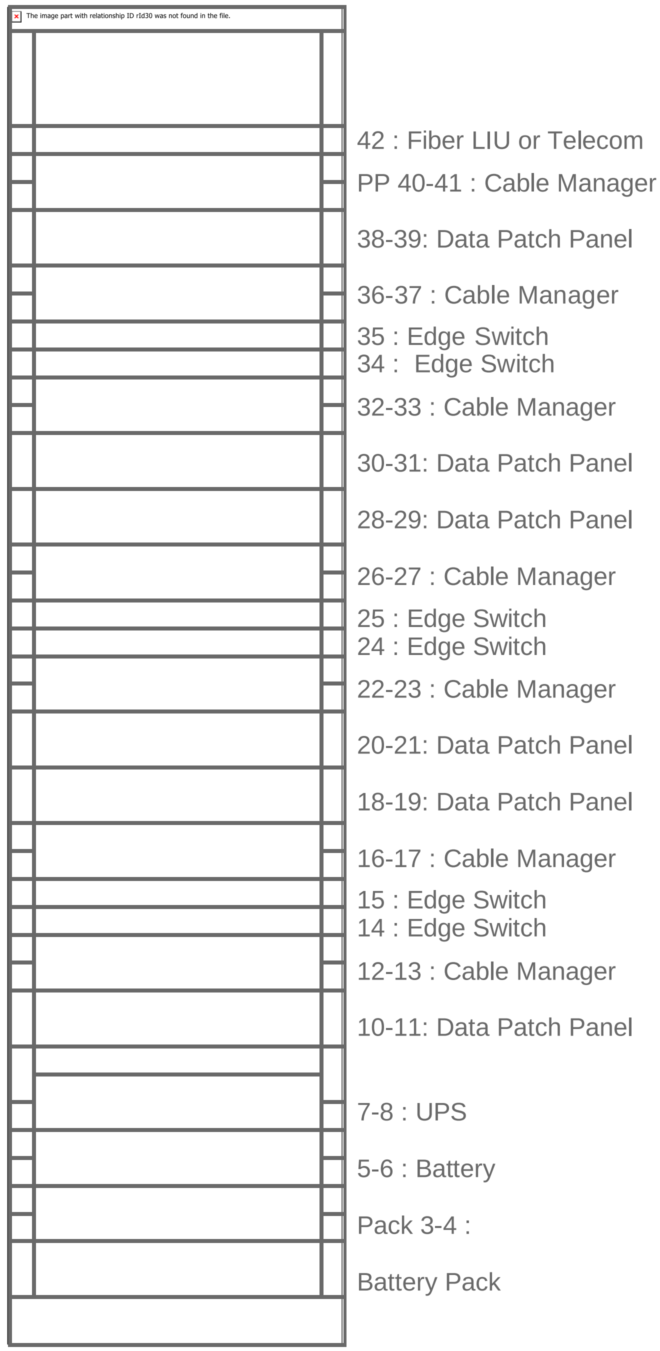
4. If six (6) or fewer data patch panels will be installed, CAT6A patch panels will be installed in the highest data patch panel positions followed by CAT6 patch panels. If more than six (6) patch panels will be installed, CAT6A patch panels will be installed in a dedicated rack.

5. The 2U cable managers will be installed at RU 40-41, 36-37, 32-33, 26-27, 22-23, 16-17 and 12-13 if they are adjacent to a patch panel.

6. The 1U Edge Switches may be installed at RU 35, 34, 25, 24, 15, and 14 as directed by OIT.

7. The 2U rack-mounted UPS will be installed at RU 7-8. Additional battery packs will be installed at RU 5-6 and 3-4 in descending order.

8. Alterations to the standard network rack layout will be considered by OIT in unique circumstances. Written waiver by OIT is required if an alternate design will be utilized.



Standard Rack Elevation

2.6 - CABLE SUPPORTS/CABLE RACEWAY

A. The Consulting Engineer shall specify Cable raceway and supports subject to approval by WCF

(Williams College Facilities) and OIT.

B. Cable trays shall be accessible. A minimum clearance of 12" above and 12" on one side is required for cable tray up to 12" in width. Cable tray wider than 12" will require a minimum clearance of its width above and on one side. (Ex. 18" cable tray requires 18" clearance above and 18" clearance on one side.)

2.7 - NAMING CONVENTIONS & LABELING STANDARDS

A. Work Area Outlet Names

1. All Work Area Outlets (WAOs) must be assigned a unique name. The following method is used to assign a name to any communications outlet including all data outlets in offices, laboratories, wall phones, wireless access points, and classrooms. This naming standard does not include audio/visual outlets, however.

2. The outlet name has two parts separated by a dash (-). The first part is the same as the room number of the Telecommunications Room servicing the WAO. This must be the final room numbers as assigned by WCF. The second part is the Patch Panel port identification.

3. For example, a WAO terminating on Patch Panel port A25 in Telecommunications room G02B would be labeled G02B - A25.

B. Work Area Outlet Cable Names

1. Each cable must be labeled at each end. The label must show the WAO name.

2. Fiber cable and electronics located in telecommunications rooms (TRs) are also named and labeled. Consult with OIT for specifics within each TR.

3. Work area outlets for communication also may be referred to as "taps", hence the "tap list" which is a list of all communication outlets and cables in a project.

C. WAO Extensions

1. Each jack in a modular furniture system must be labeled with the name of the WAO it connects to. Cables used to make this connection must also be labeled with the WAO name.

D. Telecommunications Rooms

1. Patch panels

   a. CAT6 patch panels will be identified using the letters starting with A and incrementing thru S.

   b. CAT6A patch panels will be identified using the letters starting with W and incrementing thru Z

   c. Telephone patch panels will be identified using the letter T.

2. OIT will designate Names/Labels for all other items.

3 — PRODUCTS

Substitutions for the products listed are typically not permitted. Any deviation from these standards must be approved in writing through written waiver from OIT.

3.1 - FACEPLATES

A. All faceplates shall be equipped with machine printed labels and label holders

B. Single gang 4 port faceplate shall be Hubbell P/N AFP14 (Light Almond/Office White)

C. Single gang 6 port faceplate shall be Hubbell P/N IFP16OW (Light Almond/Office White)

D. Wall phone plates shall be Hubbell P/N SP6F (Stainless steel Cat6)

E. Other face plates may be permitted by written waiver by OIT. Agreed upon attic stock must be included in project for future use by OIT if non-standard faceplates are used.

3.2 - MODULAR INSERTS

A. Single Modular inserts for all Cat6 data ports shall be Hubbell P/N HXJ6B (8-position blue TIA-568B wired category 6).

B. Single Modular inserts for all Cat6A data ports shall be Hubbell P/N HJ6AOW (8-position office white TIA-568B wired category 6A).

C. Blank Modular inserts shall be Hubbell P/N SFB10.

D. Modular inserts shall be positioned in the faceplate as follows:

E. All data jacks shall be positioned starting at the top left and proceeding to the rightmost column then down to the next row.

F. Data jacks shall be named using their Work Area Outlet Name in the tap list.

G. Other modular inserts may be permitted by written waiver by OIT. Agreed upon attic stock must be included in project for future use by OIT if non-standard faceplates are used.

3.3 - HORIZONTAL CABLE

A. UTP Horizontal cable utilized for the distribution of data shall meet or exceed Category 6 cable standards and shall comply with the Hubbell 25-year Mission Critical Warranty™. Color shall be blue.

B. UTP Horizontal cable utilized for the distribution of data to Wireless Distribution Electronics shall meet or exceed Category 6A cable standards and shall comply with the Hubbell 25-year Mission Critical Warranty™. Color shall be white.

C. Plenum rated UTP Horizontal cable is required in plenum areas. Riser rated UTP Horizontal cable may be used in non-plenum areas. If it is unclear what spaces are considered plenum, it is the contractor’s responsibility to inquire with the owner, architect, engineer or municipal officer(s).

D. New construction work shall be designed with non-plenum pathways.

E. Cable in the table below is approved by OIT. Other cable eligible for the Hubbell 25-year Mission Critical Warranty™ may be approved by written waiver by OIT.

Category	Type	Color	Manufacturer	P/N
6	Riser	Blue	Mohawk	M57202
6	Plenum	Blue	Mohawk	M57193
6A	Riser	White	Mohawk	M58651
6A	Plenum	White	Mohawk	M58647

3.4 - DATA PATCH PANELS

A. Modular patch panel(s) shall be 8 position, 8 conductor, match the category of cable terminated on them, and be approved in section 3.4.B or 3.4.C as applicable.

B. Modular patch panels in the table below are approved by OIT. Other patch panels eligible for the Hubbell 25-year Mission Critical Warranty™ may be approved by written waiver by OIT.

Category	Port Count	Manufacturer	P/N
6	48	Hubbell	HP648
6A	48	Hubbell	HP6A48

C. Modular patch panels in the table below are approved by OIT and may only be used when less than 18 horizontal cables (existing and new) will be present in the building. Written waiver by OIT is required if more than 18 horizontal cables will be present in the building at the completion of the project.

Category	Port Count	Manufacturer	P/N
6	24	Hubbell	HP624
6A	24	Hubbell	HP6A24

D. Horizontal wire management in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Height	Manufacturer	P/N
2U	Hubbell	HS23C
2U	Hubbell	HC219MS3N
2U	CableTamer/NeatPatch	NP2

3.5 - FIBER OPTIC TERMINATION HARDWARE

A. Sumitomo FutureFlex Tube Cables in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Tube Type	**Tube Count**	**Manufacturer**	**Description**	**P/N**
Outdoor	2	Sumitomo	Water-Blocked, Dielectric Tube Cable; 2 tubes	TC02TOX
Outdoor	4	Sumitomo	Water-Blocked, Dielectric Tube Cable with CSM; 4 tubes	TC04TOD
Outdoor	7	Sumitomo	Water-Blocked, Dielectric Tube Cable; 7 tubes	TC07TOX
Outdoor	19	Sumitomo	Water-Blocked, Dielectric Tube Cable; 19 tubes	TC19TOX
Indoor - Riser	2	Sumitomo	UL/CUL/CSA OFNR Rated Tube Cable/Single Jacket; 2 tubes	TC02TR3
Indoor - Riser	4	Sumitomo	UL/CUL/CSA OFNR Rated Tube Cable/Single Jacket; 4 tubes	TC04TR3
Indoor - Riser	7	Sumitomo	UL/CUL/CSA OFNR Rated Tube Cable/Single Jacket; 7 tubes	TC07TR3
Indoor - Riser	19	Sumitomo	UL/CUL/CSA OFNR Rated Tube Cable/Single Jacket; 19 tubes	TC19TR3
Indoor - Plenum	2	Sumitomo	UL/CUL/CSA NFPA 262 Plenum OFNP Rated Tube Cable/Single Jacket; 2 tubes	TC02TP2
Indoor - Plenum	4	Sumitomo	UL/CUL/CSA NFPA 262 Plenum OFNP Rated Tube Cable/Single Jacket; 4 tubes	TC04TP2
Indoor - Plenum	7	Sumitomo	UL/CUL/CSA NFPA 262 Plenum OFNP Rated Tube Cable/Single Jacket; 7 tubes	TC07TP2
Indoor - Plenum	19	Sumitomo	UL/CUL/CSA NFPA 262 Plenum OFNP Rated Tube Cable/Single	TC19TP2

			Jacket; 19 tubes	
Indoor - Unrated	1	Sumitomo	Translucent Tube - Non-flame Retardant	TC01TXX

B. Sumitomo FutureFlex Tube Distribution Units (TDUs) in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Size	**Rating**	**Manufacturer**	**Description**	**P/N**

16" x 16" x 4"	Indoor	Sumitomo	Tube Distribution Unit, Modular, Indoor	DE06MDU
20" x 20" x 7"	NEMA 1	Sumitomo	Tube Distribution Unit, NEMA 1	DE20IDU
36" x 30" x 7"	NEMA 1	Sumitomo	Tube Distribution Unit, NEMA 1	DE36IDU
24" x 24" x 8"	NEMA 4	Sumitomo	Tube Distribution Unit, NEMA 4	DE24XPPU
36" x 30" x 8"	NEMA 4	Sumitomo	Tube Distribution Unit, NEMA 1	DE36XPPU

C. Sumitomo FutureFlex Tube Distribution Accessories in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Description	P/N
Bushing for 2-Tube Cable Liquid Tight Kellem Fitting	DE02TOX
Bushing for 4-Tube Cable Liquid Tight Kellem Fitting	DE04TOD
Straight Tube Coupling (8mm) / Clear, available only in packs of 10	DE08MC2
Tube End Cap (8mm) / Slate, available only in packs of 10	DE08MA
Tube Plug (6mm) / Orange, available only in packs of 10	DE06MP
8-tube Organizer for 8 mm Tubes, available only in pks of 10	DETC008
Heat Shrinkable Cable Entry Seal	DECES3
Heat Shrinkable Cable Entry Seal	DECES4
Dust tight Kellem Fitting for Tube Cables	DEDTSR2
Dust tight Kellem Fitting for Tube Cables	DEDTSR3
Dust tight Kellem Fitting for Tube Cables	DEDTSR4
Dust tight Kellem Fitting for Tube Cables	DEDTSR5
Tube Cable Splice Kit (for 2- or 4-Tube Cables)	DE00SPL
Tube Cable Splice Kit (for 7-Tube Cables)	DE01SPL
Tube Cable Splice Kit (for 19-Tube Cables)	DE02SPL

D. Sumitomo FutureFlex Fiber in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Type	Strands	Manufacturer	Description	P/N
Single-mode	12	Sumitomo	Single-mode 12-fiber	FB12SX
Single-mode	18	Sumitomo	Single-mode 18-fiber	FB18SX
Single-mode	24	Sumitomo	Single-mode 24-fiber	FB24SX

E. Sumitomo FutureFlex Fiber Termination Units (LIUs) in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Description	P/N

1U Termination Unit / Holds 1 Splice Tray & 3 Adapter Panels (1-36 cap.)	FT01RU3P
4U Termination Unit / Holds 6 Splice Trays & 12 Adapter Panels (72-144 cap.)	FT04RU12P

F. Sumitomo FutureFlex Fiber Termination Pigtails in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Type	Strands	Manufacturer	Description	P/N
Single-mode	12	Sumitomo	LC / 12 Fiber 900um Pigtail / Singlemode / 2 meter	FT12SLC2M
Single-mode	18	Sumitomo	LC / 18 Fiber 900um Pigtail / Singlemode / 2 meter	FT18SLC2M
Single-mode	24	Sumitomo	LC / 24 Fiber 900um Pigtail / Singlemode / 2 meter	FT24SLC2M

G. Sumitomo FutureFlex Fiber Termination Accessories in the table below is approved by OIT. Other products may be approved by written waiver by OIT.

Description	P/N
LC Duplex Panel with 6 Adapters and 12 Ports / SM / Blue	FTLC06D1
12-fiber Bundle Breakout Kit (w/ 900 micron Tubing)	FTFLD12
18-fiber Bundle Breakout Kit (w/ 900 micron Tubing)	FTFLD18
24-fiber Bundle Breakout Kit (w/ 900 micron Tubing)	FTFLD24

3.6 - VOICE TERMINATION HARDWARE

A. Building Entrance Terminals: AT&T 110 quick connect terminating system type

B. Surge Protection Modules: Manufactured by CIRCA P/N-C3B1FS or equal

C. Modular telephone panels that are mounted into the 19” rack, shall be Ortronics model 808004389.

3.7 - INTRA-BUILDING BACKBONE CABLES

A. The in-building backbone cables for voice shall be solid copper, 24 AWG, twisted-pair backbone cable meeting the following specifications.

1. Characteristic impedance – 100 ohms at 1 MHz.

2. Attenuation – 7.9 dB maximum per 1000 ft at 1 MHz.

3. Listed Type CMR at minimum and UL CMP where plenum is required.

B. Intra-building fiber is generally not installed at Williams. See section 2.3 for details of the ABF design used. If intra-building fiber is needed, design must be approved in writing by OIT.

3.8 - INTER---BUILDI NG BACKBONE CABLES

A. The inter-building backbone cables for voice shall be indoor/outdoor rated, solid copper, 24 AWG, twisted-pair, gel filled backbone cable meeting the following specifications.

1. Characteristic impedance – 100 ohms at 1 MHz.
2. Attenuation – 7.9 dB maximum per 1000 ft at 1 MHz.
3. Listed Type CMR at minimum and UL CMP where plenum is required.

B. Shall have suitable over-voltage protectors installed at each end as per the NEC 70, Article 800.

C. Inter-building fiber is installed using the Sumitomo ABF system. See section 2.3 for details of the ABF design used at Williams.

3.9 - EQUIPMENT RACKS

A. 2-Post Post Rack Bundles. The Chastworth Products and Hubbell packages below include all of the OIT required parts for installing each 2-Post rack installation.

1. Chatsworth - All of the P/Ns below are required for a 2-post full rack install
   a. Chatsworth Products Standard Rack 3”D x 7’ Black - P/N: 55053-703
   b. Chatsworth Products Rack Base Dust Cover – P/N: 41050-719
   c. Chatsworth Products Two Hole Ground Terminal Block – P/N: 40167-001
   d. Three sets of Hubbell MCCVMR2 or MCCVMR22 Vertical Rings per rack.
2. Hubbell - All of the P/Ns below are required for a 2-post full rack install
   a. 19" EQUIPMENT RACK WITH 3.25" WIDE C-CHANNELS – P/N: CS1973
   b. A 2 hole non-reversible grounding lug

B. Hardware required to secure the rack to the floor shall be determined by the architect.

3.10 - EDGE NETWORK ELECTRONIC

A. Network electronics and will be specified, ordered, and installed by OIT. The project will fund these components.

3.11 - WIRELESS DEVICES

A. OFCI

B. Wireless electronics and mounting hardware will be specified and ordered by OIT. The project will fund and physically install these components.

3.12 - UNINTERRUPTIBLE POWER SUPPLY

A. Rack mounted UPSs will be specified, ordered, and installed by OIT. The project will fund these components.

B. Building wide UPSs will be designed/specified jointly by OIT and the project. The project will order, fund and physically install these components.

C. Rack Mounted UPS sizing

1. Four switches or under - 1500W UPS
2. Five or more switches- 4500W UPS
3. Depending on the load and function of a Telecommunication Room, OIT may require a larger UPS be installed than specified above.
4. UPSs in the table below are approved by OIT. Other products may be approved by written waiver by OIT.

Size	Manufacturer	Part Number
1500W	Eaton	5PX1500RTN
4500W	Eaton	9PX5KTF5

D. Building Wide UPS - Used in large buildings where consolidation is cost effective. Design will be developed jointly with OIT and must be approved in writing by OIT.

3.13 - OUTSIDE EMERGENCY PHONES

A. Outside emergency phones will be specified by OIT. The project will order, fund and physically install these components.

3.14 - ELEVATOR AND WHEELCHAIR LIFT EMERGENCY PHONES

A. Elevator and wheelchair lift emergency phones will be specified by OIT. The project will order, fund and physically install these components.

4 — EXECUTION

Part 4 outlines the planning, design and construction process for network and telephone services, which are part of any construction project within Williams buildings or Williams occupied space. The intent is to provide a process that is appropriate for any size project. All projects have four phases: Planning, Design, Construction, and Closeout.

4.1 - PLANNING

A. OIT is developing a standardized Project Fact Sheet (PFS), at this time please consult OIT at the beginning of a project so needs can be assessed. When complete, the PFS will assist in scoping IT needs of a project.

B. OIT recommends technology appropriate for the project’s program.

C. OIT will highlight any conditions that may impact the project budget or schedule.

D. Trends in technology are considered and included in scope as appropriate.

4.2 - DESIGN

A. Facilities Management will update OIT that a project is underway.

B. OIT will assist the electrical and telecommunications engineers retained for the project to define the following requirements for the communications system:

- Performance
- Security
- Reliability
- Maintainability

By specifying:
- Structured Cabling systems; type, quantity, and location
- Raceway / Pathways
- Telecommunications room; location, power, and cooling
- Telecommunications and WiFi/Mobility Equipment

C. The general contractor is responsible for installing the passive portion of the communications system: the cable, drops, jacks, patch panels, racks, cable tray, etc.

D. Once the passive portion of the communications system has been delivered, active portion of the system (the electronics) will be installed by OIT or provided to the contractor for installation.

E. The passive communication cable system must be completed and delivered before the active electronics equipment is configured and installed.

F. Construction plans must show communications outlet locations, types, and name.

G. Project Manager will provide AutoCad compatible floor plans for the project to OIT.

H. A request may be entered thru Williams' Construction Management Software (PMIS) for discovery of existing conditions if necessary. If the project is not managed thru this tool, e-mail noc@williams.edu to request a meeting.

I. All abandoned cable must be removed back to within 6 inches of the patch panel. OIT may alternately request that cables be labeled at both ends for future use.

4.3 - CONSTRUCTION

A. General

1. All data installations must receive the 25-year Mission Critical Warranty from Hubbell™ Premise Wiring by the installing contractor.

2. All fiber installations must receive Warranty Program certification from Sumitomo by the installing contractor.

3. Warranties must be submitted as a project deliverable.

4. All abandoned cable must be removed back to within 6 inches of the patch panel. OIT may alternately request that cables be labeled at both ends for future use.

B. Milestones

There are five milestones during the construction phase for OIT. Follow the milestone dates shown in the table below:

Construction Milestones	Milestone Date
Kick Off	At mobilization
Draft Tap List	10 business days after Kick Off
Project Inspections	As project progresses
Pre-Acceptance Walk Thru	20 business days before In Service Date
System Acceptance	10 business days before In Service Date
In Service	In Service date

C. Kick Off

1. The General Contractor (GC) may have the Electrical contractor hire the communications contractor or they may hire the communications contractor directly. Either way the GC is responsible for ensuring the project adheres to the current design standard for the project.

2. The construction schedule must include a ten-day service turn-up period for OIT prior to substantial completion. (Service turn-up)

3. Milestone Dates: Substantial Completion, Service Turn-up, Move-in all following in close succession.

4. OIT must be notified of any additions or changes to the locations or type of communications outlets, TRs, or pathways during construction.

D. Draft tap list and floor plan

1. Ten business days after kick off a schedule of all data cables must be received by OIT; also known as the tap list. A corresponding floor plan showing communication outlet locations and outlet name must be provided.

2. The list is used to identify the network for all services required on moving day.

3. During this period:

   a. OIT will finalize the design of the communications system for performance, and security

   b. OIT will determine network electronics and telephone equipment requirements

   c. The tap list must be accurate

E. Project Inspections

1. OIT requires three-day notice prior to pathway completion, wall closure, and ceiling

closure.

F. Pre-Acceptance Walk-Through
WCF and OIT walk through the project to determine if or not the project will meet the system acceptance date.

G. System Acceptance
The communications system, including the telecommunications room and cables, must be delivered to OIT two weeks before the In Service date.

1. Telecommunications Contractor Deliverables by System Acceptance

   a. Final tap list

   b. Construction floor plans in pdf file format showing communications outlet locations and names.

   c. Racks installed & grounded

   d. Backbone cable installed, labeled and tested

   e. Test results for fiber optic and copper cables for riser and outside plant

   f. All station cable terminated labeled and tested – must match the tap list

      - This includes installation and testing of jacks into furniture systems.
      - All testing must be done after installation of faceplates so that the jacks are not moved or handled after testing.

   g. Deliver test results for all cables in the communications system to OIT via email.

      - All cables: OSP, riser, and station cable.

2. Telecommunications Room Readiness Criteria
All construction in the communications rooms must be completed, including:

   a. Room free of dust and debris (damp mopped)

   b. All plywood on walls painted

   c. Ceilings treated to minimize dust

   d. Lighting installed and powered

   e. Electrical outlets installed, powered and stable

   f. All grounding completed

   g. HVAC installed and working

   h. Floors sealed and finished

   i. Room secure

H. Service Turn-up

1. For the turn up of special services, such as card access or elevator car phones, the service owner must schedule service activation separately in advance. For example, Campus Safety is the service owner of card access and surveillance and WCF owns building automation and metering, etc.

2. The in-service date will be ten business days after receipt by OIT of written service turn-up notification.

3. During the two-week period between delivery of the communications system provided by the contractor and the service turn-up date, OIT will inspect the work, perform random tests of the station and riser cables, and compare the results with those delivered by the communications contractor.

4. All work by OIT will be performed during normal College business hours.

5. OIT will report any failures or deficiencies in the installation in writing to the project manager so the contractor may correct the deficiencies in time for the in-service date.

6. Once the contractor has corrected problems, OIT will install network equipment, any new telephone handsets, and activate data jacks based on the tap list generated by the architect and end user.

7. Once OIT accepts the communications systems as in-service, OIT will respond according to the Service Level Agreement for each service.

8. Prior to acceptance all calls should be directed to the Facilities Project manager.

9. Once in service, calls from users should be handled thru normal OIT support channels.

4.4 - GUARANTEE

A. Parts, labor, and travel to replace defective materials and workmanship for a period of one year after final acceptance if the contractor will be providing an additional manufacturer's extended warranty. Approved manufacturer extended warranties are Hubbell Mission Critical™ and Mohawk ChannelMATE™25 year Warranty. If moves, adds or changes are done to an existing manufacturer extended warranty system, such as one of the two that are mentioned here. The contractor shall register all moves, adds or changes with the original extended warranty provider so that a complete warranty system is the result. It is the contractor's responsibility to acquire all necessary training and certifications to be eligible for installation of communication systems under these warranties. At job completion, a certificate of warranty shall be provided to the owner for one of approved warranties. Those are Hubbell Mission Critical or Mohawk 25 year warranties.

4.5 - CLOSE OUT

A. The O&M documentation must include:

1. Warranty certificates from Hubbell Premise Wiring Inc. for all data cables installed.

2. Warranty certificates from Sumitomo for all fiber.

3. As-built documentation must include communication outlet names (tap id) and locations.

4. Punch list completed.

5. Project occupant declares through the PM(Project Manager) that all is working

B. Printed test results are not required as part of the O&M documentation package, since they are submitted to Hubbell and Sumitomo as part of the warranty application and to OIT prior to service turn-up.

5 - GLOSSARY

802.11ac : Wireless networking standard in the 802.11 family developed in the IEEE Standards Association, providing high throughput wireless local area networks (WLANs) on the 2.4 and 5 GHz bands

ABF : Air Blown Fiber

AC Grade Plywood : High quality plywood for mounting equipment in Telecommunications Rooms

AFF : Above Finished Floor

ANSI : American National Standards Institute

BAS : Building Automation System

BFC : Below Finished Ceiling

BICSI : Building Industry Consulting Service International, A standards body in the structured cabling industry

CAT6 : Communications cable meeting the ANSI/TIA-568 Category 6 standard

CAT6A : Communications cable meeting the ANSI/TIA-568 Category 6A standard

CWDP : Certified Wireless Design Professional, A certification offered by CWNP demonstrating proficiency in designing WiFi systems

DAS : Distributed Antennae System

DROP : Synonomyous with WAO

EIA : Electronic Industries Alliance, A standards body in the electronics industry

GC : General Contractor

HVAC : Heating, Ventilation, and Air Conditioning

IP : Internet Protocol, One of the primary protocols network connected devices use to communicate with each other

JACK : A modular female RJ45 connector terminated on a twisted pair cable and installed within a WAO; also referred to a keystone jacks or data jacks

LIU : Light Interface unit (fiber patch panel)

MEP : Mechanical, Electrical, Plumbing

MERV : Minimum efficiency reporting value, a measure of the efficiency of HVAC filter at capturing particles

NEC : National Electrical Code

NEMA : National Electrical Manufacturers Association

NOC : Network Operations Center

noc@williams.edu : Email address used by the Network team at the Office for Information Technology at Williams College. This email address includes all network administrators and the director of networks and systems.

O&M : Operation and Maintenance

OIT : Office for Information Technology (Networks and Systems group, Networking group)

OSP : Outside Plant

P/N : Part Numbers

PM : Project

Manager

POE : Power over Ethernet, a system that delivers both data communications and electrical power over twisted pair cabling to networked devices.

RCDD : Registered Communications Distribution Designer, A certification offered by BICSI demonstrating proficiency in designing structured cabling systems

RF Engineer : Radio Frequency engineers are specialists within the electrical engineering field

RU : Rack Unit, A measure of height used for equipment in data racks

STP : Shielded Twisted Pair Cable, CAT6 unless otherwise noted. Same as UTP but with a foil shield around the cable.

TDMM : Telecommunications Distribution Methods Manual, document maintained by BICSI

TDU : Tube Distribution Unit

TIA : Telecommunications Industry Association, A standards body in the telecommunications industry

TR : Telecommunications Room

UPS : Uninterruptable Power Supply

UTP : Unshielded Twisted Pair Cable, CAT6 unless otherwise specified

WAO : Work Area Outlet; generally a faceplate or enclosure with one or more jacks installed

WAP : Wireless Access Point

WCF : Williams College Facilities department

6 - CHANGE LOG

The first revision of this document containing a change log is version 1.2. Version 1.1 is used as the base version; changes made after that version are documented below.

Version 1.2 changes

1. Updated section 1.1 narrative
2. Clarified several items in section 1.5.g and added guidance on when additional data jacks may be required in classroom spaces
3. Expanded elevator and poe door lock design guidance; moved to section 1.5
4. Updated flat panel display and ceiling mounted projector guidance; coax connections are no longer required by netsys for flat panel displays but they may be needed due to building programming; moved to section 1.5.k
5. Added guidance in section 1.5.k for keywatchers
6. Updated voice termination hardware parts numbers
7. Added an additional horizontal cable manager option
8. Added considerations for horizontal cabling fill rate calculations in section 2.4
9. Added section 2.7.c - wao extension naming (integrated modular furniture data connections)
10. Added drop, jack, poe, and stp to the glossary; updated the definition of wao
11. Minor grammatical corrections through out
12. Added change log and version identification on the bottom of each page

END OF SECTION

SECTION 27 41 16.51
INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS

PART 1 GENERAL

1.1 SUMMARY

A. Guidelines: Installed classroom AV design is inherently tied to the specific space in question. Factors such as ambient light control, sound reflectivity, size and shape all play a role in determining appropriate display tools.

B. Designs should reflect the industry standard DM (digital media) signal transmission.

C. Designs should recognize the need to refresh AV equipment and cabling on average every five years.

D. Projects that result in spaces that will be scheduled by the Registrar are required to add equipment detailed below.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

C. Warranty: Submit manufacturer’s standard warranty. We require 2 years’ parts & labor extended warranty on all installations. Include labor and materials to repair or replace defective materials. Warrantees must be submitted as a project deliverable.

D. Maintenance Data: Submit manufacturer’s maintenance data, including maintenance schedule.

E. Extra Stock: Submit extra stock equal to 2 percent of total used.

1.3 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

PART 2 PRODUCTS

2.1 General

A. All new installations are to be high definition/HDMI compatible rooms, 4K ready.

B. The control systems are Extron and new installs should be based upon either the Extron MLC type push button control panel whenever possible or an Extron touch screen for dual projection systems or greater, or where complexity makes it necessary. The GUI for touch screens should match existing Williams design (eg, Schow 030A dual projection, Clark 204 single projection).

2.2 Minimum requirements for any system supporting an electronic presentation space:

A. 1 projector & electric screen, or flat panel/monitor

B. Support for audio adequate to the space

C. At least 1 VGA and 1 HDMI input available for user connections, plus additional connections as needed for any equipment provided in the system design

D. Extron MLC type push button control or Extron touch screen with associated control system

E. A data connection to support Extron Global Viewer

F. Lighting and lighting control appropriate for a presentation space

2.3 For systems in spaces that will be scheduled by the Registrar:

A. All systems additionally require:
   a. HDMI inputs, power and network connectors for two computers (owner supplied)
   b. A rack, sized to contain system gear and computers
   c. Extron video switching and control
   d. A telephone

B. Depending on specific space requirements, systems may optionally also provide:
   a. Additional projectors or monitors which, if supplied, require:
      i. Extron Crosspoint 84 as substitute for Extron IN1608
      ii. Extron touch screen as substitute for Extron MLC
   b. Assisted Listening systems as required by applicable regulations.

2.4 Depending on specific space requirements, any system may optionally also provide:

A. Power, data and video connections to support wireless video (eg SolsticePod)
B. Power, data and video connections to support additional smart monitors, computers, etc.

2.5 Additional Details for Specifications:

A. Projectors
   a. 5000 lumen minimum (up to 12K for larger venues)
   b. Panasonic PT-RZ570U benchmark LED/laser model
   c. HD with potential 4K capacity
   d. Cat6 signal and control connection, (RS232 control available)
   e. Cat6 capable for remote monitoring
   f. Cat6 network connection available
   g. 2-gang duplex 20 Amp AC receptacle

B. Screens/Monitors
   a. Screens and/or monitors must be appropriately sized for space
   b. Motorized screens for projectors should be a Dalite Advantage Electrol w/built-In low voltage control
   c. Switch to raise and lower screen is independent of control system
   d. 16 x 10 aspect ratio
   e. Location must allow blackboard/whiteboard workspace when screen is down
   f. Duplex 20 Amp AC receptacle adjacent to screen, screen AC terminated in standard 3 prong plug

C. Wall plate inputs
   a. one HDMI/one VGA or two HDMI

D. Control processor & rack
   a. Extron IN1608 or Crosspoint Matrix
   b. 2-gang duplex 20 amp AC receptacle (total of 4 power receptacles)
   c. 5 jacks to Williams network (2 for resident computers, 1 for remote monitoring Extron Global Viewer, 2 for spare)
   d. Mid-Atlantic rack, wood or metal side panels, no door (equipment visible and available) or custom furniture to Williams Spec (e.g. Schow 030 A and B, TPL114)
   e. Empty rack spaces finished with blanks
   f. Audio amplifiers and switchers to be covered with security screens

E. Projector control/signal path
  a. a. Extron DTP HDMI 230 Tx and Rx or switcher based control. Shielded Cat6 wiring for all.
  b. b. Extron Medialink MLC-226 or similar Extron MLC

F. Sound system
  a. JBL control 28 or fuller range speaker
  b. JBL CSA-2120 amplifier, mono

G. Phone
  a. Classrooms require a wired telephone near teaching location

H. Extron Global Viewer
  a. Classroom electronics are remotely monitored with Extron Global Viewer

I. Special circumstances
  a. Large venues require scaled up projectors, sounds systems, screens etc.
  b. Multiple projection venues use Extron Crosspoint 84 and Extron touch screen
  c. Spaces with more than 40 seats require Assisted Listening systems per applicable regulations.

J. Preferred Vendor:
  a. Wassmann Audio Video Inc.
     92 State Road
     P.O. Box 270
     Whately, MA. 01093-0270
     Phone: 800-286-9744
     www.wassmannav.com

  b. Wassmann has developed and implemented the standard Extron interface used on campus. They are required to be involved with any new rooms which include a presentation system in order to ensure it is programmed properly with the Williams College standard GUI and that the system in integrated into our existing standards.

PART 3 EXECUTION

1.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.

B. Restore or replace damaged components and finishes. Test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 28 10 00
ACCESS CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. All access control installations on campus shall be provided by Gigliotti Electric.

Andy Goyette, Vice President
Gigliotti Electric, Inc.
P.O. Box 553
Pittsfield, MA 01202
andy@giggliottielectric.com
413-442-2683

B. Section includes S2 Security Corporation [NetBox®/NetBoxVR®/Enterprise®] Security and Database Management System (SMS) consisting of computer hardware, software, and associated licensing and equipment for monitoring, recording, and managing Electronic Access Control System (EACS) and Integrated Systems (IS) data and functionality.

C. The S2 [NetBox®/NetBoxVR®/Enterprise®] Security Management System shall meet the requirements of the College's access control systems. The system shall monitor and control facility access, and shall perform alarm monitoring, camera and video monitoring (when integrated with a compatible integrated Video Monitoring System), communications loss monitoring, and temperature monitoring. The system shall also maintain a database of system activity, personnel access control information, and system user passwords and user role permissions. The system shall be controlled from a web browser and require no software installation or client licenses. The system shall provide control and access to users on Local Area Networks (LAN), Wide Area Networks (WAN), wireless networks, and the Internet. The system shall provide email and/or text message alerts for all alarm conditions and threats

D. For further summary, product, and execution requirements relating to this section, please refer to S2's most current specifications and standards.

E. All network interface junctions must be placed on the hallway side of the door, unless specified by the college.

END OF SECTION

SECTION 28 20 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes an S2 Security Corporation NetVR Video Management System (VMS) consisting of computer hardware, software, and associated licensing and equipment for monitoring, recording, and managing surveillance camera system images and data.

B. The NetVR VMS shall be used to view live and recorded video from IP cameras connected to a common local and/or wide area network (LAN/WAN). NVR's will be located in the data center on campus.

C. The NetVR VMS shall be integrated with monitoring and control systems as required by the college.

D. For further summary, product, and execution requirements relating to this section, please refer to S2's most current specifications and standards

END OF SECTION

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

A. All fire detection and alarm installations on campus shall be provided by Lee Audio:

Lee Audio 'N Security, Inc.
65 Fairview Street
Lee, MA 01238
866-224-0078
sales@leeaudio.net

B. Fire alarm system with hardware and components manufactured by Notifier (ONYX). Typical base bid shall be for an addressable system with communication network and control panels. System must be UL listed for NFPA 72 and installed in accordance with current NEC standards and 780 CMR.

C. Quality Assurance

1. D.B. measurements shall be made by fire alarm installer to ensure audibility in all sleeping rooms per NFPA.

2. Provide 6-strand single-mode armored fiber cables from the Fire Alarm Control Panel to the OIT-specified telecommunication closet. Terminate cable in accordance with "Execution – Letter O" below. (Refer to 27 00 00 Communications standards for current requirements.)

3. A minimum of two rooms per floor shall be designated for the hearing impaired. Provide code compliant ADA xenon strobe in each room.

D. Submittals

1. All distribution, review, comments and acceptance of submittals will be done through the Williams College PMIS.

2. Submit all components for approval prior to order.

3. Plans of system with device locations and final room numbering must be reviewed and approved by Williams Operations personnel as well as the local AHJ prior to construction.

4. Contractor shall supply a copy of battery calculations for the Electrical Trades Shop along

with submittals.

5. Complete as-built drawings shall be furnished at completion of the project. Drawings shall include a one-line diagram, complete floor plans with device address mapping, and wire map showing all “T” tap, module, relay and auxiliary equipment locations.

6. System shall be warranted for parts and services for two years, commencing after system acceptance.

7. Base bid shall include quantity of each device specified.

PART 2 PRODUCTS

A. Addressable Components

1. All addressable components for alarm initiating, alarm monitoring or control, and trouble reporting shall have the ability to report to the control panel a unique address per device, and shall be powered by the system hard wired data network cable or by a dedicated supervised auxiliary power from the control panel. Each device shall report by address both alarm and trouble conditions to the control panel. All devices provided shall be the latest approved model number from Notifier.

2. Manual Stations (Addressable): A firm pull of the lever shall activate the alarm. Front of the station shall be hinged and must be opened with a key to re-set the station. Include flush trim ring or surface back box as required. The back box for a surface pull station shall be Notifier SB-10. The operable part of each manual fire alarm box shall be not less than 1.1m (31/2 ft) and not more than 1.37m (41/2 ft) above floor level per NFPA 5.12.4 and ADA requirements.

3. Heat Detectors (Addressable): Rate of rise and/or fixed temperature, temperature range of 135 or 200 degrees F. Detectors shall mount on a two wire addressable base. If a monitor module is used, it shall be located in an accessible location.

4. Photoelectric Smoke Detectors (Addressable): Low profile modular smoke detectors. Detectors shall be of the solid-state photoelectric type and shall operate on the light scattering, photodiode principle. Detector shall contain an integral LED, which shall flash during normal operation and lock in on alarm. Detector shall mount on a two wire addressable base.

5. When Carbon Monoxide detectors are required, compatible detectors shall be tied into the fire alarm panel and report as a CO alarm.

6. Audible and Visual Alarm Indicators: Shall be ADA and state approved, xenon strobe flashing light and horn combination units and stand-alone strobes. Units shall operate on 24 VDC from the Fire Alarm Control Panel. The units shall mount on a 4” square box. Provide a BBS Skirt for surface applications. Also all Audible & Visual Alarm Indicators are to be synchronized. Wall mounted appliances shall be mounted such that the entire lens is not less than 2.0m (80 in.) above the highest floor level or 152mm (6 in.) below ceiling level, whichever is lower. Per NFPA 7.5.4 and MAAB/ADA requirements.

B. Intelligent Control Relays/EOL Resistors/Monitor Modules

1. Shall be powered by supervised 24 VDC, and report to the control panel over the control panel data loop for monitor and control functions as follows:

   B1 Control: For signals, speakers, bell circuits, light circuits, for Class B monitoring.

2. All relays and resistors shall be located near the FACP or in another location approved by the owner.

C. Fire Alarm Control Panel

1. Control Panel shall be equipped with ALL necessary control components to achieve required functions minimally as follows:

   a. 80-character dynamic LCD display.
   b. Class B (Style B) or Class A (Style D) initiating device circuits.
   c. Variable sensitivity settings.
   d. Seven-day time-controlled day/night mode of operation.
   e. Automatic dirty sensor indication.
   f. Automatic excessively dirty indication.
   g. Control relays with positive feedback circuitry.
   h. Battery supervision (low/no battery).
   i. Field configurable/expandable programming.
   j. Walk test.
   k. 400 event historical logging.
   l. Zone selectable alarm verification.
   m. Programmable zone coding (PNIS).
   n. Individual circuit disconnect/disable.
   o. Selective signaling and/or relay control.
   p. On-board trouble-shooting diagnostics.
   q. Interface to addressable devices.
   r. Trouble silenced reminder.
   s. A/V circuits to satisfy present requirements and two spare circuits.
   t. Power supplies, sized for as in a and b below:
      i. AV power sized for present building configuration plus 25% spare.

   ii. Panel internal module power sized for present building configuration plus 25% spare.

u. 24-hour battery backup calculated to specified and future requirements. Components as listed above and in accordance with NFPA 72-1-5.2.6 to provide 24 hrs of standby service followed by 5 minutes of full alarm evacuation service.
v. Integral digital alarm communication transmitter.
w. High-speed Notifier network fiber card.

PART 3 EXECUTION

A. Power

1. System power shall be provided from a dedicated branch circuit in the main distribution panel, which shall be locked at all times. The dedicated circuit breaker shall have a red marking and be labeled “Fire Alarm Control Panel”. All work shall conform to NFPA 72 and NEC. In addition, the panel and circuit number shall be listed in the Fire Alarm Control Panel.

2. Magnetic Door Holders shall have a power supply separate from the fire alarm control panel and be set up to release the doors either from a general alarm or AC power failure.

3. An AC outlet shall be located near the fire alarm control panel.

D. Cabling for New Work

1. Finished spaces: All wiring shall be concealed in walls or ceilings and run in EMT or electrical non-metallic tubing where permitted by code.
2. Unfinished spaces: Where exposed run cable in EMT, where concealed in walls or ceilings Red Striped MC is permitted. All boxes and covers shall be painted red.
3. All cable shall be per NFPA 72 or manufacturer’s specifications. THHN will be accepted with permission from the college using our color code requirements.

a. Red & Black	Horn/Strobes
b. Brown	Magnetic door holders
c. Blue & Yellow	Sounder Bases
d. Shielded Cable	Annunciator - only
e. Fire Cable Non-Shield Twisted	SLC Loop

4. Surface boxes intended for fire alarm devices shall have System Sensor back box skirt or equivalent i.e.: System Sensor/Spectra Alert BBS or BSC

E. Cabling for Old Work

1. Finished spaces run in red striped MC cable, EMT or ENT as permitted by code.
2. Unfinished spaces run in EMT or red striped MC.

F. Shielding

1. Provide shielded cable if needed per manufacturer's requirements.
2. When required, all shielded cable shall be bonded at the panel only. Bonding shall be continuous through all junction boxes, carefully folded back and taped to prevent inadvertent grounding. At no point shall the shield be connected to form a loop. At last device, tape back a minimum of four inches of shield for future use.

G. Smoke Detectors

1. Smoke detectors shall be installed in all rooms, closets and concealed spaces, except as noted on drawings.
2. Where smoke detectors will be mounted above 25' or so as to be inaccessible from a ladder, beam type or VESDA detectors shall be used.
3. Smoke detectors intended for early warning of fire in high air movement areas or in any other location that will cause smoke dilution by the direct air stream, shall be installed per NFPA 72 Chapter 5.7.5.3.3.
4. Smoke detectors shall be labeled with loop and address on the base and the numbers shall be visible from the floor. This shall be done with a label maker.
5. Where detectors are above or behind access panels or ceiling grid, panels or grid must be correspondingly labeled.
6. **All smoke detectors shall be accessible for maintenance – i.e. reachable from the floor with a testing wand.**

H. Heat Detectors

1. Heat detectors shall be installed in attics and mechanical rooms. Temperature ranges shall be as shown on drawings.
2. Where non-addressable heat detectors are used, the monitor modules shall be located outside the area in an easily accessible location.
3. Heat detectors shall be labeled with loop and address number visible from the floor. This shall be done with a label maker.
4. **All heat detectors shall be accessible for maintenance – i.e. reachable from the floor with a testing wand.**

I. Audible/Visual Annunciation Devices

1. Provide pathways for potential bidirectional amplifier system for all new and renovated systems when required by the local AHJ – to be reviewed with Williams College.
2. Audible devices shall be installed as shown on plans.
3. Provide one weatherproof audible/visual device on the exterior of the building above the entrance which leads to the Annunciator panel.
4. Provide sounder bases or horn/strobes in bedrooms and common rooms. Units are to be mounted on a 4" square deep box. If surface mounted provide a BBSWC Skirt. For the EOL supervision relays that monitor the power to the sounder bases these are to be mounted in an **accessible location – i.e. reachable from the floor with a testing wand.**

J. Annunciator Panel

1. If required, provide and install annunciator panel capable of displaying all alarm and trouble conditions by point on an interior building wall immediately adjacent to the main entrance with a key to enable function buttons. The top of the annunciator panel shall be at 5 feet above surrounding surface.
2. Provide an external horn-strobe at the entry door nearest the annunciator panel.

K. Fire Alarm Control Panel (FACP)
   1. FACP shall be located in the mechanical/electrical room unless otherwise specified and as designated on the plans at a height of 5'-6" to the top of the cabinet. Remote annunciator installed as needed.

L. Card Access System
   1. Provide relay *modules* as necessary next to the card access reader distribution panel (RDP) to interface with building card reader system. Relay shall be configured to allow for door release or secure upon activation of FACP. Coordinate with Williams College Electrical Trades Shop.

M. Sprinkler System
   1. Provide monitor modules as necessary in FACP to interface with and annunciate sprinkler flow and tamper. Run cable as necessary and coordinate with Sprinkler Contractor.
   2. Boxes containing modules shall be labeled with loop and address number visible from the floor. This shall be done with a label maker.
   3. Sprinkler and Tamper switches shall be labeled with loop and address number visible from the floor.

N. Testing and Final Acceptance

   1. Fire alarm testing must be coordinated with the Williams College office of Safety and Environmental Compliance (SEC).
   2. Four weeks prior to acceptance testing, provide the architect/engineer and the SEC office with a copy of the fire alarm program, including a complete list of descriptions and addresses of all addressable devices, and a set of floor plans that include room and device numbers. The device descriptions shall match the building signage and shall be approved by the owner's representative and architect/engineer. Perform a dry run of all components and include a printout showing descriptions of each device and operation. The alarm program will be reviewed for accuracy prior to acceptance testing.
   3. Pre-acceptance testing - The fire alarm contractor and a representative from the SEC office will perform a pre-acceptance test on the fire alarm system prior to final testing by the building official. The pre-acceptance test will include testing of all devices throughout the building.
   4. Final acceptance test shall be conducted in the presence of the building official (chapter 9§901.5), the local fire chief, the owner's representative, and the architect/engineer. Coordinate with College project manager and schedule test at least 48 hours in advance. Testing will include a 100% test of all devices, modules and associated systems. Contractor shall be responsible for any costs arising out of failure of the test, including all retesting costs.
      a. On the day of the final acceptance test:
         i. Make sure the fire alarm panel is normal without any trouble codes.
         ii. Ensure all rooms are properly numbered.

        iii. Provide a complete set of floor plans that include room numbers and device numbers.
        iv. Make sure all smoke detectors, pull stations and modules are labeled per Williams College spec.
        v. Provide one person with knowledge of the fire alarm system installation to assist with testing.
        vi. Provide one person with knowledge of the fire alarm panel and programming during testing.
        vii. Provide one person with knowledge of sprinkler system in order to activate flow and tamper alarms.
    b. After final acceptance testing:
        i. Provide NFPA 72 record of completion documents to be signed by the contractor, property owner and the AHJ. This document will not be signed until final testing is 100% complete.
        ii. Provide a copy of the signed NFPA 72 form to the SEC office.
5. The contractor shall perform the NFPA 24-hour battery test. The system will be tested for five minutes at the end of the 24-hour test.
6. The contractor shall verify that magnetic release doors perform as designed when the fire alarm is activated.
7. Contractor to supply fire alarm control program on flash drive and upload into WC Project Management Information System (PMIS).

O. Campus Monitoring and Communication

1. At the fire alarm panel
    a. Install existing red armored fiber into a new Corning SPH-01P wall enclosure mounted as close as possible to the fire alarm panel
    b. Terminate fiber at wall enclosure using FP900SM-LC-2M LC fusion splice pigtails
    c. Install Corning CCH-CP06-A9 LC panel adapter within wall enclosure and install pigtail connectors
2. At data rack
    a. Install existing red armored fiber onto data rack using modified Wiremold entrance fitting 5785 bolted to rack frame using two 1/4-20 through bolts
    b. Route unarmored fiber through existing rack cable management following the same path as the existing air blown fiber into the existing LIU. Velcro both fibers together spaced as needed.
    c. Terminate fiber within existing Sumitomo LIU using FP900-LC-2M LC fusion splice pigtails
    d. Install Sumitomo FTLC0601 LC panel adapter (painted red) within the existing enclosure and install pigtail connectors
3. Test fiber to confirm all strands pass and that all strands are paired in the correct order using the Williams College tester
4. Patch cords to connect each end by others

END OF SECTION

SECTION 32 10 00
BASES, BALLASTS, AND PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Bituminous concrete roadway pavement
2. Concrete sidewalk pavement
3. Granite, cast-in-place or precast curbing
4. Cast-in tactile strips for accessibility
5. Non-reflective yellow striping

1.2 RELATED SECTIONS

A. The following items of related work are specified and included in other Sections of the Specifications:

1. Site preparation
2. Earthwork
3. Site improvements
4. Lawns and Planting

1.3 DEFINITIONS

A. The following related items are included herein and shall mean:

1. Standard MDPW Specifications: Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, including latest revisions.
2. ASTM: American Society for Testing and Materials.
3. AASHTO: American Association of State Highway and Transportation Officials.

1.4 SAMPLES AND SUBMITTALS

A. All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College PMIS web portal.

PART 2 - PRODUCTS

2.1 BITUMINOUS CONCRETE PAVEMENT

A. At least 30 days prior to intended use, the contractor shall provide the following samples and/or submittals for approval in conformance with requirements of roadway shall be Class 1, Type I 1, furnished in accordance with Section M3. Paragraph 3.11.03 of the Standard Specifications, except as modified herein.

B. Bituminous concrete for roadway shall consist of two (2) courses of bituminous concrete with a minimum finished pavement depth after rolling of five and a half (5.5”) inches.

a. Binder course shall be three and a half inches (3.5”) in thickness consisting of one lift of Binder Course bituminous concrete.

b. Finished top course shall be two and a half inches (2.5”) in thickness consisting of one course of Dense Mix bituminous concrete as modified herein.

c. Base materials shall be specified under Section 02 20 00, Earthwork. Depths shall be as shown on the Drawings, but in no case less than twelve inches (12”) including four inches (4”) of dense grade.

d. Tack coat shall consist of asphalt emulsion, Type RS 1 as described in the Standard Specifications under M3.03.0 and M3.11.06.

2.2 CONCRETE PAVEMENT

A. All campus sidewalks to be cast-in-place concrete per the sketch below.

B. Cast in place concrete shall be air entrained concrete conforming to the requirements and applicable provisions of Section 701 of the Standard Specifications. Minimum 28-day compressive strength shall be 4000 psi.

C. Wire mesh for reinforcement shall conform to AASHTO M55, latest requirements. Gauge of wire and dimensions of mesh as shown on the Drawings.

D. Bonding grout shall be a three component, water-based epoxy resin/Portland cement bonding agent: "Armatel 110' as manufactured by Sika Corporation, Lyndhurst NJ.

E. Expansion Joint Materials

1. Joint filler shall consist of the following:

a. Transverse Joints In concrete pavement shall have pre-formed joint filler composed of cellular fibers bonded together and uniformly saturated with asphalt in conformance to requirements of ASTM D1751. Provide removable plastic joint cap with integral permanent plastic bond breaker. Cover depth shall be sized to match width of joint filler.

b. Filler for joins abutting dissimilar materials and for smaller radius and other non-regular alignments shall consist of isomeric polymer foam meeting the physical requirements of ASTM D1752. Provide closed cell polyethylene backer rod of circular rod stock. Backer rod shall be sized thirty-three percent (33%) larger than joint width.

2. Expansion dowels and sleeves shall be as furnished by A.H. Harris & Sons, Inc. Medfield. MA or equal and shall consist of a one-half inch by twenty-four inch (2'x 24") smooth steel dowel and compatible waxed tube sleeve twelve inches (12") in length.
3. Sealant shall be polyurethane based, one component, elastomeric sealant complying with Fed. Spec. TT S 00230C, Class A, Type 1.

F. Acrylic Curing, Sealing, Hardening and Dustproofing Membrane: The Euclid Chemical Company; Rez-Seal. Refer to Product Data Sheet following this Section.

G. Base material shall be as specified under Section 02200, EARTHWORK.

H. Formwork: The dimensions of the lumber used to form concrete pavements shall not be less than 2'' (nominal thickness) by the required pavement depth.

I. Typical figure: See figure at end of section.

2.3 GRANITE CURBING

A. Unless otherwise specified, granite curbing shall be provided and installed per "Specifications for Granite Curb" published by the American Granite Curb Producers (AGCP) http://americangranitecurb.com/ and Standard MDPW Specifications.

2.4 PRECAST CONCRETE CURBING

A. Unless otherwise specified, precast concrete curbing shall comply with Standard MDPW Specifications.

2.5 CAST-IN-PLACE CONCRETE CURBING

A. Unless otherwise specified, all cast-in-place curbing shall comply with Standard MDPW Specifications.

2.6 BITUMINOUS CONCRETE CURB

A. Not permitted.

2.7 CAST-IN TACTILE STRIPS FOR ACCESSIBILITY

A. Cast-in tactile strips shall comply with Section 32 17 26.

2.8 NON-REFLECTIVE YELLOW STRIPING

A. All College pavement stripings and markings shall be non-reflective yellow only.

PART 3 - EXECUTION

3.1 BITUMINOUS CONCRETE ROADWAY

A. Make any corrections necessary to base material furnished and placed under Section 02200, Earthwork, to bring base course materials to sections and elevations shown on the Drawings.

B. Place binder and top course bituminous concrete in conformance to application and depth requirements shown on the Drawings and specified herein. All depths referenced shall be compacted thickness. Bituminous concrete for binder course and top course shall be furnished and laid in accordance with Section 460 of the Standard Specifications and as directed herein and by the details.

C. No vehicular traffic of any kind shall be allowed to pass over the newly finished surface until it has had time to set. Twenty-four (24) hours will be considered sufficient time for the pavement to set in most cases, but this period may be extended by the College Representative as required by weather or other reasons.

3.2 CONCRETE PAVEMENT

A. Make any corrections necessary to granular fill furnished and installed under Section 02200. EARTHWORK: to bring base material to the sections and elevations shown on the Drawings.

B. Concrete pavement placement curing testing reinforcing and protection and form work shall be as specified In Section 901 of the Standard Specifications and as directed herein. Concrete shall have a medium broom finish and scored according to the detail Drawings.

C. All forms shall be joined neatly and tightly, shall be set hue to line and grade, well staked and braced, and shall have uniform bearing throughout their length.

D. Wire mesh used for reinforcement shall be rolled flat before placing concrete. Mesh reinforcement shall be held firmly in place against vertical or transverse movement by means of satisfactory devices. Where mesh reinforcement is spliced, It shall be lapped at least twelve Inches (12'). Unless designated otherwise on the Drawings, wire mesh shall be placed midway within the depth, and parallel to the finished surface of concrete pavements.

E. Concrete shall be placed in one (1) course, to full depth, as detailed on the drawings.

F. No concrete shall be deposited until the College has inspected the placing of reinforcement and given permission to place concrete.

G. Expansion joints shall be placed where pavement meets curbing or structures including light bases, hydrants and at other conditions as shown on the Drawings.

1. Place expansion Joints twenty feet (20) on center and/or as indicated on the drawings. Follow the manufacturer’s application recommendations for joint filler and sealer. Expansion Joints shall be one half Inch (2') wide. Joint alignment shall be straight and true.
2. Clean joint surfaces immediately before application of primer and installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which Interfere with bond of sealant. Do not proceed unless all joint surfaces are completely dry. Use primer for Joints as recommended by sealant manufacturer.

H. Install expansion dowels and sleeves perpendicular to and across all expansion joints in the concrete paving at two feet (2) on center minimum, or as shown on the Drawings.

1. Forms shall not be moved for 72 hours after the concrete has been placed, or for a longer period if directed by the College. Extreme care shall be taken in removing forms In order that no damage will be done to the concrete. Under no condition shall any bar, pick or other tool be Used which depends upon leverage on the concrete for removal of the forms.

3.3 CONCRETE TOOLING AND FINISHING

A. Concrete pavement shall be scored in a grid pattern as shown on the Drawings and tooled at expansion joint edges with a one quarter inch (1/4') radius edging tool. Tooling must extend all the way to the edge of the pavement.

B. Following edging, concrete pavement shall receive a medium broom finish applied in a direction perpendicular to the flow of traffic.

3.4 CONCRETE PAVEMENT CURING AND PROTECTION

A. Curing of the finished concrete surface shall be started as soon as it is possible to do so without damaging the surface. The surface shall be wetted or otherwise kept moist throughout a minimum six (6) day curing period through the use of polyethylene film, wetted burlap, or by a spray applied curing compound. The concrete surface shall be protected from all traffic or other disturbance during the curing period.

B. The Contractor shall provide adequate surveillance for all poured in place concrete pavements until concrete has set firmly, to prevent unwarranted markings of the concrete surface. Any unauthorized marking or graffiti in the finished surfaces shall be a cause for rejection by the College and replacement by the Contractor.

C. Adequate protection shall be provided where temperatures of forty degrees (40EF.) or lower occur during placing of concrete, and during the early curing period. The minimum temperature of fresh concrete after placing, and for the first Three (3) days shall be maintained above fifty-five degrees (55E F). In addition to the above requirements, an additional three (3) days of protection from freezing shall be maintained.

3.5 PRECAST CONCRETE CURB

A. Trenching: The trench for the curb shall be excavated to a width of nineteen inches (19') and to a minimum depth below finished grade of six inches (6') plus the depth of the curb, or as shown on the details.

B. Place gravel borrow in accordance with the requirements of SECTION 02200, EARTHWORK. All spaces under the curb shall be filled with compacted gravel so that the curb will be completely supported throughout its length.

C. Install curb in accordance with details shown on the Drawings. After proper alignment of curbing and concrete base has been established, place concrete as detailed on the drawing.

D. Joints: The curb shall be set vertically at the line and grade as shown on the Drawings. Unless otherwise directed, individual curb sections shall be butted closely together. Maximum joint spacing shall be three quarter inch (3/4”). The overall alignment shall be uniform, with smooth and continuous arris lines. Radius curbs shall meet with a common tangent.

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END OF SECTION

SECTION 32 17 26
TACTILE WARNING SURFACING

PART 1 PRODUCTS

A. Provide cast iron detectable warning tiles

1. Must meet all ADA and 521 CMR requirements.
2. Wet-set.
3. Removable/replaceable.
4. Natural cast iron finish; no coating.

PART 2 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 32 33 13
SITE BICYCLE RACKS

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Review bicycle accommodation and storage requirements with Project Manager.

1. Refer to Appendix VI for typical site canopy and rack details.
2. Alternately, use Global Industrial #652771 when approved by Project Manager.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 32 33 43
SITE SEATING AND TABLES

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Provide 6-foot Monarch teak bench(es) as needed by Country Casual Teak

1. https://www.countrycasualteak.com/teak-garden-bench-monarch-6-ft-4613.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

SECTION 32 90 00
PLANTING

PART 1: GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of landscape development work is shown on drawings and in schedules.

B. Subgrade Elevations: Excavation, filling and grading required to establish elevations shown on drawings are not specified in this section. Refer to earthwork sections.

1.03 QUALITY ASSURANCE

A. Subcontract landscape work to a single firm specializing in landscape work.

B. Source Quality Control

1. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

2. Do not make substitutions: If specified, landscape material is not obtainable, submit proof of non-availability to Architect and Owner together with proposal for use of equivalent material.

3. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

4. Topsoil: Before delivery of topsoil, furnish Architect and Williams Facilities Department with written statement giving location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown during past two years. TOPSOIL ACQUISITION AND AMENDMENTS TO TOPSOIL ARE THE RESPONSIBILITY OF THE LANDSCAPE CONTRACTOR (see also Part 2.01, F).

5. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 (latest edition) "American Standard for Nursery Stock." Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

6. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

7. Furnish the Architect and College Horticulturist with a complete as-built listing of plant nursery sources of all plants installed upon initial plant acceptance by Architect.

C. Inspection: The Architect and Owner may inspect trees and shrubs either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to further inspect trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from project site.

1.04 SUBMITTALS

A. Certification: Submit certificates of inspection as required by governmental authorities. Submit manufacturers or vendors certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.

1. Submit seed vendor’s certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.

B. Planting Schedule: Submit proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reason for delays.

C. Provide and pay for materials testing. Testing agency shall be acceptable to the Architect. Provide the following data:

1. Test representative material samples proposed for use.
2. Topsoil:
    a. pH factor
    b. Mechanical analysis
    c. Percentage of organic content

d. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting

e. Bio-assay topsoil for toxin detection.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Sod: Time delivery so that sod will be placed within twenty-four hours after stripping. Protect sod against drying and breaking of rolled strips.

C. Trees and Shrubs: Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by Architect. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery. Do not drop balled and burlapped stock during delivery. Do not let plan roots dry, crush or be exposed to heat or cold during deliveries.

D. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than six hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture.

E. Do not remove container grown stock from containers until planting time.

1.06 JOB CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect when encountered. No planting under such conditions will occur until approved by Architect.

D. Coordination with Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Architect. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.07 SPECIAL PROJECT WARRANTY

A. Warranty lawns through specified lawn maintenance period, and until final acceptance.

B. Warranty trees and shrubs through specified maintenance period, and until final acceptance.

C. Warranty trees and shrubs, for a period of one year after date of substantial completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Landscape Installer's control. Proper watering during full warrantee period is the responsibility of the landscape contractor.

D. Remove and replace trees, shrubs, or other plants immediately if found to be dead or in unhealthy condition during warranty period. Make replacements during the next specified planting season. Replace trees and shrubs which are in doubtful condition during the next planting season. Replace trees and shrubs which are in doubtful condition next planting season, unless, in opinion of Architect, it is advisable to extend warranty period for a full growing season.

1. Another inspection will be conducted at end of extended warranty period, if any, to determine acceptance or rejection. Only one replacement (per tree, shrub or plant) will be required at end of warranty period, except for losses or replacements due to failure to comply with specified requirements.

PART 2: PRODUCTS

2.01 TOPSOIL

A. Stockpiled topsoil from stripping of site may be used if meeting requirements specified. Furnish additional topsoil required for planting and lawns from sources off the site if stockpiled topsoil is insufficient, unsatisfactory, or stockpiling is not performed.

The college has used the following local sources of topsoil:

Countryside Landscape, Williamstown, MA

Vermont Natural Soils, Stamford, VT

Galusha Excavating, Williamstown, MA

All other soil must meet the below described specifications.

B. Topsoil material shall consist of weathered surface soils (A horizon), or amended unweathered subsoil (B horizon) or a blend of both, and shall be free of hard fragments and stones larger than one inch across the greatest dimension, objectionable salts, noxious weeds and plants, partially disintegrated debris, or any other material inferior to the surface soils. All soils to be obtained from naturally drained sources and shall contain at least two percent natural organic matter (as determined by loss on ignition of moisture) – free samples dried and tested in accordance with current methods of the Association of Official Agricultural Chemists.

C. Topsoil shall be amended as needed to meet the following requirements:

1. A minimum of 3%, and not to exceed 6% of combined organic matter.

2. Soil acidity range: pH 5.5 to pH 7.0 inclusive.

3. Soil fertility shall rate “high” in natural nutrients based on the coordinated ratings in pounds per acre as established by the National Soil and Fertilizer Research Committee.

4. Should tests and analysis indicate that soil proposed for use is deficient in any of the above requirements, a system of ameliorating may be proposed for approval.

D. All topsoil obtained from on-site or loam borrow obtained from off-site used for work of this section shall be tested prior to being spread or mixed. All testing shall be done by approved independent test laboratory or by agriculture unit of State University System. Contractor shall provide required representative samples of material proposed for use to testing facility for analysis and recommended treatment. The Contractor shall bear any and all costs incurred in testing and analysis. Test reports also contain specific recommendations as to the exact types, times and rates of application of soil additives and fertilizers based upon the soil test results and type of material to be planted. Approved materials and topsoil shall be covered with waterproofing membrane if stored on site. Approved material shall be stockpiled as not to be contaminated or to interfere with other work or with other sub grade or fill materials. Recommendations shall be followed during planting operations.

E. Analysis shall include:

1. Classification of soil

2. Percent organic content

3. Soil acidity

4. Recommendation shall include type of soil additive and fertilizer, their composition and rate, and means of application.

F. Note that any and all materials and procedures with respect to soil additive and fertilizers, contained herein, are the responsibility of the landscape contractor and are approximate, and that all soil additives will be adjusted to comply with test reports.

2.02 SOIL AMENDMENTS

A. Lime: Natural dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 10 mesh sieve, and not less than 50% passes a 100 mesh sieve.

B. Aluminum Sulfate: Commercial grade.

C. Peat Humus: FS Q-P-166 decomposed peat with no identifiable fibers and with pH range suitable for intended use.

D. Super phosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.

E. Sand: Clean, washed sand, free of toxic materials.

F. Mulch: Double hammer milled bark mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants.

G. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients:

1. For lawns, provide fertilizer with percentage of nitrogen required to provide not less than 1 lb of actual nitrogen per 1,000 sq ft of lawn area and not less than 4% phosphoric acid and 2% potassium. Provide nitrogen in a form that will be available to lawn during initial period of growth; at least 50% of nitrogen to be in organic form.

2.03 PLANT MATERIALS

A. Quality: Provide trees, shrubs, and other plants of size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 (latest edition) “American Standard for Nursery Stock.”

B. Deciduous Trees: Provide trees of height and caliper scheduled or shown, and with branching configuration recommended by ANSI A300.1 (latest edition) for type and species required. Provide single stem trees except where special forms are shown or listed.

1. Provide balled and burlapped (B&B) trees with root flare exposed or container grown deciduous trees as specified on plant list.

C. Deciduous Shrubs: Provide shrubs of the height shown or listed and with not less than minimum number of canes required by ANSI Z60.1 (latest edition) for type and height of shrub required.

1. Provide balled and burlapped (B&B) or container grown deciduous shrubs as specified on plant list.

2.04 GRASS MATERIALS

A. Sod is the preferred grass material.

B. If sod is not available, Schedule of Grass Seed Requirements:

1. All grass seed will be fresh, clean, new crop seed delivered in original unopened packages, bearing guaranteed analysis.

2. Seed germination test results for each seed type and cultivar must be performed within 10 months prior to landscape installation of seed, and must have no less than ninety percent (90%) germination rate.

3. All grass seed cultivar purity must be no less than ninety percent (90%) by weight.

4. All grass seed and grass seed mixes used will consist of one of the following four (4) types:

TYPE 1 - Kentucky Bluegrass (Poa pratensis) Seed Mix: This grass seed will be used without exception for all non-athletic turf campus lawn seedings unless specified otherwise in writing by the Architect. This seed mix will consist of the following:

Twenty-five percent (25%) of each of any three of the nine choices of named Kentucky Bluegrass cultivars listed below to total 75% of the Kentucky Bluegrass Seed Mix (e.g. Type 1) by weight. Kentucky Bluegrass cultivar choices include: Midnight, Midnight 2, Caberner, Huntington, Bordeau, Shiraz, Langara, and Diva.

Fifteen percent (15%) by weight of one of the following: Chewing Fescue (Festuca rubra) seed cultivars: Enjoy, Abram, or Checker; OR Hard Fescue (Festuca longifolia) seed cultivars: Reliant, Aurora, Spartan, Waldina, or SR#3000.

Ten percent (10%) by weight of one of the Perennial Ryegrass (Lolium perenne) seed cultivars: Paragon GLR, Exacata 2, Revenge GLX, or Fiesta 4.

Seed mix consisting of different percentages of required grass species must be approved by the Architect.

TYPE 2: Perennial Ryegrass Seed (Lolium perenne): This grass seed will not be used, except as 10% of the Type 1 Kentucky Grass Seed Mix, or for athletic field or other temporary lawns only when specified in writing by the Architect. Use one of the following Perennial Ryegrass (Lolium perrene) seed cultivars: Paragon GLR, Exacata 2, Revente GLX, or Fiesta 4.

TYPE 3: Fine Fescue Seed (Festuca rubra): This shade tolerant turf grass (will be used only for lawn establishment in heavily shaded areas receiving less than 4 hours of direct sunlight daily and upon written approval of the Architect. Equal parts by weight of at least two of the following grass seeds will be used: Nordic, Stonhenge, Jasper 3, Predator, Sea Breeze, and Quatro.

TYPE 4: Fine Leaf Tall Fescue (Festuca arundinacea): This seed will only be used on low maintenance athletic fields with poorer quality soil and draughty site conditions, and only upon written approval of the Architect. Equal parts by weight of at least two of the following grass seed cultivars will be used: Falcon 4, Falcon 5, Avenger, Hunter, or Biltmore.

A. Seed may be mixed by an approved method on site, or may be mixed by a seed dealer. If the seed is mixed on site, each cultivar shall be delivered in the original containers which shall bear the dealer's guaranteed analysis legibly printed on the seed label as required by law. If the seed is mixed by a dealer, the contractor shall furnish the owner with the dealer's guaranteed statement of the composition of the mixture. All seed labels for seed used on campus will be furnished to the Architect for review, and then incorporated into the owner's project files.

2.05 MISCELLANEOUS LANDSCAPE MATERIALS

A. Anti-Erosion Mulch: Provide clean, shredded hay or shredded straw.

B. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

C. Filtration/Separation Fabric: Water permeable filtration fabric of fiberglass or polypropylene fabric.

D. Stakes and Guys: Provide stakes and deadmen of sound new hardwood, treated softwood, or redwood, free of knot holes and other defects. Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 gauge. Provide not less than 1/2" (one-half inch) diameter rubber or plastic hose, or approved straps, cut to required lengths and of uniform color, material and size to protect tree trunks from damage by wires.

E. Temporary Lawn Protection: Shall include 1″ x 1″, green-colored hardwood stakes, 4' (four feet) high, a maximum of 10' (ten feet) apart with a single line of double stranded white rope.

PART 3: EXECUTION

3.01 PREPARATION

A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Architect's acceptance before start of planting work. Make minor adjustments as may be requested.

B. Preparation of Planting Soil

1. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

2. For pit and trench type backfill, mix planting soil prior to backfilling, and stockpile at site.

C. Preparation for Planting Lawns

1. Loosen subgrade of lawn areas to a minimum depth of 10" (ten inches). Remove stones over 1 1/2" (one and one-half inch) in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.

a. Spread top soil to a minimum of 6” (six inches) to meet lines, grades and elevations shown, after light rolling and natural settlement.

b. Place approximately 1/2 of total amount of top soil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil. Add specified soil amendments and mix thoroughly into upper 10" (ten inches) of topsoil.

D. Preparation of Unchanged Grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: till to a depth of not less than 6" (six inches); apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.

1. Prior to preparation of unchanged areas, completelyremove existing grass, vegetation, and turf with non-selective herbicide unless otherwise approved. Dispose of such material outside of Owner’s property; do not turn over into soil being prepared forlawns.

2. Allow for sod thickness in areas to be sodded.

3. Apply specified commercial fertilizer at rates specified and thoroughly mix into upper 3" (three inches) of topsoil. Delay application of fertilizer if lawn planting will not follow ithin seven days.

E. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Rake and drag lawn areas, remove ridges, fill depressions and remove soil nuggets and debris at soil/grass transitions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading. Allow for soil settlement.

F. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

G. Preparation of Planting Beds

1. Remove 12″ (twelve inches) of existing soil from beds

2. Thoroughly loosen subgrade of planting bed areas to a minimum depth of 12″(twelve inches) below planting mix. Remove stones over 1 1/2″ (one and one-half inch) in any dimension, and sticks, stones, rubbish and other extraneous matter.

3. Spread planting soil mixture to minimum depth required to meet lines, grades and elevations shown, after light rolling and natural settlement. Place approximately ½ of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

H. Excavation for Trees and Shrubs

1. Excavate pits, beds and trenches, with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.

a. For balled and burlapped (B&B trees and shrubs), make excavations at least half as wide as the ball diameter and equal to the ball depth, plus following allowance for setting of ball on a layer of compacted backfill:

1. Allow for 3" (three inch) setting layer of planting soil mixture.

b. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

I. Dispose of subsoil removed from planting excavations. Do not mix with planting soil or use as backfill.

3.02 PLANTING

A. Planting Trees and Shrubs – follow ANSI Z.60.1 (latest edition)

A. Set balled and burlapped (B&B) stock on a 2″ (two inch) layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball approximately 2″ (two inches) above adjacent finished landscape grades – root flare must be exposed. Remove burlap from sides of balls; retain on bottoms. Remove minimum of upper two thirds of wire. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3-full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

B. Set container grown stock 1″ (one inch) above grade as specified for balled and burlapped stock, except cut cans on two sides with an approved can cutter and remove. Remove bottoms of wooden boxes after partial backfilling so as not to damage root balls.

C. Dish top of backfill to allow for mulching.

D. Mulch pits, trenches and planted areas. Provide not less than following thickness of mulch and work into top of backfill and finish level with adjacent finish grades.

1. Provide a 3" (three inch) thickness of mulch. Mulches are not to be applied against collar of trees and shrubs.

E. If deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.

F. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character.

G. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

H. Guy and stake trees immediately after planting, as indicated. Remove guys and stakes after one season.

3.03 SEEDING NEW LAWNS

A. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage and not more than a nine-month-old 85% germination result rate.

B. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other.

C. Sow grass seed at rate that aligns with manufacturer’s instructions.

D. Rake seed lightly into top 1/8" (one-eighth inch) of soil, roll lightly.

E. Protect seeded slopes against erosion with an organic erosion netting such as jute or other methods acceptable to the Architect.

F. Protect seeded areas against erosion by spreading shredded straw mulch, or acceptable organic hydroseeding cellulose mulch within 24 hours after seeding. During the months of June, July and August, only shredded straw mulch will be used. Place straw mulch uniformly in a continuous blanket at the rate of 2-2/2 tons per acre, or 2-50 lb bales per 1,000 sq ft of area. A mechanical blower must be used for straw mulch application.

G. Time of Seeding (for conventional method):

1. Seed immediately after preparation of seed bed. Seeding shall be done between April 1 and June 1, or between August 15 and September 30. When delays in operations carry the work beyond the seasons specified, or when conditions of high winds (winds that exceed 5 mph velocity), drought, excessive moisture or ice are such that satisfactory results are not likely to be obtained at any stage of the work, the work will stop and it shall be resumed only when the desired results are likely to be obtained, or when approved corrective measures and procedures are adopted.

H. Seed indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations after proper soil preparation as specified in section 3.01.

I. Work notification: Notify Architect at least seven (7) working days prior to start of seeding operations.

J. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.

K. Perform seeding work only after planting and other work affecting ground surface has been completed, or as otherwise approved by Architect.

L. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required, as referenced in section 3.07.

M. Provide hose and lawn watering equipment as required.

N. Method of Seeding:

1. Broadcast seed shall be covered to a depth not exceeding 1/4" (one-quarter inch) by raking, brush or chain harrowing, or other approved method. Broadcast seeding shall not be done during windy weather. After sowing, the seeded areas shall be lightly rolled and the seed bed before and after seeding shall weigh not more than 65 pounds per foot of width.

3.04 RECONDITIONING EXISTING LAWNS

A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials and equipment, and movement of vehicles. Also, recondition existing lawn areas where minor regrading is required. (see also Part 3.01, D-F)

B. Provide fertilizer, seed or sod, and soil amendments as specified for new lawns, and as required, to provide a satisfactorily reconditioned lawn.

C. Cultivate bare and compacted areas thoroughly to a depth of 6" (six inches) to provide a satisfactory planting bed.

D. Remove dead and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings or other harmful chemicals, stone, gravel, and other loose building materials.

E. Where greater than 60% of lawn remains, mow. In areas where there is less than 60% of disturbed grass rake, aerate if compacted, fill low spots, remove humps, and cultivate soil, fertilize, and seed. Remove weeds before seeding, if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.

F. Water newly planted lawn areas and keep moist until new grass is established AND ACCEPTED IN WRITING BY THE ARCHITECT.

G. Begin maintenance immediately after planting.

3.05 SODDING NEW LAWNS

A. Lay sod within 24 hours from time of stripping. Do not plant dormant sod, or if ground is frozen.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

1. Anchor sod on slopes steeper than 2:1 with wood pegs to prevent slippage.

C. Water sod thoroughly to a depth of 2 - 3″ below sod with a fine spray immediately after planting.

3.06 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs and other plants until final acceptance, but in no case less than specified period.

C. Maintain trees, shrubs and other plants by pruning, cultivating and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.

D. Maintain seeded or sodded area until final acceptance.

1. Maintenance period shall begin immediately after sod or seeding is completed for each designated area on Plan, and shall continue until all lawn areas have been fully accepted, not less than 60 days after agreed upon start of establishment period approved by Williams College.

2. If seeded in Fall continue maintenance the following Spring until lawn is established and accepted, IN WRITING, by Architect and Owner.

3. Maintenance of seeded or sodded lawn areas shall include watering, spot weeding, fertilizing, disease and insect pest control, mowing, reseeding, application of herbicides, fungicides, and insecticides until a full, well rooted uniform stand of grass, free of weeds, undesirable grass species, disease and insects is achieved and accepted by the Architect.

4. Contractor is to provide water daily, or as conditions dictate, to maintain adequate surface soil moisture for proper seed germination. Watering shall be done in the late afternoon or early evening hours and shall continue for a period not less than 30 days. Thereafter, apply 1/2" (one-half inch) of water twice weekly until acceptance. Water shall be from Owner’s source. Contractor shall provide and maintain at his expense, adequate connections, hoses, sprinklers, etc., with minimum leakage. Where use of hoses is not practical, Contractor shall water with a tank truck filled at Owner’s source. When Owner’s water source is not available, Contractor shall include cost of water from off-site source in base bid.

5. Grass shall not be allowed to grow more than 3" (three inches) in height during the maintenance period. Mowing height to be set at 2.5" (two and a half inches) unless otherwise directed.

6. Pick-up of grass clippings shall be required during or immediately after each mowing, if clippings are an average of 1" (one inch) or longer in length.

7. Contractor to repair, rework, and reseed all areas that have washed out, are eroded, or do not establish. Restore bare areas by top dressing with topsoil as specified. Apply seed at specified rate. Roll with a light roller and cover with a 1/2" (one-half inch) mulch of pre-moistened peat moss.

8. Contractor will provide such barricades, temporary fencing, signs or policing as may be necessary to eliminate or minimize damage to lawn. Contractor is responsible for all damage that occurs unless damage is beyond Contractor's control. Should damage occur beyond Contractor's control, Contractor will submit request for a Change Order and provide reasonable proof of damage.

3.07 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors, and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.08 INSPECTION AND ACCEPTANCE

A. When landscape work is completed, including maintenance, Architect and Owner will, upon request, make an inspection to determine acceptability.

1. Landscape work may be inspected for acceptance in parts agreeable to Architect and Owner, provided work offered for inspection is complete, including maintenance.

B. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Architect and Owner and found to be acceptable. Remove rejected plants and materials promptly from project site.

C. Upon final acceptance, and within one week of such acceptance, Architect will notify the Owner, in writing, before final turn over.

END OF SECTION

SECTION 33 09 01
UTILITY METER REGISTERS (METERING)

PART 1 SUMMARY

A. All buildings that are served by the central heating plant, the chilled water plants, and/ or the campus electrical grid shall be metered in Automated Logic (ALC) and historical trend data stored in energy reports. For all other buildings, the MEP Supervisor shall be consulted to determine what metering is required, if any.

B. Provide meters for steam, condensate, chilled water, and electric systems.

C. Steam Meters: Condensate meters are preferred for building load applications. Reserve steam meters for supply mains, or loads where condensate return path is complex and/or significant condensate is lost.

1. Steam Supply: Veris-Accelabar 316SS dual differential pressure type, of McCrometer V-cone type.

    a. Accuracy +/- 0.75% minimum.

    b. Repeatability +/- 0.15% minimum.

    c. Turndown 15:1 minimum.

    d. Provide temperature sensor and transmitter for sensible heat calc.

    e. Provide pressure sensor and transmitter for latent heat calc.

    f. Only MODBUS interface to BMS.

    g. Provide data to ALC Energy Reports system via WebCtrl.

2. Condensate, Gravity Flow: Lincoln Bucket type, size A-G.

    a. See standard installation detail for piping

    b. Install aft of condensate pump.

    c. Size to peak heating load, not line size.

    d. Provide temperature sensor and transmitter for sensible heat calc.

    e. Provide pressure sensor and transmitter for latent heat calc.

    f. Alarm on high temperature condensate (indicates blowing trap).

    g. Use pulse output to compute and track volume directly, do not use pulses to compute a rate and then integrate rate to compute volume

h. Provide data to ALC Energy Reports system via WecCtrl

3. Condensate, pumped: ISTEC 1800-series industrial single jet water meter, size ½" to 2"

   a. Install aft of condensate pump.

   b. Size to peak heating load, not line size.

   c. Provide temperature sensor and transmitter for sensible heat calc.

   d. Provide pressure sensor and transmitter for latent heat calc.

   e. Alarm on high temperature condensate (indicates blowing trap).

   f. Use pulse output to compute and track volume directly, do not use pulses to compute a rate and then integrate rate to compute volume (rate is meaningless).

   g. Provide data to ALC Energy Reports system via WebCtrl.

D. BTU Meters:

1. Hydronic hot water and chilled water Btu meter: Emco/Spirax-Sarco UTM-10 Type E Ultrasonic

   a. 24 VAC power.

   b. Transducer mounting locations per manufacturer's instructions.

   c. Not less than 10 pipe diameters upstream and 5 pipe diameters downstream of straight, unobstructed pipe.

   d. 1000-ohm platinum RTD temperature sensors for supply and return, preferred configuration is interfaced directly to flow meter. Surface-mounted only on existing installations, new installations to use wetted sensors in wells (preferred for all).

   e. Only MODBUS interface to BMS

   f. Provide data to ALC Energy Reports system via WebCtrl.

   g. Read and record kBtu from meter and interface with Automated Logic (input shall be kBTU), do not integrate Btu/hr interval value to compute kWh

DI. Electric Meters:

1. Electric: Veris H-81xx series, digital real-time, revenue grade.

   a. System accuracy, +/- 1.0% of reading from 2% to 100% of the rated current of the CTs, accomplished by matching the CTs with electronics and calibrating them as a system.

   b. Sample rate of 1280 Hz

c. Provide appropriately sized fuse and fuse holders (Veris part # AH04)

d. Size to peak demand, not necessarily service size. Check turndown to ensure accuracy at minimum load.

e. Only MODBUS interface to BMS

f. Provide data to ALC Energy Reports system via WebCtrl.

g. Read and record kWh from meter, do not integrate kW interval value to compute kWh.

2. Provide power system protection by Schweitzer Engineering Laboratories, Inc. (SEL), or approved equal.

END OF SECTION

SECTION 33 61 00
HYDRONIC ENERGY (CHILLED WATER) DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. This section provides a guide for the selection of new equipment for use on the campus chilled water distribution system. In general, this section covers chilled water distribution equipment only.

B. Operating Standards

Central Loop Chilled Water Supply (LCHS) Temperature	45 Deg. F
Central Loop Chilled Water Return (LCHR) Temperature	55 Deg. F
Building Chilled Water Supply (BCHS) Temperature	46 Deg. F
Building Chilled Water Return (BCHR) Temperature	58 Deg. F

C. Equipment Standards

1. Building chilled water coils are to be selected for 46 Deg. F EWT, 58 Deg F. LWT and maintain exit condition down to 15% load. Coil tube velocity shall be >- 4 fps at peak conditions.

2. Terminal unit controls shall be two-way fully modulating.

3. Building tertiary pumps should not be needed as system differential pressure should satisfy building flow requirements. A system flow analysis (Hydraulic Model) must be done to verify that the Central Chilled Water System will meet design conditions of the new system. The latest hydraulic model is available from Williams Facilities.

4. Building differential pressure design requirements must be verified by the TAB contractor and added as a set point in the building BMS. In the chilled water control sequence the static pressure set point will be tied to the central plant variable chilled water pump speed control.

5. Differential Pressure sensors shall be Setra Model 231G-MSx-3V-D or approved equal. Accuracy to be +_ 0.5% full scale.

6. Above ground (in building) chilled water piping shall be Schedule 40 black steel meeting ASTM A53 A or B, with welded joints. Welded fittings shall meet ANSI

B16.5, B15.9 and B16.28 and ASTM A420. Fittings 2” and smaller shall be Schedule 40 screw type.

7. Above–ground (in building) water piping shall be insulated with rigid preformed fiberglass having a density of -> than 3.5psv and K value -> 0.23, with white, foil scrim Kraft vapor jacket (“ASJ”) and painted canvas wrap. Insulation jacket shall be dark blue in color.

8. Install galvanized steel shields over pipe insulation in tunnels and mechanical rooms where pipes may be walked on.

9. Identification Systems: Label all chilled water piping per ANSI/ASME A13.1. Reference latest Williams College BIM standards and requirements for all tagging and labeling of equipment, etc.

10. Central Distribution piping shall be direct-buried ductile iron, with motor lining and bituminous coating. Carrier pipe shall be centrifugally cast gray ductile iron meeting ASTM A536, AWWA A21.50, and AWWA A21.51. Lining shall be factory applied and conform to AWWA A21.4, thickness -> 1/16”. Joints shall be mechanically restrained, Megalug 1100 series by EBAA Iron or approved equal. Mechanical restraints shall have a working pressure of 350 psig and conform to AWWA A 21.11 or AWWA A 21.53.

11. Direct buried chilled water supply and return lines do not require insulation.

12. Chilled Water lines shall be buried at least 5’ below grade to protect against freezing.

<u>Valve and Gauge Chart</u>

Type	Size	Requirements	Acceptable Manufacturers
Ball Valve	1/2" to 2"	Two piece with Stainless Steel Trim	Sharpe High-Performance Ball Valves or approved equal.
Gate Valve	21/2" to 5"	Iron Body class 125,200# WOG RH turn to open	Quadax or approved equal
Globe Valve	21/2" to 5"	Iron Body class 125,200# WOG	Quadax or approved equal
Butterfly Valve	21/2" to 12 "	Ductile Iron Body,200# WOG, Lug type, 316 Stainless disk,17-4 PH shaft,PTFE seat and seal	Quadax or approved equal
Butterfly Valve	14" and Larger	Ductile Iron Body,200# WOG, Lug type, 316 Stainless disk,17-4 PH shaft,PTFE seat and seal	Quadax or approved equal

END OF SECTION

SECTION 33 71 19
ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES

PART 1 GENERAL

A. Williams College strives to make its buildings beautiful, functional, sustainable, long-lasting, and easily-maintained.

PART 2 PRODUCTS

A. Ductbanks

1. Concrete: Concrete shall be 3,000 PSI at 28 days. Concrete shall be integrally colored red concrete. Color to be submitted by the Contractor, and approved by the College Project Manager.

2. Detectable Warning Tape: Place detectable warning tape a minimum of 12 inches above the top of all ductbanks.

PART 3 EXECUTION

A. Follow manufacturers' requirements, directions, and specifications for all applications and installations.

END OF SECTION

Appendix I

OFFICE OF SAFETY AND ENVIRONMENTAL COMPLIANCE POLICIES AND GUIDELINES

1.1 REFERENCE

A. The Office of Safety and Environmental Compliance policies and guidelines may be accessed at:

http://sec.williams.edu/environment-compliance/

Belimo Pressure Independent Valve Flow Verification and Commissioning

PIVs are very different from pressure dependent control valves (standard control valves). Pressure variations in the system do not affect flow through the PIV. PIVs do not require additional flow regulating devices (e.g. – circuit setters and automatic flow limiting devices). This makes the Testing and Balancing (TAB)/Commissioning process much different from standard control valves. This document details the flow verification and commissioning procedures for a Pressure Independent Valve (PIV). These procedures are not mandatory to ensure proper operation of PIV.

When using PIV, Electronic Pressure Independent Valve (EPIV), or Energy Valve (EV), flow verification can be performed using the valve's built-in flow sensor and a hand-held tool (ZTH US) that connects to the valve. However, if independent verification is required, the use of 3 P/T ports is recommended.

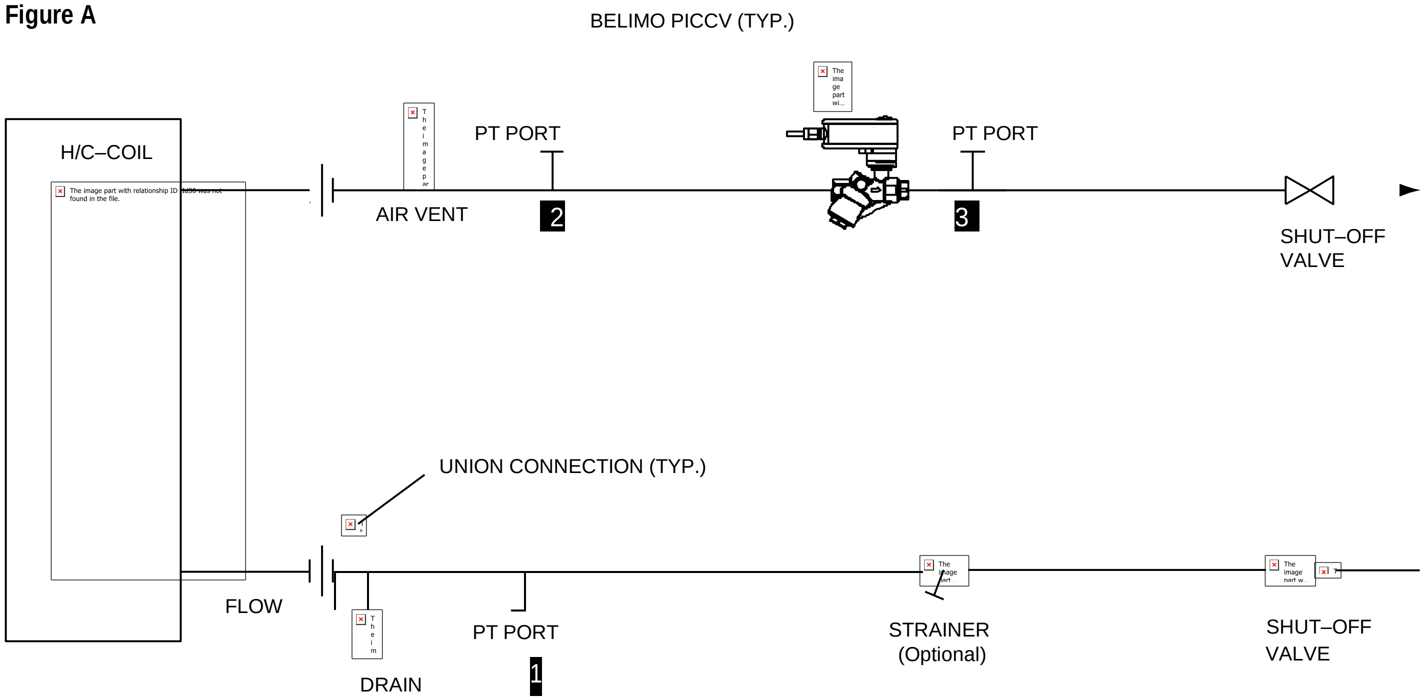
NOTE: When using mechanical PIVs, Pressure Independent Characterized Control Valves (PICCV), it is essential that the mechanical contractor install three (3) independent pressure/temperature ports (P/T ports) if the PICCV is not supplied with integrated ports. For P/T port locations, refer to Figure A in this document.

External P/T ports allow for independent verification of proper PIV operation and these ports allow for future comprehensive troubleshooting and diagnosis.

For proper and accurate flow verification of mechanical PIV, it is essential that the mechanical contractor install P/T ports as shown in Figure A. Some PIVs may be ordered with integrated P/T ports.

- P/T port #1 and P/T port #2 are used to measure the pressure and temperature drop across the cooling or heating coil. This information in combination with the coil flow curves can be used to calculate flow and delta T.
- P/T port #2 and P/T port #3 are used to measure pressure drop across the PIV. PIVs must have 5 – 50 psid (11.5 ft – 115 ft H_2O) (or per manufacturer's specification) pressure drop across the valve only. PIVs must be commanded to design flow position via analog or BMS (Building Management System) signal. Do not manually open the valve with the override handle to check for design flow or pressure. The required operating pressure drop range is necessary to ensure pressure independent operation of the PIV.

Figure A



Belimo Pressure Independent Valve Flow Verification and Commissioning

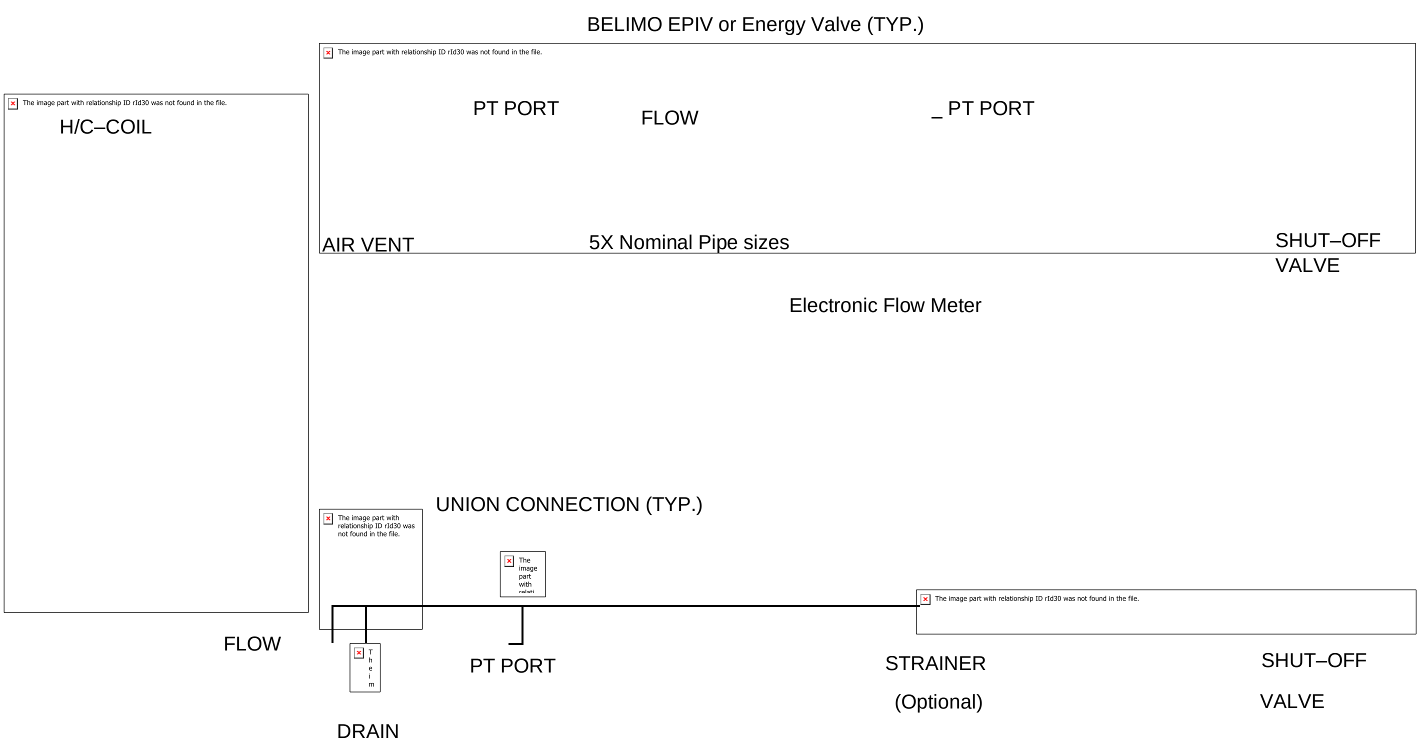
Mechanical PIV Pre-Flow Verification Checklist

- Verify that system is purged of air and filled to proper pressure.
- Verify that each PIV has the manufacturer's required operating pressure drop range across P/T ports 2 and 3 (Figure A).
- Verify proper pump operation per manufacturer's specifications.
- Verify proper supply water temperature is available and is at design temperature.
- Proper air filter maintenance has been completed.
- Fan belts are in proper working order.
- Heat transfer devices (coils) are clean.
- Strainers are clean.
- All manual shutoff valves are open.
- All bypass valves are closed.
- No automatic or manual balancing valves exist. If they do exist, they must be set fully open and locked not interfere with the pressure independency function of the PIV.

Electronic PIV Pre-Flow Verification Checklist

- Verify that system is purged of air and filled to proper pressure.
- Verify that each electronic PIV is set to pressure independent/ flow control mode.
- If the PIV is an Energy Valve, the Delta T Manager™ must be disabled during the flow verification and commissioning procedure.
- Verify that each PIV has the manufacturer's required operating pressure drop range across P/T ports 2 and 3 (Figure B).
- Verify proper pump operation per manufacturer's specifications.
- Verify proper supply water temperature is available and is at design temperature.
- Proper air filter maintenance has been completed.
- Fan belts are in proper working order.
- Heat transfer devices (coils) are clean.
- Strainers are clean.
- All manual shutoff valves are open.
- All bypass valves are closed.
- A flow verification tool is available (ZTH US).
- No automatic or manual balancing valves exist. If they do exist, they must be set fully open and locked to not interfere with the pressure independency function of the PIV.

Figure B



Procedure #1 (System Verification) – Total System Flow Method

Verification for PIV Cooling/Heating

1. Verify that the system is in proper working order. Depending on the valves used, check the items listed for PIV Pre-Flow Verification Checklists.
2. If diversity factor = 100%, command open all PIV via the BMS system. Systems with less than 100% diversity need to have a percentage of valves closed to match design diversity.
3. Ensure that pumps are either manually commanded to sufficient speed to provide proper pressure drop across all valves or if pumps are under DDC pressure control ensure □P setpoint is sufficient to provide the above conditions.
4. Verify total system flow in main return line is at system design flow rate using one of the following methods:
   - Orifice
   - Venturi
   - Electronic flow meter
   - System-level Flow Device
5. Decrease the pump speed (or decrease □P setpoint if under control) until a measureable flow decrease occurs.
6. Increase pump speed (or increase □P setpoint if under control) slowly until design flow is reestablished. Make note of the resulting □P. This will be the maximum system □P operating setpoint.

NOTE: If total flow does not match design flow then troubleshooting must be completed to determine cause. This may involve verifying flows at the terminal level.

Procedure #2 (Terminal Level Verification) – Air Delta T Method

Verification for PIV Heating

1. Verify that the system is in proper working order. Depending on the valves used, check the items listed for PIV Pre-Flow Verification Checklists.
2. Ensure that water is at design temperature.
3. Ensure that terminal airflow is at design airflow rate (cfm).
4. Command open the PIV via analog or BMS control signal to maximum design flow position. Do not manually open the PIV.
5. Reference approved engineering document containing design air temperature drop/rise for design conditions.
6. Measure coil inlet air temperature and coil discharge air temperature.
7. Difference between coil inlet air reading (EAT) and coil discharge air reading (LAT) should equal or exceed design air delta T as shown on the contract documents.

Procedure #3 (Terminal Level Verification) – Water Delta T Method

Verification for PIV Heating

1. Verify that the system is in proper working order. Depending on the valves used, check the items listed for PIV Pre-Flow Verification Checklists.
2. Ensure that water is at design temperature.
3. Ensure that terminal airflow is at design flow rate (cfm).
4. Command open the PIV via analog or BMS control signal to maximum design flow position. Do not manually open the PIV.
5. Reference approved engineering document containing design water temperature drop/rise for design conditions.
6. Measure water temperature differential of coil by using P/T ports #1 and #2 as referenced in Figure A.
7. Measured temperature differential should be equal to designed water temperature differential as shown on the coil manufacturer or engineering documents.

This is the preferred method.

Procedure #4 (Terminal Level Verification) – Coil ΔP (Delta P) Method

Verification for PIV Cooling/Heating

1. Verify that the system is in proper working order. Depending on the valves used, check the items listed for PIV Pre-Flow Verification Checklists.
2. Command open the PIV via analog or BMS control signal to maximum design flow position. Do not manually open the PIV.
3. Reference approved engineering document containing design coil water pressure drop for design flow conditions (usually expressed in ft. of water). This value will be for the heating/cooling coil associated with corresponding PIV.
4. Measure coil ΔP by using P/T ports #1 and #2 as referenced in Figure A.
5. Formula to calculate flow is:

   $$\text{Actual GPM} = \text{Design GPM} \times \sqrt{(\text{Measured Coil } \Delta P / \text{Design Coil } \Delta P)}$$

NOTE: Coil ΔP and design ΔP expressed in feet of water.

Procedure #5 (Terminal Level Verification) – Electronic Coil Flow (EPIV/EV) Method

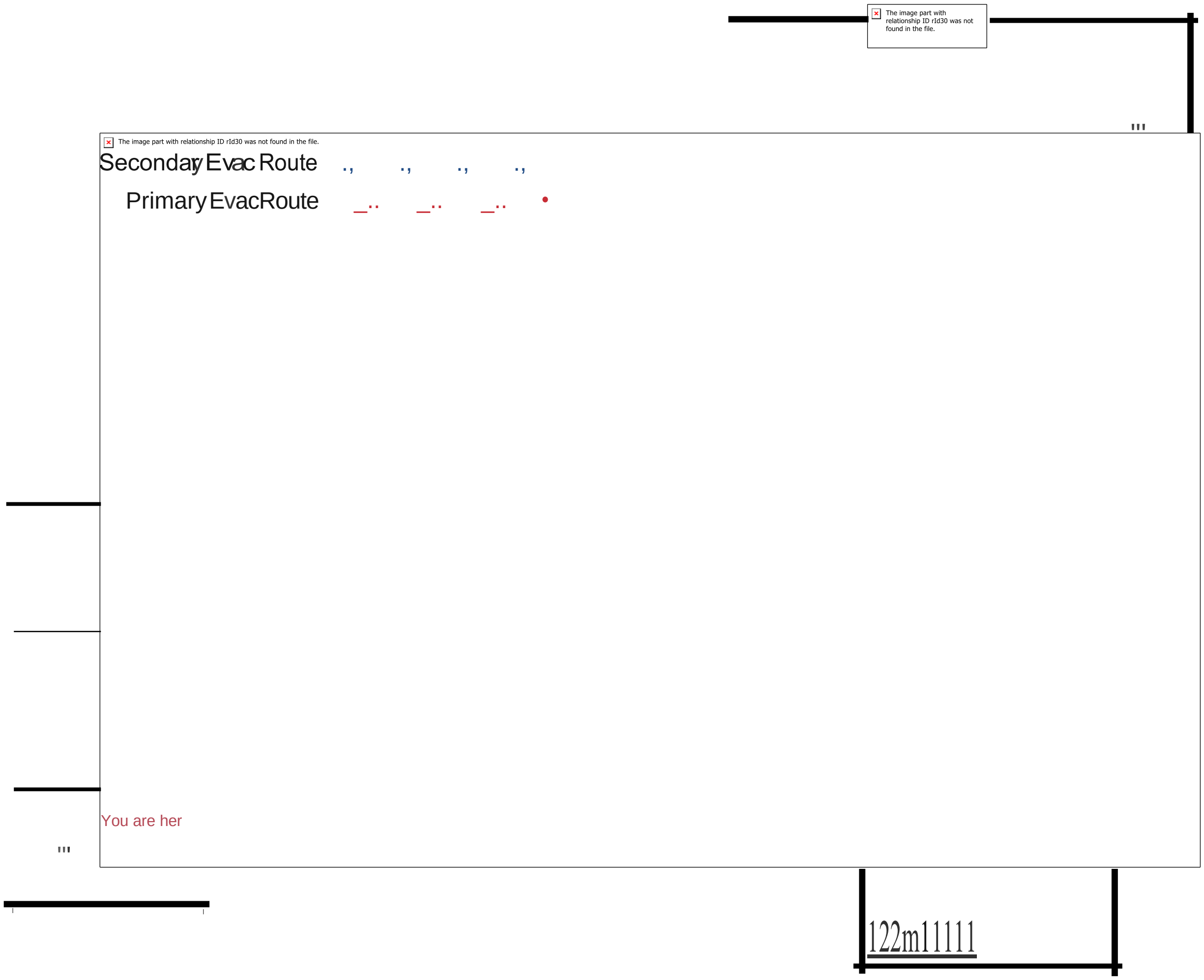
Verification for electronic PIV Cooling/Heating

1. Verify that System is in proper working order. Depending on the valves used, check the items listed for Electronic PIV Pre-Flow Verification Checklists.
2. Command open the electronic PIV via analog or BMS control signal to maximum design flow position. Do not manually open the electronic PIV.
3. Reference approved engineering document containing design coil water flow in GPM for the coil.
4. Verify flow by connecting the valve to the handheld tool or computer software.

For additional information pertaining to the flow verification and commissioning, visit these organizations websites that promote the certification and continuing education of industry professionals in the Test and Balance discipline.
NEBB - National Environmental Balancing Bureau, http://www.nebb.org
TABB - Testing Adjusting Balancing Bureau, http://www.tabbcertified.org

APPENDIX IV

Garfield House
1st Floor
Emergency Evacuation Plan



WHEN A FIRE ALARM SOUNDS

1. Quick ly dress for weather - put on shoes, coat, etc...
2. Feel tne door.
   IF THE DOOR IS HOT, DO NOT OPEN THE DOOR.
   REMAIN IN YOUR ROOM AND FOLLOW DIRECTIONS IN BOLD BELOW.
3. If the door is cool, open cautiously.
4. Leave the room; close the door.
5. If hallway Is not smoke filled. follow designated route and exit ouilding immediately.
6. Use emergency phone to call 9-911
7. Move away from the building.
8. Do not re-enter the building until advised by Security.

If designated route is smoke filled, use alternate route.
If bothroutes are smoke filled,. return to your room.

Close thedoor, stuff somethingincracks under and around door, open window, hang a sheet or towel over ledgeto signal for assistance and stay visible at the window. Use room phone to call 9-911 and give location of the room number you are in.

IN TH E EV ENT OF BAD WEATHEROR
IN THE EVENT OF AN ACTUAL EMERGENCY,
REGARDLESS OF THE WEATHER CONDITIONS,
YOU MUST REPORT TO WOODHOUSE
WHERE YOU WILL RECEIVE FURTHER INFORMATION.

Appendix V - Typical Asset Log - See Williams College Project Manager for Excel file

QR Code	Makes up Equipment ID (QR Code)																					
Equipment ID (QR Code)	**Building ID**	**Floor ID**	**Room ID**	**Equipment**	**Equipment Description**	**Serial Number**	**Manufacturer**	**Make**	**Model #**	**Size**	**Unit of Measurements (If Applicable)**	**Warranty (In Months)**	**Account Number**	**PM Account Number**	**Condition ID**	**Acceptance Date**	**Vendor ID**	**Active Status ID**	**Refrigerant Type ID**	**Refrigerant Charge (Pounds)**	**Refrigerant Charge (Ounces)**	**Image URL**
See BIM/CAD Deliverables	**SM Buildings B0**			**WC AM Equipment Type (use abbreviations in GUIDE - Equipment Type)**	**WC AM Equipment Type + Unique Number**		**WC AM Manufacturer (use abbreviations in GUIDE - Manufacturers)**			**Width/Height /Length**	**Inches (IN) Horsepower (HP) etc.**		**FM Service Activities SA or SM Groups G0**		**WC AM Condition**		**WC AM Vendor**	**WC AM Active Status**	**WC AM Refrigerant Type**			
combine in Excel	Excel	Revit Floor	Revit Room or Excel	Revit "Mark"	Revit "Mark" or combination of "Mark" and "Type Mark"	Excel	Revit "Manufacturer" or Excel		Revit "Model" or Excel	Revit automatic pending category and/or Excel	Excel	Excel	WC use only	WC use only	WC use only	WC use only	WC use only	WC use only	Excel only	Excel only	Excel only	Excel only
BL311-3-309-MEC-ERU-ERU002	BL311	3	309	ERU	ERU002													A				

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Appendix VI

CONSULTANTS

MATERIAL PROPERTIES:

EARTHWORK MATERIAL PROPERTIES:

1. SELECTED FILL: RUN-OF-BANK WELL DRAINING WELL GRADED NATURAL SANDS AND GRAVEL FREE OF ORGANIC MATTER AND DELETERIOUS MATERIAL, AND HAVING THE FOLLOWING GRADATION:
   - 100 % PASSING A 4" SIEVE
   - 0 - 70 % PASSING A No. 40 SIEVE
   - 0 - 10 % PASSING A No. 200 SIEVE
2. STRUCTURAL FILL: PROCESSED SCREENED OR RUN-OF-BANK WELL DRAINING WELL GRADED NATURAL SANDS AND GRAVEL FREE OF ORGANIC MATTER AND DELETERIOUS MATERIAL, AND HAVING THE FOLLOWING GRADATION:
   - 100 % PASSING A 2" SIEVE
   - 60 - 100 % PASSING A 1" SIEVE
   - 25 - 85 % PASSING A No. 4 SIEVE
   - 10 - 60 % PASSING A No. 20 SIEVE
   - 4 - 35 % PASSING A No. 50 SIEVE
   - 3 - 10 % PASSING A No. 200 SIEVE
3. SUBBASE: PROCESSED CRUSHED ROCK AND GRAVEL FREE OF ORGANIC MATTER AND DELETERIOUS MATERIAL, AND HAVING THE FOLLOWING GRADATION:
   - 100 % PASSING A 2" SIEVE
   - 70 - 100 % PASSING A 1 1/2" SIEVE
   - 50 - 85 % PASSING A No. 3/4" SIEVE
   - 30 - 60 % PASSING A No. 4 SIEVE
   - 0 - 10 % PASSING A No. 200 SIEVE
4. STONE: CLEAN WASHED CRUSHED AND SCREENED STONE FREE OF ORGANIC MATTER AND DELETERIOUS MATERIAL, AND HAVING THE FOLLOWING GRADATION:
   - 100 % PASSING A 1" SIEVE
   - ☐90 - 100 % PASSING A 3/4" SIEVE
   - 10 - 50% PASSING A 1/2" SIEVE
   - 0 - 20% PASSING A 3/8" SIEVE
   - 0 - 5% PASSING A No. 4 SIEVE
5. CUSHION SAND: CLEAN, INERT, HARD, DURABLE GRAINS OF QUARTZ OR OTHER HARD DURABLE ROCK, FREE OF ORGANIC MATTER AND DELETERIOUS MATERIAL, AND HAVING THE FOLLOWING GRADATION:
   - 100 % PASSING A 1/4" SIEVE
   - 0 - 10% PASSING A No. 200 SIEVE
6. FILTER OR SEPARATION FABRIC: MIRAFI 160N FABRIC
7. STABILIZATION FABRIC: MiRAFI 500X FABRIC
8. FOUNDATION DRAIN PIPING: 4" DIA CORRUGATED PERFORATED HDPE PIPING, ADS SINGLE WALL OAE. COMPACTION: 95% MODIFIED PROCTOR UNO.

CONCRETE MATERIAL PROPERTIES:

1. FOOTINGS AND PIERS:
   - 1" MAX AGGREGATE
   - 4,000 psi AT 28 DAYS
   - 6% AIR ENTRAINMENT.
   - COLORED CONDITIONED CONCRETE ADMIXTURE COLORED BLACK AS SPECIFIED BY ARCHITECT, PIERS ONLY. PROVIDE SAMPLE TO ARCHITECT FOR APPROVAL
2. CONCRETE SLUMP:
   - MAX SLUMP 4" WITH NO PLASTICIZER.
   - MAX SLUMP 6" WITH LOW DOSE OF SUPER-PLASTICIZER.
   - MAX SLUMP 8" WITH FULL DOSE OF SUPER-PLASTICIZER.
3. REBAR: ASTM A615, GRADE 60, MIN LAP SPICE 40 BAR DIAMETERS.
4. WELDED WIRE REINFORCING: ASTM A1064, 6x6 WWR - W4.0xW4.0

STEEL MATERIAL PROPERTIES:

1. WIDE FLANGE BEAMS: ASTM A992, 50 ksi.
2. FLAT PLATES: ASTM A529 GR. 50, 50 ksi.
3. OTHER ROLLED SHAPES: ASTM A36, 36 ksi.
4. HSS (SQUARE AND RECTANGULAR TUBE SECTIONS): ASTM A500 GRADE B.
5. PIPE: ASTM A53 GRADE B.
6. TIE RODS, HEADED AND L-ANCHOR BOLTS, ASTM F1554, GRADE 36.
7. BOLTS CONNECTING STEEL MEMBERS, ASTM A325, OR ASTM A325TC
8. WELDING: ALL SHOP AND FIELD WELDING PER CURRENT AWS CODE AND AISC, CONDUCTED BY PERSONNEL WITH CURRENT CERTIFICATIONS FOR ALL TYPES AND POSITIONS OF WELDS PERFORMED.
9. WELDING ELECTRODES: E70XX UNO.
10. NON SHRINK GROUT: (UNDER BASEPLATES) UECLID NS GROUT OAE COLORED BLACK WITH ADMIXTURE

TO MATCH COLOR OF CONCRETE PIERS AS SPECIFIED BY ARCHITECT.

FASTENER, ADHESIVE, AND SEALANT MATERIAL PROPERTIES:

1. ADHESIVE STUD ANCHORS (THREADED ROD) IN CONCRETE: HILTI HIT-HY 200 ADHESIVE, OAE.
2. ADHESIVE STUD ANCHORS (THREADED ROD) IN WET APPLICATIONS: HILTI HIT-RE 500 MAX, OAE.
3. ADHESIVE STUD ANCHORS (THREADED ROD) IN COLD WEATHER APPLICATIONS: HILTI HIT-ICE ADHESIVE, OAE.
4. ADHESIVE STUD ANCHORS (THREADED ROD) IN HOLLOW AND SOLID MASONRY: HILTI HIT-HY 70 ADHESIVE, OAE.
5. LATEX CAULK: DAP ALEX PLUS,100% ACRYLIC LATEX CAULK, COLOR AS SPECIFIED BY ARCHITECT.
6. SILICONE CAULK: GE SILICONE II XST
7. URETHANE CAULK: SIKAFLEX 1A, OR PL POLYURETHANE CONCRETE AND MASONRY SEALANT.
8. BUTYL CAULK: PERCORA BC-158 ONE-PART BUTYL RUBBER SEALANT.

WITH MINIMUM

CONSTRUCTION NOTES:

GENERAL:

1. DESIGN IS PER THE EIGHTH EDITION OF THE MASSACHUSETTS STATE BUILDING CODE (MSBC).
2. THESE STRUCTURAL DRAWINGS ARE NOT INTENDED AS STAND ALONE DOCUMENTS. REFER TO FULL CONSTRUCTION DOCUMENT PACKAGE FOR COMPLETE PROJECT INFORMATION AND DETAILS.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD AS WORK PROGRESSES AND SHALL REPORT ANY DISCREPANCIES BETWEEN EXISTING WORK AND CONTRACT DOCUMENTS TO ARCHITECT AND ENGINEER FOR CLARIFICATION BEFORE PROCEEDING WITH WORK.
4. DO NOT SCALE DRAWINGS.
5. ALL DETAILS AND NOTES ARE TYPICAL UNO.
6. CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY SHORING AS REQUIRED BY THE MEANS AND METHODS UNDERTAKEN.
7. CONTRACTOR SHALL RETAIN A LICENSED PROFESSIONAL ENGINEER FOR THE DESIGN OF ALL TEMPORARY SHORING AND SHEETING FOR REVIEW BY THE DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE OF STRUCTURAL DESIGN UNO.
8. PROVIDE ALL TEMPORARY BRACING UNTIL ALL REQUIRED STRUCTURAL SYSTEMS ARE IN PLACE.
9. COMPONENTS NECESSARY FOR CONSTRUCTION SAFETY ARE THE RESPONSIBILITY OF THE CONTRACTOR AND THE MEANS AND METHODS UNDERTAKEN.
10. OBSERVE ALL CURRENT OSHA REQUIREMENTS IN CONSTRUCTION ACTIVITIES.

BUILDING FOUNDATION SUBGRADE PREPARATION NOTES:

1. CLEAR AND GRUB THE PROJECT WORK AREA (10 FT OUTSIDE OF EXCAVATION LIMITS OF THE FOOTPRINT PROPOSED BUILDING FOUNDATION UNO).
2. STRIP ALL TOPSOIL FROM THE PROJECT WORK AREA. STOCKPILE TOPSOIL ON SITE FOR REUSE OR DISPOSE OF OFF SITE AS DIRECTED ELSEWHERE IN THE CONTRACT DOCUMENTS.
3. EXCAVATE AND REMOVE UPPER LAYER OF UNSUITABLE SOIL FROM THE PROJECT WORK AREA. UNSUITABLE SOIL IS ANY SOL MATERIAL THAT CONTAINS ORGANIC MATERIAL, PEAT, ROOTS, UNCONTROLLED FILL, CONCENTRATIONS OF CLAY OR SILT GREATER THAN 20%, CONSTRUCTION DEBRIS, ETC. REMOVE ALL UNSUITABLE SOIL MATERIAL REGARDLESS OF DEPTH. DISPOSE OF UNSUITABLE SOIL MATERIAL OFF SITE.
4. EXCAVATE TO THE BOTTOM OF SUBGRADE LAYER FOR THE BUILDING SLAB ON GRADE. SEE THE CONTRACT DRAWINGS AND OR DETAILS FOR THIS ELEVATION AT THE BOTTOM OF STONE FILL, SUBBASE MATERIAL, AND OR STRUCTURAL FILL BELOW SLABS ON GRADE. NOTE THAT THIS SUBGRADE ELEVATION MAY VARY IN DIFFERENT AREAS OF THE PROJECT.
5. PROOF COMPACT THE FINAL SUBGRADE AREA WITH A SMOOTH DRUM VIBRATORY ROLLER HAVING A MINIMUM STATIC WEIGHT OF 10 TONS. DO THIS IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE OR ENGINEER. OPERATE THE COMPACTOR IN VIBRATORY MODE AND COMPLETE 5 OVERLAPPING PASSES IN ONE DIRECTION. REPEAT THE PROCESS IN THE PERPENDICULAR DIRECTION.
6. AFTER PROOF COMPACTION, PROOF-ROLL SUBGRADE AREAS WITH A FULLY LOADED TRI-AXLE DUMP TRUCK IN BOTH DIRECTIONS.
7. ALL AREAS OF SUBGRADE THAT PUMP AND WEAVE UNDER PROOF COMPACTION, OR THAT OTHERWISE FAIL TO STABILIZE, SHALL BE MARKED FOR OVER-EXCAVATION TO REMOVE ALL ADDITIONAL UNSUITABLE MATERIAL.
8. REPLACE OVER-EXCAVATED AREAS WITH SELECT GRANULAR MATERIAL OR SUBBASE MATERIAL PLACED IN 8 INCH DEEP MAX LIFTS AND COMPACTED TO MINIMUM 95% MODIFIED PROCTOR.

FOUNDATION / EXCAVATION NOTES:

1. BEGIN EXCAVATION FOR FOUNDATIONS ONLY AFTER THE PROJECT WORK AREA FOR THE BUILDING SITE HAS BEEN PREPARED IN CONFORMANCE WITH THE NOTES ABOVE.
2. EXTEND ALL FURTHER FOOTING / TRENCH EXCAVATIONS BELOW THE MAIN BUILDING SLAB SUBGRADE LEVEL VERTICALLY TO REMOVE EXISTING UNSUITABLE MATERIAL.
3. EXTEND ALL EXCAVATIONS FOR CONSTRUCTION PROJECT HORIZONTALLY 1'-6" MIN CLEAR BEYOND LIMITS OF FOOTINGS UNO.
4. CAREFULLY TRIM FINAL GRADES TO MINIMIZE DISTURBANCE TO THE EXISTING SUBGRADE SOILS.
5. SLOPE ALL EXCAVATIONS AT 1/4" PER FOOT (MINIMUM) TO ACHIEVE POSITIVE DRAINAGE AND TO PREVENT ACCUMULATION OF STANDING WATER DURING ALL PHASES OF CONSTRUCTION.
6. PROOF COMPACT ALL ESTABLISHED FOOTING SUBGRADES WITH (3) OVERLAPPING PASSES WITH A SMOOTH DRUM WALK BEHIND VIBRATORY ROLLER OR A RAMMER TYPE COMPACTOR TO SHAPE AND SEAL THE SOIL SURFACE. ALL AREAS OF FOOTING SUBGRADES THAT FAIL TO STABILIZE SHALL BE MARKED FOR OVER-EXCAVATION TO REMOVE ALL UNSUITABLE MATERIAL.
7. REPLACE ALL OVER-EXCAVATED AREAS WITH SELECT GRANULAR MATERIAL OR SUBBASE MATERIAL PLACED IN 8 INCH DEEP MAX LIFTS AND COMPACTED TO MINIMUM 95% MODIFIED PROCTOR.
8. REVIEW PLANNED EXCAVATION DEPTHS WITH RESPECT TO THEIR DISTANCE TO ADJACENT STRUCTURES. PROVIDE ALL NECESSARY SHEETING AND OR SHORING REQUIRED TO PERFORM THE CONTRACT WORK WITHOUT DISTURBANCE TO ADJACENT STRUCTURES. (SEE GENERAL NOTES 6, 7.)
9. MINIMUM DEPTH OF EXTERIOR FOOTINGS IS 4'-0" MIN BELOW FINISHED GRADE UNO.
10. GROUNDWATER WILL LIKELY BE ENCOUNTERED WITHIN THE EXISTING FILL SOILS AND AT THE INTERFACE WITH INDIGENOUS SOILS.
11. SLOPE ALL EXCAVATION SUBGRADES TO ACHIEVE POSITIVE DRAINAGE OF RAINWATER AND GROUNDWATER TO EXCAVATED SUMPS PITS TO PREVENT THE ACCUMULATION OF STANDING WATER AT ALL TIMES.
12. MAINTAIN DEWATERING CONTINUOUSLY THROUGHOUT THE DURATION OF THE PROJECT UNTIL ALL EXCAVATIONS ARE BACKFILLED TO ACHIEVE POSITIVE SURFACE DRAINAGE.
13. SOIL SUBGRADE CONDITIONS THAT ARE ALLOWED TO POOL STANDING WATER OR BECOME SATURATED, FROZEN, OR DISTURBED SHALL BE REWORKED.

CONCRETE PLACEMENT NOTES:

1. SEE STRUCTURAL DRAWINGS FOR FOOTING DETAILS.
2. CONCRETE COVER DISTANCES:
   - 2.1. FOOTINGS: 3" U.N.O.
   - 2.2. WALLS 1-1/2" U.N.O.
   - 2.3. PILASTERS: 1-1/2" U.N.O.
   - 2.4. FLOOR SLABS: 1-1/4" U.N.O.
3. PROVIDE MATCHING CORNER BARS FOR CONTINUOUS HORIZONTAL REINFORCEMENT IN ALL FOOTINGS AND WALLS. SEE DETAILS ON STRUCTURAL DRAWINGS.
4. PROVIDE MATCHING CORNER BARS AT ALL INTERSECTING FOUNDATION WALLS. SEE DETAILS ON STRUCTURAL DRAWINGS.
5. PLACE ALL FORMWORK AND REINFORCEMENT PER CURRENT EDITION OF ACI 301.
6. TIE ALL REINFORCING SECURELY IN PLACE PRIOR TO CONCRETE POUR. WET SETTING OF DOWELS OR OTHER REINFORCING INTO PLASTIC CONCRETE IS NOT PERMITTED.
7. FOLLOW THE RECOMMENDATIONS OF ACI 305R DURING HOT WEATHER PLACEMENT
8. FOLLOW THE RECOMMENDATIONS OF ACI 306R DURING COLD WEATHER PLACEMENT.
9. CONSOLIDATE ALL CONCRETE, INCLUDING SLABS, WITH A VIBRATOR PER ACI RECOMMENDATIONS.
10. LEAVE FORMWORK IN PLACE TO AID IN CURING CONCRETE FOR A MINIMUM OF 7 DAYS PER ACI RECOMMENDATIONS. STRIP FORMWORK AFTER 1 DAY AT FOOTINGS AND WALLS ONLY IF THE CONCRETE IS CURED BY MEANS OF A SPRAY-ON DISSIPATING ACRYLIC POLYMER CURING COMPOUND, OR BY A MOIST CURING METHOD. EARLY FORM REMOVAL AND CURING METHODS AND MATERIALS MUST BE APPROVED BY THE OWNER'S REPRESENTATIVE.
11. DO NOT REMOVE FORMWORK OR SHORING AT BEAMS OR SUSPENDED SLABS, OR AT WALL OPENINGS WIDER THAN 4 FT BEFORE CONCRETE STRENGTH HAS ACHIEVED 70% fc' (TYPICALLY 7 DAYS MINIMUM).
12. REMOVE ALL CONCRETE FINS OR OTHER PROJECTIONS AT BETWEEN FORMWORK JOINTS AND PATCH ALL VOIDS AND FORM-TIE HOLES WITH NON-SHRINK GROUT ON THE SAME DAY THAT FORMWORK IS STRIPPED. GRINDING THE CONCRETE OR PARGING OVER THE CONCRETE SURFACE LATER WILL NOT BE ACCEPTED.

STRUCTURAL STEEL FABRICATION / ERECTION NOTES:

1. STRUCTURAL STEEL COMPONENTS SHALL BE FABRICATED BY A SHOP OR FABRICATOR OF FIVE YEARS EXPERIENCE SPECIALIZING IN THIS WORK.
2. ALL WELDING SHALL BE PERFORMED BY PERSONNEL WITH CURRENT AWS CERTIFICATION FOR THE TYPE OF WORK PERFORMED.
3. SUBMIT SHOP DRAWINGS FOR ALL STRUCTURAL STEEL COMPONENTS, INCLUDING

A1 S-201 · 23'-0" · 1'-0" · 3'-0", TYP · 3'-3" · HSS12x12 · HSS8.625x0.25" BELOW, TYP · 3/8" END PLATE, TYP · BUILT UP PLATE MEMBER · 12'-0" · 11'-0" · 7'-9"

J10 ROOF FRAMING PLAN

REF: SCALE 1/4"=1'-0"

21'-0" · A1 S-201 · ISOLATED CONCRETE FOOTING, TYP · 24 INCH DIAMETER CONCRETE PIER, TYP · HSS8.625x0.25, TYP · 4'-0" · 6'-0"

STAMP

73 troy road
suite 2h
east greenbush ny 12061

518.487.4755 telephone
518.670.0122 facsimile
springlinedesign.com

PROJECT NAME

BIKE RACK CANOPY
WILLIAMS COLLEGE
WILLIAMSTOWN, MA

DRAWING TITLE

GENERAL NOTES AND PART PLANS

The image part with relationship ID rId36 was not found in the file.

C

B
APPROVED

A

INGS, ERECTION PLANS, AND DETAILED DRAWING FOR ALL FABRICATED COMPONENTS.

4. DO NOT BEGIN STEEL FABRICATION UNTIL STEEL SHOP DRAWINGS HAVE BEEN APPROVED BY THE OWNER'S REPRESENTATIVE.
5. ERECT STEEL IN CONFORMANCE WITH THE CURRENT EDITION OF AISC 303 CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES.
6. ALL STEEL AND EXPOSED CONNECTION MATERIAL IS ARCHITECTURALLY EXPOSED STRUCTURAL STEEL. GRIND ALL WELDS SMOOTH FLUSH WITH FACE OF STEEL PRIOR TO GALVANIZING. PROVIDE TEMPORARY HOLES IN PLATES AND TUBES FOR GALVANIZING, AS REQUIRED BY GALVANIZER. SEAL WELD ALL HOLES AND GRIND SMOOTH AFTER GALVANIZING AND PRIOR TO COATING. TOUCH UP ALL GALVANIZING PRIOR TO COATING.
7. ALL STEEL AND EXPOSED CONNECTION MATERIAL, INCLUDING BOLTS, ANCHOR RODS, WASHERS, NUTS, PLATES, AND LEVELING PLATES, SHALL BE COATED WITH DUNCAN GALVANIZING COLORGALV GLOSS BLACK AS SPECIFIED BY ARCHITECT, OR APPROVED EQUIVALENT. COATING SHALL BE APPLIED ACCORDING TO DUNCAN GALVANIZING STANDARD COLORGALV PROCEDURES, OR EQUIVALENT. NO WELDING SHALL OCCUR AFTER FINAL FINISH COAT IS APPLIED.
8. CARE SHALL BE TAKEN DURING SHIPPING AND HANDLING TO PREVENT DAMAGE TO FINISH. FINAL COATED PRODUCT SHALL HAVE A UNIFORM FINISH AND FREE OF SCRATCHES, CHIPS, GOUGING, AND DISCOLORATION.

A10 FOUNDATION PLAN

REF: SCALE 1/4"=1'-0"

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

D

DRAWING DATE	DRAWING SCALE
2017-05-12	AS NOTED
	DRAWN BY
	DA

C

PROJECT NUMBER
07216007

REVISIONS

B

DRAWING NUMBER

S-101

A

STRUCTURAL DRAWING LEGEND

NUMBER	TITLE
REF:	SCALE

CONSULTANTS

CONTINUOUS 1/2" LEXAN STRIP ABOVE EACH RIB

1/4" x 1 1/2" SELF-DRILLING FLAT HEAD SCREWS AT 12" OC, COATED BLACK TO MATCH STEEL COATING

1/4" EDM FLAT RUBBER BLACK SELF SEALING GASKET AS SPECIFIED BY THE ARCHITECT

5/16" DIAMETER HOLE IN LEXAN, COUNTERSINK

1/4" x 1" SELF-DRILLING SCREWS AT 12" OC, , COATED

BLACK TO MATCH STEEL COATING

1/2" LEXAN PANEL

3/8" GAP BETWEEN PANELS

1 1/2"

3"

TYP. SEAL WELD ALL JOINTS AND

1/8 4-12 GRIND SMOOTH PRIOR TO GALVANIZING

1/4" 3" 1/4" 1/4" TOP AND BOTTOM PLATES

VARIES

1'-2"

1 3/4" 10 1/2" 1 3/4"

7/16 TYP

HSS COLUMN

1" DIAMETER ANCHOR RODS, ASTM F-1554 GRADE 36, GALVANIZED AND COATED TO MATCH COLOR OF FINISH COAT

3/4"x3" SQUARE PLATE WASHERS, GALVANIZED AND

COATED TO MATCH COLOR OF

FINISH COAT. CONCRETE PIER

M1 BASE PLATE DETAIL

REF: SCALE 1 1/2"=1'-0"

11'-0"

TYP, RIB TO TUBE 1/4

PROVIDE TEMPORARY HOLES IN TOP PLATE FOR GALVANIZING, AS REQUIRED BY GALVANIZER. SEAL WELD ALL HOLES AND GRIND SMOOTH PRIOR TO COATING. TOUCH UP ALL GALVANIZING PRIOR TO COATING.

M8 S-201

3/8" END PLATE

7'-1 1/4"

7'-0"

NOTES:

1. ALL STEEL AND CONNECTION MATERIAL SHALL BE HOT DIPPED GALVANIZED AND FINISH COATED. SEE STRUCTURAL STEEL FABRICATION NOTES AND ARCHITECTURAL SPECIFICATIONS FOR COATING REQUIREMENT.

M8 TYPICAL BUILT UP PLATE SECTION

REF: SCALE 3"=1'-0"

3'-3"

1/2"x2 1/2"x4" PLATE WASHER, TYP

LEXAN PANEL

HSS12x12

3/4" PLATE

SEE ARCHITECTURAL DRAWINGS FOR CURVATURE DIMENSIONS

CONTRACTORS OPTION TO WELD IN LIEU OF BOLTING PER DETAIL. DO NOT FIELD WELD.

A15 S-201 ROTATE 90 DEGREES

HSS8.625

M1 S-201

ANCHOR RODS PLATE WASHERS

STRUCTURAL DRAWING ABBREVIATIONS

ADDL ADDITIONAL
ADJ ADJACENT
AFF ABOVE FINISHED FLOOR APPROX APPROXIMATE
B / BOTTOM OF
B/FTG BOTTOM OF FOOTING BLDG BUILDING
BOT BOTTOM
BRG BEARING
BP BASE PLATE
CANT CANTILEVER

CFMF COLD FORMED METAL FRAMING CJ CONTROL, CONTRACTION, OR CONSTRUCTION JOINT
CL CENTER LINE
CMU CONCRETE MASONRY UNIT COL COLUMN
CONC CONCRETE

CONT CONTINUOUS
COORD COORDINATE DIA DIAMETER
DIM DIMENSION
DN DOWN
DO DITTO
DWG DRAWING
EA EACH
EL ELEVATION
EMBD EMBED, EMBEDMENT EOD EDGE OF DECK
EOS EDGE OF SLAB

ES EACH SIDE
EQ EQUAL

EQUIP EQUIPMENT EW EACH WAY
EXIST EXISTING
EXP EXPANSION
EXT EXTERIOR
FDN FOUNDATION
FOW FACE OF WALL
FS FAR SIDE
FTG FOOTING
GA GAGE
GWB GYPSUM WALL BOARD HDG HOT DIP GALVANIZED

HORIZ HORIZONTAL
HSS HOLLOW STRUCTURAL SHAPE ID INSIDE DIAMETER

INFO INFORMATION
INT INTERIOR
INV INVERT
LG LONG
LLH LONG LEG HORIZONTAL LLV LONG LEG VERTICAL
LOC LOCATION
LW LIGHT WEIGHT
LVL LAMINATED VENEER LUMBER MAX MAXIMUM
MECH MECHANICAL MIN MINIMUM
MISC MISCELLANEOUS

MO MASONRY OPENING
NIC NOT IN CONTRACT
NTS NOT TO SCALE
NW NORMAL WEIGHT
No. NUMBER
OC ON CENTER
OD OUTSIDE DIAMETER

OPNG OPENING
OPP OPPOSITE
PAF POWDER ACTUATED FASTENER PCF POUNDS PER CUBIC FOOT PERP PERPENDICULAR
PL PLATE
PLF POUNDS PER LINEAL FOOT PSF POUNDS PER SQUARE FOOT PSI POUNDS PER SQUARE INCH PT PRESSURE TREATED
REQD REQUIRED
REINF REINFORCEMENT

REV REVISED, REVISION
RO ROUGH OPENING

SF SQUARE FEET
SIM SIMILAR
SP SPACE, SPACES, SPACED
STD STANDARD
STL STEEL
SQ SQUARE
T / TOP OF
TYP TYPICAL
UNO UNLESS NOTED OTHERWISE VERT VERTICAL
VIF VERIFY IN FIELD
W / WITH

WWR WELDED WIRE REINFORCEMENT
WCJ WALL CONTROL JOINT

X S-XXX

DETAIL NUMBER

DRAWING NUMBER

SECTION MARK

ELEVATION NUMBER

X S-XXX

DRAWING NUMBER

CAST-IN-PLACE CONCRETE

EXISTING CONCRETE

EXISTING SUBGRADE, EARTH

GENERAL

GRAVEL BACKFILL, CMU GROUT

LOAD-BEARING MASONRY

MASONRY VENEER, MASONRY PARTITIONS

NON-SHRINK GROUT, DEPRESSED TOP OF FOUNDATION WALL

PLYWOOD

OSB - ORIENTED STRAND BOARD

RIGID INSULATION

STEEL

SUBBASE

EXISTING ROCK

TOP SOIL,

LOAM

WASHED STONE

STEEL FRAMING SYMBOLS

MOMENT SPLICE

CONTINUOUS BEAM OVER COLUMN

MOMENT CONNECTION

10.0 k R

SIMPLE CONNECTIONS

SHEAR SPLICE

BEAM REACTION

SEAT CONNECTION

SIMPLE BEAM CONNECTIONS

STAMP

1 1/2"

3" 3"

1'-0" SPACING

3" 3" 3"

1'-0" SPACING

LEXAN PANEL

FASTENERS, TYP LEXAN

STRIP FASTENERS, TYP

1 1/2"

3" 3"

3" 3" 3"

F15 TYPICAL LEXAN CONNECTION TO RIB

73 troy road
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PROJECT NAME

BIKE RACK CANOPY

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SITE FINISHES AS SPECIFIED BY THE ARCHITECT

1 1/2" NON-SHRINK GROUT, COLORED BLACK TO MATCH PIER

3/4" BASE PLATE
1/2" LEVELING PLATE, GALVANIZED AND COATED TO MATCH COLOR OF FINISH COAT. RADIUS CORNERS.
CONCRETE COLORED BLACK WITH ADMIXTURE, PIERS ONLY

1'-6" EMBEDMENT

No. 4 TIES

(8) No. 6 VERTICAL, HOOK TOP AND BOTTOM

FILL

STRUCTURAL

(7)No. 5 TOP AND BOTTOM SHORT WAY

(5) No. 5 TOP AND BOTTOM LONG WAY

BLEND OF No. 1 AND No.2 CRUSHED STONE SUBBASE

A1 CANOPY SECTION

REF:

SCALE 3/4"=1'-0"

REF:

SCALE 1"=1'-0"

3/8" END PLATE WELDED ALL AROUND AND GROUND SMOOTH. PROVIDE TEMPORARY HOLES IN PLATE FOR GALVANIZING. SEAL WELD ALL HOLES AND GRIND SMOOTH PRIOR TO COATING. TOUCH UP ALL GALVANIZING PRIOR TO COATING.

1'-2"

1 1/2" 11" 1 1/2"

HSS TUBE

HSS

COLUMN

TOP PLATE

(4) 3/4" DIAMETER THREADED RODS, ASTM A193 B7, GALVANIZED AND COATED TO MATCH COLOR OF FINISH COAT.

7/16 TYP

1/4

CONTRACTORS OPTION, WELD IN LIEU OF BOLTING. DO NOT FIELD WELD.

A15 TOP PLATE CONNECTION

REF:

SCALE 1 1/2"=1'-0"

WILLIAMS COLLEGE WILLIAMSTOWN, MA

DRAWING TITLE

SECTIONS AND DETAILS

DRAWING DATE	DRAWING SCALE
2017-05-12	AS NOTED
PROJECT NUMBER	DRAWN BY
07216007	DA

REVISIONS

DRAWING NUMBER

S-201

Appendix VII

WILLIAMS COLLEGE

CAD\BIM STANDARDS & REQUIREMENTS

Last Revised 01.10.2019

TABLE OF CONTENTS

INTRODUCTION

The purpose of this document is to outline the BIM requirements for projects and to provide all Williams College Consultants guidelines for producing and delivering CAD drawings and Building Information Models for facility use. The guidelines are intended to ensure the successful use and control of CAD and BIM data throughout the College.

Please direct any questions or comments about this document to your Project Manager at the address below.

Williams College
Facilities Service
Building 60 Latham
Street
Williamstown, MA 01267
tel: 413-597-2301
ATTN: ____________________

SECTION 1 – Overview

1.1 – BIM EXECUTION PLAN\USAGE OF THIS DOCUMENT

The design\construction team will develop a BIM Execution Plan (BEP) for each project at Williams College. Williams College will provide the BEP document to be developed. There are two BEPs that will be provided, one for the design team and one for the construction team.

The BEP will outline how BIM technologies will be used on the project. The document is intended to provide the background information that design\construction teams will require in order to cohesively produce a BIM. The design\construction team will determine who will take the lead in producing the BIM execution plan for the project. This document and information herein can be appended to the BEP or otherwise included.

1.2 – HOW DOES WILLIAMS COLLEGE USE CAD\BIM?

Williams College maintains an up to record of the existing conditions floor plans of all its building assets in AutoCAD and is moving toward maintaining an up to date Building Information Model(s) of the campus. All new buildings are maintained in Revit. FM: Systems' CAFM software as developed by FM: Systems, is utilized for database management of all spaces, equipment, building components and other building operation's needs.

1.3 – CAD\BIM TOOLS

Files submitted must be in the following formats unless otherwise requested differently by your Project Manager at WC.

File Extension	Software	Version\Year
RVT	Revit	2018 and higher
dwg	AutoCAD	2013 and higher
ifc	Industry Foundation Classes	IFC 2x3
nwd	Navisworks	
xlsx	Excel	
PDF		
Accdb	Access	2016 and higher

Williams College recognizes that design and construction firms may not use the same CAD or BIM tools as requested. Design and construction teams are free to use whatever software\technology tools they wish, however all files submitted must be in the approved file formats, and files must use 'native' entities in the software. (Ie. If a Revit Files is required, 3D CAD files inserted\linked into Revit and submitted will not be accepted.)

1.4 - WHICH PROJECTS HAVE CAD DELIVERABLE REQUIREMENTS

All projects which change in locations of walls or doors must submit 2D CAD bounded drawings of all sheets issued.

1.5 - WHICH PROJECTS HAVE BIM REQUIREMENTS

Any new construction will require BIM deliverables.
Williams College will require any new work to any existing building in a BIM environment; any project which results in changes to walls, structure or mechanical systems must be developed with BIM. BIM tools will be required to be used and BIM deliverables will be required for any project meeting any of the following criteria.

- All new construction projects.
- Any projects increasing the square footage of the Campus.
- Any renovation project larger than 10,000sf
- Any project which impacts structure (columns, beams, braces, exterior walls, floors)

- Any project which adds\changes large portions of mechanical systems (ie. AHU's and RTU's, rework duct "trunks") regardless of architectural square footage served.

1.5.1 - BIM USES

For any project where BIM is required, BIM must be used with the following. Additional details on each item follow.

A. Existing Conditions Models of adjacent buildings for projects greater than 10,000 sf.
B. Coordination\Clash Detection of Arch\Structural\MEPFP building elements
C. Construction Closeout
   C.1. Record Coy of Design Models
   C.2. As-Built Models
   C.3. Facilities Management Data Requirements

1.5.1A - EXISTING CONDITIONS BIM

Any project which requires field measuring of existing conditions as part of the scope of the project, field measuring of existing conditions should document those conditions using Revit and deliver models conforming to Williams College BIM Standards. Exact scope\extents of field measuring should be verified with William College Space Database Administrators.

1.5.1B- COORDINATION\CLASH DETECTION

Williams College requires projects to perform electronic clash detection and coordination during design and construction to minimize (hopefully eliminate) constructability issues.

Refer to Section 3 for additional details.

1.5.1 C.1 - RECORD COPY OF DESIGN DOCUMENTATION (CAD OR BIM)

Williams College requires a complete electronic record of all design documentation prepared by design team at project closeout. Electronic records will include any changes issued during construction process. Design record files are to be submitted in both 2D AutoCAD plans and RCP's and all native Revit File Formats. PDF copies of each sheet are also required.

For AutoCAD submissions, one drawing\file should be submitted for each sheet in the contract document set. (No Xrefs permitted.) Drawings must follow AIA layer naming conventions. Include all used fonts not normally supplied by AutoCAD with the as-built DWG files. AutoCAD plotting table files (.ctb or .stb files) if used to control drawing lineweights, need to be submitted with drawings.

PDFs should be combined into one electronic file per discipline and sheets should be in

correct sequence. Revit Files can be submitted as used by the design team with the following

additional requirements

- Purge any views, schedules, legends not on a sheet for plotting
- Purge any unused families.
- If more than 1 Revit model is submitted, a diagram indicating Revit model organization structure, showing file names must be included.

1.5.1C.2 - AS-BUILT (CAD\BIM\FM)

Williams College requires submission of 'As-built' models at project completion. The goal of the 'As-Built' deliverable is to have an accurate record of the installed locations of all building elements for reference for future projects, and for use in operating and maintaining the building. In addition to accurately showing the building geometry, the as-built models must contain data as outlined herein to enable facilities staff to identify building elements.

All objects are to be of accurate overall dimension, shape and location. Any clearances required for access or maintenance to equipment are to be included in the model as separate selectable objects

WC is using FM: Systems' CAFM Software, as developed by FM: Systems, for database management and building operations and will update this document with any needs required. For any questions regarding FM data needs, please contact Williams College Building Operations.

Please see Section 2 for CAD requirements, Section 4 for Revit Requirements.

1.5.1C.3 - FACILITIES MANAGEMENT BUILDING DATA REQUIREMENTS

Williams College requires that data which is useful for management and operations of the facility be incorporated into the Facilities Management BIM model and provided in Microsoft Excel, formatted to allow for seamless incorporation into FM Systems.

Please see Section 5 for FM data requirements.

1.6- PLANS FOR ROOM NUMBERING APPROVAL

Williams College Operational staff will be responsible for establishing 'Final' room numbers which the design team must use in its documents. As early as is practical in the design process, at the point when the room locations are finalized, the architect will send PDF floor plans. Williams staff will assign final room numbers which the architect needs to include and maintain in the construction documents through the end of the project. Prior to the completion\issuance of final CD's, the architect will submit PDF floor plans showing final Williams College Room numbers for sign-off.

Please refer to the Williams College Design Standards Document for additional information on room numbering. This is a separate document and should be provided to you by your Williams College Project Manager.

1.7 - SUBMISSION REVIEW\APPROVAL

Approval of CAD\BIM files is one of the Project Close Out requirements which must be met before final payment will be rendered. Williams College will review all electronic file submissions and either accept or reject the submissions. Rejected submissions will be returned for correction.

SECTION 2 – CAD REQUIREMENTS

Below are listed the requirements for CAD files submitted to Williams College for including cad files submitted as design record, as-builts, or for Facilities Management CAD Backgrounds

2.1 – EXISTING CONDITIONS CAD FILES

Williams College will provide CAD files of existing conditions of the building(s) as required when the CAD information exists. Plans are provided for reference only. Use of files is at own risk. All existing conditions must be verified. All field verification changes must be incorporated, and Williams College notified.

All parties must sign the Williams College CAD File release agreement form.

2.2 - FILE FORMAT\VERSION

All CAD files are to be submitted in AutoCAD 2013.dwg format unless otherwise indicated by Williams College.

2.3 - FILE NAMING

1 file should be submitted for each sheet in the construction document set. Files should be named as follows Use hyphens between each grouping.

Design Record Drawings & As-Builts CAD

CAD Files should be named as follows

Project Identifier	Sheet Number	Date		
	A101	2019-01-01		
	4 characters	YYYY-MM-DD		

Facilities Management Backgrounds CAD

CAD files submitted for FM Backgrounds are to be named as follows.

Project Identifier	Building ID	Floor ID	Discipline Code	Date
	BL001	01	Arch	2019-01-01
	5 characters	2 characters	4 Characters	YYYY-MM-DD

Example: Main Building- First Floor-Architectural-Jan1 01, 2108 would be named as follows.
BL001-01-Arch-20180101.dwg

2.4 - ORIGIN POINT

Williams College master campus file contains an origin point.
An origin point has been established in each Williams College master CAD file. All drawings submitted as part of deliverable requirements must use that established origin point.
Mapping datums are NAD 83 for the horizontal and NAVD 88 for the vertical. North in our mapping is grid, or True north. The variation, or declination in Williamstown is 14 degrees 4 minutes west.

If this is not provided, the files must be located at the AutoCAD 000 at a corner of the building or project team approved grid intersection and must be captured in the projects BEP, BIM Execution Plan.

2.5 - SCALE & UNITS

All building entities should be drawn at 'real world' scale. Annotations should be scaled appropriately for intended plot scale. Drawing units are set to Architectural Units with 1/32' precision.

2.6 - AutoCAD Layering

CAD submission files must adhere to Williams College layering guidelines. Design record files and as-built must follow AIA standard layer naming conventions. All Williams College layers contain the suffix -EXST. Design record files and as-built files can use their own layering system. If exporting from Revit, please use the _WC Export Settings provided in the Revit Master Library.

2.7 - Color & Line Weights

Design Record Drawings & As-Builts CAD
Design\Construction teams are free to assign their own colors and lineweights to drawing elements. All colors & lineweights must be controlled by layers (Assigning colors and lineweights directly to individual elements is prohibited.)

Facilities Management Backgrounds CAD
Williams College uses the default acad.ctb "color-dependent" plot style table for plotting but lineweights are controlled from the layer dialog box. All layers should be set to default lineweight. The default lineweight for the drawing should be 0.13 mm.

2.8 - File Organization – XREF Usage

All Xrefs need to be removed prior to submission. If 'binding' xrefs be sure that layers from bound drawings are removed.

2.9 - Paper Space vs. Model Space\Titleblocks\Printing Layouts

At a minimum, the titleblock should include the following information: Name and location of the project, lead design team, drawing date, revision / addendum date, sheet number and title of the sheet, a place for the design professional's stamp, who designed / drawn and reviewed.

At a minimum, the cover sheet should include the following information: Name and location of the project, Office of Planning, Design and Construction, the PM from Williams listed, lead design team including contact information, all sub-consultants, drawing date, revision / addendum date, title of the sheet at the time of printing (schematic, construction, bid phase, conformed, etc), any revisions listed.

Design Record Drawings & As-Builts CAD
All building entities should be drawn in model space.
Drawing should contain only 1 layout which should be for the sheet to be plotted.

Facilities Management Backgrounds CAD
All building entities should be drawn in model space.
Drawing should contain only 1 layout which should be empty.

2.10 - 2D Geometry

ALL drawing information will be of 0 height on the XY plane. No drawing should contain any 3D elements.

2.11 -Block Usage

All block entities must be created on layer 0 with color and linetype settings as either 'bylayer' or 'byblock'. Layers must not be embedded into any blocks.

2.12 - Fonts and Text Styles

There are no font or text style requirements for design record files or as-built files.

2.13 - DIMENSIONING

Williams College Standard Dimension style is as follows

- Colors and Lines Bylayer unless noted otherwise
- Extend dimension & extension lines 1/16', Offset from origin 1/8'
- Baseline spacing – 1/4"
- Architectural tick for dimension lines - 3/32'
- Closed filled arrow - Size 3/32'
- Text Style: Arial Narrow
- Font Height - 3/32', Fraction Height: 0.75
- Text Above and Centered and aligned with dimension line- 1/32' above
- Text style set to standard - annotative
- Arch Units, Precision 1/16' & 2 decimals, diagonal stacked
- Suppress 0 feet

2.14 – DRAWING CONTENT REQUIREMENTS

Design Record & As-Built CAD

If the project is produced with CAD as permitted by the guidelines, design record drawings must be submitted and follow these requirements. If the project is produced with BIM, design record documents only need to be submitted in BIM format.

Drawings must only contain content which is required to produce sheets. All other extraneous content not shown on a sheet should be removed. 1 file should be submitted for each sheet in document set. All xrefs must be removed.

Facilities Management Backgrounds CAD

FM CAD background drawings must include the items in the chart below if they are part of the scope of work for that project. **There should be no extraneous items in the drawing beyond what is identified on the list below.** Any items not specifically listed below must be removed from the drawing. All items should reside in 1 drawing file for each floor of each building. (If drawing elements originally exist in more than one CAD file they must be combined into a single drawing per floor per building.) All 'Existing' to remain elements must be on a layer with '-Exist' suffix. Any items to be removed as part of the scope of the project shall be on layers with the '-demo' suffix and all new elements shall be on layers with '-New' suffix. The layer list below shows suffix for existing conditions. Replace that suffix with -new or -demo as required.

Note: If exporting from Revit, the WC-Master Library contains a WC export setting

Required Element	Layer Name	Color	Notes\Additional Requirements
Column Grid Lines	S-Grid-Exist	23	
Columns	S-Cols-Exist	24	
Room Data	A-Area-Iden	2	Room Names, Room Numbers, Room Description
Room Polylines	RM	4	All rooms should be polylined to WC standards
Walls	A-Wall-Exist	41	
Wall Rating Lines	A-Wall-Rating	7	
Doors	A-Door-Exist	143	Rated doors identified. Doors with closers identified.
Windows\Glazing	A-Glaz-Exist	83	
Plumbing Fixtures	P-Fixt-Exist	63	Maintain ADA graphics related to clearances.
Built In Casework\Millwork	A-Case-Exist	23	
Stairs	A-Stairs-Exist	33	
Railings	A-Rail-Exist	41	

Required Element	Layer Name	Color	Notes\Additional Requirements
Elevators\Escalators	A-Elvtr-Exist	35	
Fixed Medical Equipment	A-Equip-Med-Exist	61	Ie. Medical Equipment
'Office' Equipment	A-Equip-Office-Exist	61	
Furniture	A-Furn-Exist	13	Furniture & Cubicles
Furniture-Cubicle Panels	A-Furn-Panl-Exist	15	Cubicle\Workstation panels
Electrical Panels	E-Panl-Exist	51	
Mechanical Equipment	M-Equip-Exist	140	
Tel\Data Jacks	E-Comm-Exist	51	GFCI outlets indicted.
Smoke and Fire Dampers	M-Damp-Exist	140	
Security Items – Card Readers	E-Secr-Exist	51	
Life Safety Items	LS-Equip-Exist	11	Extinguishers, Hoses, AED, Fire Alarm Pulls.
Ceilings	A-Clng-Exist	153	GWB ceiling need to show hatch.
Light Fixtures	E-Lite-Exist	51	
Diffusers	M-Diff-Exist	140	
Sprinklers	F-Sprnk-Exist	20	
Smoke Detectors	LS-Smoke-Exist	12	Smoke\Heat Detectors
Roof Plans			
Mechanical Equipment	M-Equip-Exist	140	
Roof Drains & Roof slope indicators	P-Drain-Storm-Exist	63	
Roof Paths	A-Roof-Path	2	
Utility\Civil			
Cable TV	Util-Catv-Design	7	Design Intent
Cable TV	Util-Catv-AsBuilt	30	As-Built Information
Cable TV Notes & Text	Util-Catv-Text	8	Labels, notations
Communications / Fiber Optic	Util-Com-Design	107	Design Intent
Communications / Fiber Optic	Util-Com-AsBuilt	2	As-Built Information
Comms Notes & Text	Util-Com-Text	8	Labels, notations
Chilled Water	Util-CW-Design	7	Design Intent
Chilled Water	Util-CW-AsBuilt	30	As-Built Information
Chilled Water Notes & Text	Util-CW-Text	8	Labels, notations
Drain	Util-D-Design	204	Design Intent
Drain	Util-D-AsBuilt	30	As-Built Information
Drain Notes & Text	Util-D-Text	3	Labels, notations
Electric	Util-E-Design	241	Design Intent
Electric	Util-E-AsBuilt	30	As-Built Information
Electric Notes & Text	Util-E-Text	8	Labels, notations
Gas	Util-G-Design	40	Design Intent
Gas	Util-G-AsBuilt	2	As-Built Information
Gas Notes & Text	Util-G-Text	8	Labels, notations
Potable water	Util-PW	1	Applicable to Kellogg House only
Sanitary	Util-S-Design	6	Design Intent
Sanitary	Util-S-AsBuilt	20	As-Built Information
Sanitary Notes & Text	Util-S-Text	8	Labels, notations
Steam	Util-ST-Design	20	Design Intent
Steam	Util-ST-AsBuilt	160	As-Built Information

Steam Notes & Text	Util-ST-Text	8	Labels, notations
Telephone	Util-T-Design	82	Design Intent
Telephone	Util-T-AsBuilt	4	As-Built Information

Required Element	Layer Name	Color	Notes\Additional Requirements
Telephone Notes & Text	Util-T-Text	8	Labels, notations
Water	Util-W-Design	171	Design Intent
Water	Util-W-AsBuilt	30	As-Built Information
Water Notes & Text	Util-W-Text	8	Labels, notations

SECTION 3 – BIM CLASH DETECTION\COORDINATION

3.1 – OVERVIEW

Williams College requires projects to perform electronic clash detection and coordination during design and construction to minimize (hopefully eliminate) constructability issues. The scope of 3D modeling and tolerances required for coordination will be detailed in each projects BIM execution plan. At a minimum, coordination should include architecture, structure, mechanical, electrical, plumbing, & fire protection. Clearance\Access zone areas must be modeled and coordinated. The recommended minimum clash tolerance is 2'.

3.2 - COLOR ASSIGNMENTS

For ease of identification during the coordination clash process the follow trades will be represented in the following colors for the Navsiworks and\or Solibri models, pending which the Construction team plans to use.

*colors determined by project team and should be kept the same for final FM model submission and included within the projects BIM Execution Plan. The following colors must be used although the project teams may expand upon them further.

Architectural Models	
Architectural	white (255, 255, 255)
Concrete (floors and walls)	grey (224,224,224)
Glass, Ceilings, Doors	white 50% transparent
other	white (255, 255, 255)

Structural Models	
Structural Steel	maroon (128, 0, 0)
Footings & Foundations	192,160,160
Floors	192,160,160
Walls	208,192,192
other	255, 192,192

MEPFP Models	
Fire Protection	red (255, 0, 0)
Mechanical Ductwork Supply	blue (0, 0, 255)
Mechanical Ductwork Return	blue (153, 204, 255)
Mechanical Piping	cyan (0, 255, 255)
Electrical	green (0, 255, 0)
Chilled Water	blue (0,128,192)
Condenser Water	green (0,128,64)
Domestic Cold Water	blue (77.197,255)
Domestic Hot Water	green (75,120,7)
Fuel Oil	orange (255,128,0)
Steam	tan (163,125,29)
Condensate	tan (231,199,114)
Toxic & Corrosive Elements; Plumbing – Storm/Overflow	orange (255, 165, 0)

Pneumatic Tubing	magenta (205, 0, 205)
Flammable Elements	yellow (255, 255, 0)
Other	

3.3 – NAVISWORKS VIEWS

It is important to note that Williams College will be using Navisworks Freedom and therefore will require all views and walkthroughs created by the design\construction team to remain. The Construction team is to clarify the required views with the WC project manager for additional views and document in the projects BEP.

The bowser tree as well as the views named within Navisworks should be organized and easy to follow.

At a minimum, there should be the following views provided;

- Each level as a scope box from floor to floor above.
- Each level as a scope box from floor to floor above showing egress path.
- Each level as a scope box from floor to floor above showing life safety items highlighted.
- Each level at ceiling to floor above showing all services above ceilings
- One view per each room – view to be named room number/name.
- One view per each level with all trades turned on w arch/struct at 50% transparency.
- One view per each trade entire building with arch/struct at 50% transparency.
- One view entire building with all trades on, arch/struct at 50% transparency.

SECTION 4 – REVIT REQUIREMENTS

Below are listed the requirements for Revit files submitted to Williams College as design record, as-builts.

4.1 - OVERVIEW

William College maintains an up to date BIM of the architecture and structure of the building for planning, tracking space data and assets, for use in renovation projects, and for reference in maintenance and operations. Williams College requires submission of design record model files and as-built files at project completion. In order to ensure consistency from project to project, WC requires that design record and as-built files adhere to standards as identified in this document. Design record models can deviate from these standards during design, however, must be updated to these standards for submission.

Design Record Models

Models should contain only content which is required to produce sheets. All other extraneous content must be removed. Files must be submitted in Revit or otherwise discussed with the WC Building Operations team.

As-Builts BIM Models

Models used for coordination will be updated to reflect actual install locations and delivered to owner as the 'as-built' record models. After installation, the construction team is required to update models with the as-built conditions and attach any required data.

4.2 - FILE FORMAT\ORGANIZATION

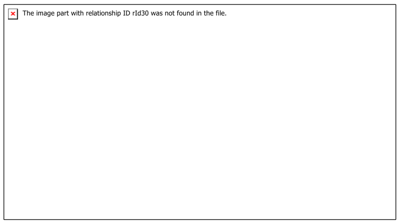
Design Record Models & As-Builts BIM Models

Models can be submitted in their original file format. In order to facilitate future renovation projects, WC requires as-built models to use the following organization structure, unless otherwise asked from Williams College. (ie. MEPFP may be one combined model pending size of project)

Discipline	Abbreviation	Organization	Notes
Architectural	AR	1 Core Shell File per Building	
		1 file per floor per building for all interior fit out	Fit out requirements are walls, doors, ceilings, floors as needed and fixed\built in FFE and casework.
		1 file per floor per building for all FFE	This is a separation of all items that are not built-in.
Structural	ST	1 file per building	
Mechanical	ME	1 file per building	
Electrical	EL	1 file per building	
Plumbing	PL	1 file per building	
Fire Protection	FP	1 file per building	

4.3 - File Naming

Revit files must be named as follows. Use hyphens between each grouping.



Example: BL001-AR-R2018.rvt

Refer to REFERENCE section of this document, for Building ID's and Discipline Abbreviations. If design is a new building, a Building ID shall be provided to you by Williams College.

4.4 –Model Content Requirements

Remove any extraneous content from drawing including any extra views, schedules, legends, design options, and drawing elements which are not displayed on any plot sheet in the construction document set.

Design Record Models
Design Record Model should contain only content which is required to produce construction document sheets. All other extraneous content should be removed.

As-Builts BIM Models
As-Built Model should contain only content which is required to produce as-built sheets. All other extraneous content should be removed.

All objects are drawn with accurate overall dimension, shape and location. Any clearances required for access or maintenance are to be included in model as separate selectable objects.

4.5 - Model Accuracy

New Construction - Architectural elements to 1/8'.

Existing Conditions Documentation - Architectural elements to 1/2' (Ie. 4-7/8' walls can be drawn at 5'.)

4.6 - Origin Point

Shared coordinates will not be used until a Revit campus model has been developed for Williams College. Design team is asked to use true AutoCAD 000 as the survey point in Revit and for the building point locate at a building corner and utilize elevation only.

4.7 - Revit Views

Design Record Models
No additional requirements.

As-Builts BIM Models
Architectural Models should contain a floor plan, ceiling plan, and area plan view for each level. MEPFP models should contain one plan view for each level. Whenever possible use a standard architectural scale. It is expected that all views not placed on sheets will be removed from project.

4.8 – REVIT FAMILY STANDARDS

In order to ensure consistency of electronic deliverables for various projects, Williams College requires its project teams, for its FM model delivery, to use or conform to WC standards for the Revit items listed below. Williams College approved content will be made available to project teams via the WC Revit Library. Williams College content can be used by design\construction team through design, however if design\construction team uses their own content, that content must be renamed to match or replaced with WC content for the FM model deliverable.

(NOTE that other content beyond items below will be required in FM model deliverable, but only the items listed below require conformance with WC Revit family standard requirements.)

Items which must follow WC standards

- Wall Types
  - Wall Ratings - indicated graphically with WC linetypes and Revit wall parameter populated appropriately. If parameter is firm specific, remove firm identifier in parameter name.
    - Rating types are to be 30min\1hr\2hr\smoke

      ** Architectural naming convention is to be defined by WC at a later time. Wall Naming Convention by Architectural firm standards or otherwise confirm with WC Project Manager.*
- Door Types
  - Door Ratings and Closers - indicated graphically with WC linetypes and rating parameter populated appropriately.
    - Rating types are to be 30min\1hr\2hr\smoke

      ** Architectural naming convention is to be defined by WC at a later time. Door numbering by Architectural firm standards or otherwise confirm with WC Project Manager.*
- Floors – remove finish floors. Structural floors should be modelled.
  - "Finishes" are to be added to the room as a schedulable text data field.
- *Life Safety

  _WC Life Safety legend must be used and 2D annotation must be incorporated to design team families if WC families not used. Life Safety items which are required in the model by Williams College include the following;
  - Fire Exit signage
  - Fire Alarms\Horns\Strobes\Pulls\Heat Detectors
  - Fire Extinguisher Locations and types\C02
  - Laser\Hazard\AED\Eyewash locations indicated.
  - Hearing impaired rooms indicated on plan as well as in room data.
  - Egress path drawings required. Egress line\3D path\schedule and tags provided in the WC BIM Library.
- Ceiling Types
  - Rated Ceilings are to be identified.

    **Ceiling naming convention is to be defined by WC at a later time.*
- Light Fixtures - Renamed or replaced with WC approved types.

  ** Architectural naming convention is to be defined by WC at a later time. MEPFP to follow WC Data requirements found in Section 5: FM MODEL Data Requirements.*
- Plumbing Fixtures - Renamed or replaced with WC approved types.

  **Architectural naming convention is to be defined by WC at a later time. MEPFP to follow WC Data requirements found in Section 5: FM MODEL Data Requirements.*
- Room Tags - Replaced with WC Room tags
- Data drops. WC library suggested to be used.
  - Power\tel\data locations are required to be indicated in the model.
  - GFCI locations indicated.
- *Wayfinding Signage.
  - All types are included in the WC BIM Library.

*Note: all items noted above are subject to project contract requirements.

For any items not specifically mentioned above, or included in the WC BIM Library, project teams can use their own Revit families, provided any unnecessary detail in those families is removed. Families should all be LOD 500 which is similar to LOD 300 with data attached. Fabrication Level of detail should be removed.

4.8.1 – WC General Revit Family Naming Conventions

- All WC approved families use the prefix '_WC' so they can be easily identified. Any other content not specifically approved by WC should not contain prefix.
- Naming should continue with a **generic descriptor** followed by one or more **additional descriptor(s)**
  as required. Use Hyphens to separate descriptors.
- **Family names do not need to include the category name.** Typically, the category is identified by the folder in which the family is stored. Family names should be descriptive enough that they cannot be misinterpreted (therefore while category names are not required, they are permitted.)
- **Do not use any sizes in family name**. If a size designation is required, it should be part of the type name within the family.

4.8.2 – Wall Type Naming

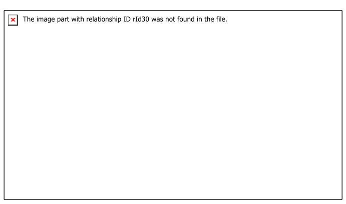
Williams College Building Operations team will be defining wall naming conventions in the future. For the time being, design teams wall naming conventions should follow a similar convention until WC updates this BIM Requirements document with requested wall naming.

Exterior Walls

Exterior Wall Types Shall be labeled with exterior veneer material, core material and overall nominal thickness.

Interior Partitions

Interior Partition types shall be named as using the following convention until otherwise noted.



Should your firm's wall naming standards not mimic the above, please confirm with Williams College Building Operations if acceptable.

__Wall Layers rules__

- For all 'single sided' drywall partitions, gwb should be placed on interior side.
- All gwb layers should be set to finish (1). Reserve finish (2) for any additional coverings.
- For multiple layers of GWB on one wall, all layers are set to finish (1).
- Exterior Wall - Surface layers are set to finish (1). 'Furring' layers use Substrate (2)

4.8.3 – Revit Floors and Ceilings

All 'finish' floors should be removed from model. Finishes are to be added to the room data. Only 'Structural' floor types should remain.

Within Revit a schedule, by room, of Floors and Ceilings should be provided. This schedule should also be provided as an excel spreadsheet.

4.9 – Revit In-Place Families

In place families are permitted only with system family categories (Walls, Floors, Roofs, etc) where free form geometry is required and cannot be achieved with standard modeling tools or a Revit family.

4.10 – Revit Groups

Design Record Models
No additional requirements

As-Builts BIM Models
All groups (model or detail) must be removed from any file submitted for FM usage.

4.11 – Revit Design Options

Design Record Models
No additional requirements

As-Builts BIM Models
All design options must be removed from any file submitted.

4.12 – Revit Worksharing

Design Record Models
Refer to the projects BEP. No additional requirements.

As-Builts BIM Models
If worksharing is used during model development, it must be disabled for submission to Williams College (Detach from Central and Discard Worksets)

4.13 -Revit Phasing

Design Record Models
No additional requirements

As-Builts BIM Models
Closeout files must only contain 2 Revit phases, existing and new. All building elements must be placed in existing phase when delivered to Williams College. There should be no objects in New Phase.

4.14 - Revit Parameters

Design Record Models
No additional requirements

As-Builts BIM Models
No additional requirements

SECTION 5 – FM MODEL DATA REQUIREMENTS

Williams College requires that data which is useful for management and operations of the facility be incorporated into the Facilities Management BIM model and provided in Microsoft Excel, formatted to allow for seamless incorporation into FM Systems. Williams College Building Operations team will provide an excel spreadsheet for CM\Subs to populate as required.

It is anticipated that the information will be collected by the construction team (CM and subs). The design\construction team will need to ensure that all required building components are in the model in order to store the required data fields only.

Engineering Equipment ID Naming

Equipment requiring maintenance at regular intervals throughout the year through pre-defined preventive maintenance schedules are tracked with a unique identifier. **This ID will be used with QR coded labels affixed to each piece of equipment in order to identify it**. The graphic below shows an example of this naming convention.

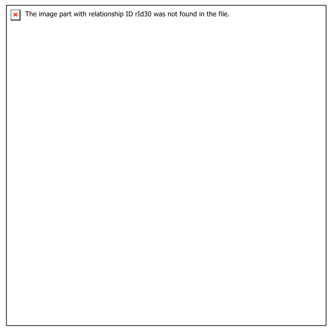
The image part with relationship ID rId30 was not found in the file.

[Building ID] – See Reference Section R.1
[Building Floor] – See Reference Section R.2
[Room Number] – Unique and approved by
WC [Service Type] – See Reference Section
R.4 [Equipment Type] – See Reference
Section R.5
[Unique ID&Number] - ID Abbreviation (Section R.5) and 3 digit number

QR Code

All equipment owned by Williams College will be required to have a QR coded label affixed to it. This label will have the Equipment ID number and will allow technicians to access equipment detail, including repair history by simply pointing a camera equipped mobile device at the code while in FM: Interact. Below is a sample of what may be displayed.

NOTE: A third party QR code reader is required.



BL311-3-309-MEC-ERU-ERU002

<u>Data deliverables within the Revit Model For All MEPFP Elements</u>

No URL\hyperlinks are to be provided within the Revit Environment.

The following information is required for all building elements provided to Williams College via an excel spreadsheet in the order provided below.

Item	**Description**	**Responsible Party**	**Revit/Excel**
Equipment ID (QR Code)	**Is QR Code**	CM	Excel
Install Location (Building ID)	**See REFERENCE for all Building ID's**	CM	Revit and/or Excel
Install Location (Level)	Floor Associated With	CM	Revit and Excel
Install Location (Room)	Room Associated With	CM	Revit and Excel
WC Service Center	See REFERENCE for Service Center Abbreviation and Equipment serviced.	CM	Excel
Equipment Type	Air Compressor, Condenser, Backflow Preventer, **See REFERENCE for Abbreviations**	CM	Revit and Excel
Item Unique ID (Equipment Type + ###)	Air Compressor, Condenser, Backflow Preventer, CUH, etc. (AHU001)	CM	Revit and Excel
Manufacturer		CM	Revit and/or Excel
Model		CM	Revit and/or Excel
Serial Number		CM	Excel
Number of Units		CM	Excel

O&M Manual	PDF link or website URL to manual \ or via barcode	CM	Excel
Service Life	Life Expectancy as per manuf.	CM	Excel

Warranty Information (Months)		CM	Excel
Purchased Date		CM	Excel
Purchased From (Vendor)	Vendor name	CM	Excel
Vendor contact phone number	Vendor contact number	CM	Excel
Date Installed\Acceptance Date		CM	Excel
Sub-Contractor\Service Provider	Contact information for provider\installer	CM	Excel
Cost		CM	Excel
Power Source		CM	Excel
Emergency Power		CM	Excel
Lease ID	If applicable	WC	Excel
Refrigerant Type			
Refrigerant Charge (Pounds\Ounces)			

Note: Williams College Excel Template may have other data fields for specific MEPFP elements. Leave fields blank if not applicable to the item.

REFERENCE

R.1 - Abbreviations - Building Names and ID's

Property	ID # BL(XXX)	Location (No) (Street Name)	
224 Pine Cobble Road	BL489	224	Pine Cobble Road
261 Pine Cobble Road	BL484	261	Pine Cobble Road
290 Pine Cobble Road	BL490	290	Pine Cobble Road
340 Pine Cobble Road	BL479	340	Pine Cobble Road
350 Pine Cobble Road	BL483	350	Pine Cobble Road
510 Pine Cobble Road	BL474	510	Pine Cobble Road
540 Pine Cobble Road	BL481	540	Pine Cobble Road
730 Pine Cobble Road	BL477	730	Pine Cobble Road
735 Pine Cobble Road	BL478	735	Pine Cobble Road
ABC House	BL286	58	Hoxsey Street
Adams Block	BL307	36-42	Spring Street
Adams Memorial Theatre	BL201	1000	Main Street
Agard House	BL101	96	South Street
Alpine Ski	GRCA46		
Athletic Fields	GRCA30		
Austen House	BL488	68	South Street
B & L Building First Floor	BL301	100	Spring Street
B & L Building Second Floor	BL204	100	Spring Street
B & L Building Third Floor	BL404	100	Spring Street
Bascom House	BL271	33	Stetson Court
Baseball	GRCA44		
Beals House	BL403	51	Jerome Drive
Berhard Music Center	BL205	54	Chapin Hall Drive
Bike Club Building	BL288	187A	Park Street
Bookstore	BL311	81	Spring Street
Brinsmade House	BL405	71	Stetson Court
Bronfman Science Center	BL206	18	Hoxsey Street
Brooks Conferences	BL207	983	Main Street
Brooks House	BL102	983	Main Street
Brown House	BL407	33-35	Latham Street
Bryant House	BL103	1020	Main Street
Camp Richmond	BL209	64	Cross Road, Rowe
Campus Grounds	GRCA		
Campus Landscape	GRCA20		
Campus Lawns	GRCA21		
Campus Plantings	GRCA23		
Campus Trees	GRCA24		
Campus Unimproved	GRCA22		
Caretakers House	BL208	60	Elm Tree Loop

Carlton House	BL410	51	Stetson Court
Carter House	BL104	36	North Street
Cemetery	GRCA70		
Center for Theater and Dance	BL273	1000	Main Street
Chadbourne House	BL105	42	Stetson Court
Chaffee Tennis House	BL210		Stetson Road/Lynde Lane
Chandler - Commercial	BL302	28 - 32	Spring Street
Chandler Athletic Center	BL211	34	Spring Street
Chandler House	BL411	26	Walden Street
Chapin Hall	BL212	62	Chapin Hall Drive
Chaucer House	BL467	110	Meacham Street
Clark Hall	BL213	947	Main Street
Clark House	BL412	79	Southworth Street
Class of 1937 House	BL214	51	Park Street
Cole Field House	BL215	85	Stetson Road
College Garage	BL216	54	Heating Plant Drive
Currier Hall	BL106	14	Driscoll Hall Drive
Danforth Block - Commercial	BL303	66 - 79	Spring Street
Danforth Block - Housing	BL416	68 - 74	Spring Street
Dickens House	BL401	111	Meacham Street
Dodd Annex	BL107	68	Mission Park Drive
Dodd Dining	BL003	64	Mission Park Drive
Dodd House	BL108	64	Mission Park Drive
Doughty House	BL109	45	Walden Street
Driscoll Dining Hall	BL004	49	Driscoll Hall Drive
Dropper House	BL218	15	Park Street
East College	BL110	10	Lawrence Hall Drive
Elm Tree House	BL219	60	Elm Tree Loop
Ephs Grave	GREP		
Facilities Barn	BL290	60	Stetson Road
Facilities Building	BL257	60	Latham Street
Faculty House	BL005	968	Main Street
Farley/Lamb Football Field	GRCA52		
Fayerweather Hall	BL111	28	Lawrence Hall Drive
Fielding Brown House	BL417	179	Park Street
Fisher House	BL418	71 - 73	School Street
Fitch House	BL112	30	Driscoll Hall Drive
Fort Hoosac House	BL113	175	South Street
Friedrichs House	BL464	33	Whitman Street
Garfield House	BL114	45	South Street
Gavitt House	BL420	80	Stetson Court
Gladden House	BL115	44	North Street
Goodrich Hall	BL221	863	Main Street
Goodrich House	BL116	65	Mission Park Drive

Greylock Dining Hall	BL006	41	Whitman Street
Griffin Hall	BL222	844	Main Street
Grundys - Art Studio	BL304	28	Water Street
Hardy House	BL225	20	Morley Drive
Hawthorne House	BL422	146 - 150	Meacham Street
Heating Plant	BL227	50	Heating Plant Drive
Hewat House	BL423	100	Hoxsey Street
Hollander Hall	BL282	24	Hopkins Hall Drive
Hopkins Forest Apartment	BL424	271	Northwest Hill Drive
Hopkins Hall	BL229	880	Main Street
Hopkins Observatory	BL230	829	Main Street
Horn Hall	BL148	64	Stetson Court
Hubbell House	BL117	72	Mission Park Drive
Jenness House	BL231	10	Morley Drive
Jerome House	BL425	66	Jerome Drive
Jesup Hall	BL232	22	Lab Campus Drive
Jewish Religion Center	BL233	24	Stetson court
Johnson House	BL426	73	Stetson Court
Kellogg House	BL234	55	Mission Park Drive
Lambert House	BL118	80	Hoxsey Street
Lamphier House	BL427	64 - 66	Meacham Street
Lansing Chapman Rink	BL235	76	Latham Street
Lasell Gymnasium	BL236	871	Main Street
Lawrence Hall	BL237	15	Lawrence Hall Drive
Lee Track	GRCA51		
Lehman Hall	BL119	94	Chapin Hall Drive
Leigh House	BL428	57	Stetson Court
Library Shelving Facility	BL284	835	Simonds Road
Marcus House	BL429	24	Sabin Drive
Mark Hopkins House	BL120	32	North Street
Mason House	BL239	4	Southworth Street
Mason House - Housing	BL430	3	Southworth Street
Mather House	BL240		
Maxcy House	BL431	41	Hoxsey Street
McGuinniss House	BL432	42	South Street
Mears House	BL241	75	Park Street
Mears West	BL242	23	Whitman Street
Melville House	BL433	67-69	Southworth Street
Men's Practice Soccer	GRCA40		
Men's Rugby	GRCA42		
Men's Soccer	GRCA35		
Messer House	BL434	23	Lynde Lane
Milham House	BL121	53	Hoxsey Street
Miller House	BL243	54	South Street

Miscellaneous Practice Fields	GRCA31		
Mission Park	BL123		Lynde Lane
Mission Park Dining Hall	BL007		Lynde Lane
Morey House	BL436	121	Southworth Street
Morgan Hall	BL127	7	Spring Street
Morley Science Laboratories	BL244	31	Morley Drive
Mt. Hope Farm	BL245	1478	Green River Road
Mt. Hope Inn	BL437	1439-45	Green River Road
Mullen House	BL308	84 - 86	Spring Street
Nordic Ski	GRCA47		
North House	BL439	14 - 16	Chapin Court
Oakley Center	BL246	90	Denison Park Drive
Orwell House	BL485	196	Southworth Street
Paddle Tennis	GRCA56		
Paddle Tennis Courts	BL285		Lynde Lane
Paresky Center	BL279	39	Chapin Hall Drive
Paresky Center Dining Hall	BL010		
Park St. Condominiums	BL440	125	Park Street
Parking Garage	BL248	45	Whitman Street
Parsons House	BL128	82	Mission Park Drive
Patrie House	BL441	1573	Green River Road
Pecks Grandstand Building	BL292		Latham Street
Perry House	BL129	1017	Main Street
Pilgrim Inn	BL442		
Pine Cobble Pump Station	BL249		Pine Cobble Road
Poker Flats	BL130	45	Stetson Road
Practice Soccer	GRCA37		
Pratt House	BL487	185	Park Street
Presidents House	BL250	936	Main Street
Pressbox and Grandstand Building	BL293		Latham Street
Prospect House	BL131	59	Driscoll Hall Drive
Quinn House	BL443	37	Southworth Street
Rice House	BL251	30	Morley Drive
Roberts House	BL445	135 - 137	Southworth Street
Rogers House	BL446	163	Park Street
Rosenburg Center	BL228	271	Northwest Hill Road
Royal House	BL310	184	Southworth Street
Ruland House	BL448	40	Southworth Street
Sage Hall	BL132	71	Chapin Hall Drive
Sawyer Library	BL253	26	Hopkins Hall Dr
Schapiro Hall	BL283	85	Mission Park Drive
Schow Science Library	BL254	41	Lab Campus Drive
Sears Bungalow	BL255	25	Whitman Street

Sewall House	BL133	49	Mission Park Drive

Shaw Boat House	BL258	50	Onota Lane
Sherman House	BL449	820	Main Street
Sinclair House	BL470	100	Meacham Street
Smith - Rudnick Building	BL306	18 - 20	Spring Street
Softball	GRCA45		
South House	BL450	17 - 19	Chapin Court
Southworth Schoolhouse - Housing	BL451	96	School Street
Spencer House	BL134	973	Main Street
Spencer Studio Art Building	BL260	33	Driscoll Hall Drive
St. Anthony Hall - CDE	BL135	1065	Main Street
Stocking House	BL452	107 - 109	Southworth Street
Susan B. Hopkins House	BL137	60	Denison Park Drive
Taconic Golf Club	BL262	19	Meacham Street
Team Support Building	BL294		Latham Street
The Knolls	BL457	181	The Knolls
The Log	BL001	78	Spring Street
Thompson Biology Lab	BL263	59	Lab Campus Drive
Thompson Chemistry Lab	BL264	47	Lab Campus Drive
Thompson Hall	BL138	172	Park Street
Thompson Health Center	BL238	105	The Knolls
Thompson Memorial Chapel	BL265	860	Main Street
Thompson Physical Lab	BL266	33	Lab Campus Drive
Thoreau House	BL471	88	Meacham Street
Tower House	BL458	37	Lee Terrace
Towne Field House	BL267	82	Lathan Street
Treadway House	BL459	70	Mission Park Drive
Tyler Annex	BL139	185	Park Street
Tyler House	BL140	183	Park Street
Vogt House	BL268	63	Park Street
West College	BL142	931	Main Street
Weston Field Structures	BL269		Latham Street
Weston Hall	BL270	995	Main Street
Wharton House	BL461	30	Latham Street
Whittier House	BL473	60	Meacham Street
Wild House	BL462	21 - 23	Southworth Street
Williams College Childrens Center	BL281	44	Whitman Street
Williams Hall	BL143	93	Chapin Hall Drive
Williams Outing Club Shed	BL287	835	Simonds Road
Williamson Field	GRCA48		
Women's Practice Soccer	GRCA39		
Women's Rugby	GRCA41		
Women's Soccer	GRCA36		
Wood House	BL144	1039	Main Street

Woodbridge House	BL145	17	Park Street
Woodworth House	BL463	89	Southworth Street

R.2 - Abbreviations - Floor Numbering

For existing buildings floor levels, please confirm with WC Building Operations.

Floor ID	**Floor Description**
1	First Floor
1A	First Floor A
2	Second Floor
2A	Second Floor A
3	Third Floor
4	Fourth Floor
5	Fifth Floor
6	Sixth Floor
7	Seventh Floor
A	Attic
B	Basement
BL	Bridge Level
G	Ground
L1	2 Levels below Grade
L2	3 levels below Grade
LL	Lower Level
M	Mezzanine
P	Penthouse
PL	Plaza Level
R	Roof
UL	Upper Level

R.3 - Abbreviations - Discipline Codes

Discipline	**Abbreviation**
Architectural	AR
Life Safety	LS
Structural	ST
Mechanical HVAC	ME
*Electrical	EG
*Electrical Lighting	EL
*Electrical Protection	EP
*Electrical – Telecommunication	TL
Plumbing	PL
Drainage System	DS
Water Supply System	WS
Fire Protection	FP
Interiors	ID
Civil	CE

Landscape	LA
General	00

*NOTE: In the case that Electrical is not broken to the sub disciplines, EG shall be used.

R.4 – FM SERVICE CENTER ABBREVIATIONS

Please see below for Williams College Operations Management Abbreviations.
Should you not know which to choose for the equipment being labeled please use UNK 'Unknown.'

Service Center ID	Service Center Description
ADM	Administration [Facilities Department]
ARC	Architectural [Carpentry] [Locksmith] [Painting] [Signs]
CUS	Custodial [Custodial Services] [Pest Control]
ECO	Energy Controls [Controls]
ELE	Electrical [Electronic Door Access] [Alarms] [Fire Safety]
FLE	Fleet [College Cars Fleet] [Facilities Fleet] [General College Fleet]
GEN	Generic Initial Routing to Facilities Service Coordinator
GRO	Grounds [Moves, Deliveries, and Setups] [Grounds]
HPL	Heating Plant [Boilers] [Steam Turbine Generators] [Fuel Oil Tanks] [DA Tanks] [Condensate Tanks] [Atlas Copco Compressors]
MEC	Mechanical [Heating] [Ventilation] [Cooling] [Plumbing] [Sprinkler]
PUR	Inventory [Stockroom]
REN	Real Estate [Faculty Rentals] [Commercial Rentals]
SEC	Safety and Environmental Compliance [Mold] [E-Waste] [Inspections] [Life-Safety] [Asbestos] [Lead]
SER	Services [Special Events] [Conferences][Mount Hope Events] [Sports Camps] [Town Gown]
UTL	Utilities [Metal Clad Switchgear] [Turbine Condensate Meters] [?]
UNK	Unknown

R.5 – FM EQUIPMENT TYPE ABBREVIATIONS

Please see below for approved abbreviations of Equipment Types.

Equipment Type ID	Equipment Type Description
ACB	AC Branch Controller
ACN	Air Conditioner

ACO	AC Unit Outdoor

ACP	Air Compressor
ACU	AC Split Unit
ADR	Air Dryer
AER	Aerator
AFD	Athletic Field
AFL	Air Filters
AHU	Air Handler Unit
ALM	Alarm
APL	Appliance
BDS	Blowdown Separator
BDT	Blowdown Tank
BEX	Building Exterior
BFL	Backflow
BIN	Building Interior
BLD	Building
BOI	Boiler
BTU	BTU Meter
CAP	Capacitor
CAR	Car
CCW	Central Chilled Water System North Campus
CGR	Campus Grounds
CHL	Chiller
CLR	Cooler
CMM	Commercial
COM	Compressor
CON	Condenser
COP	Condensate Pump
COT	Condensate Tank
CTL	Controller
CTW	Cooling Tower
CUH	Cabinet Unit Heater
CWA	Cage Washer
CWM	Chilled Water Meters
DAT	DA Tank
DCP	Domestic Circulating Pump
DHC	Duct Heating Coil
DHU	Dehumidifier
DIB	Dining Building
DIS	Disconnect
DWC	Domestic Hot Water Circulator
DWF	Domestic Water Fountain
DWH	Domestic Water Heating Tank
DWT	Domestic Water Expansion Tank
EDH	Electric Duct Heater

EEL	Emergency Exit Light
EFT	Electric Finned Tube Radiator
EGB	Education and General Building
ELE	Electrical
ENC	Energy Controls
ERU	Energy Recovery Unit
EXD	Exterior Doors
EXE	Exterior Envelope
EXF	Exhaust Fan
EXS	Exterior Signs
EXT	Expansion Tank
FAN	Fan
FCU	Fan Coil Unit
FGA	Field - Game
FGP	Field - Game and Practice
FHD	Fume Hood
FIL	Filter
FOT	Fuel Oil Tank
FPR	Field - Practice
FRZ	Freezer
FTR	Finned Tube Radiation
GEN	Generator
GRE	Grounds Equipment
GRM	Gravity Meter
GRO	Grounds
HAF	Hot Air Furnace
HCA	Heat Cable
HDS	Hardscape
HPL	Heating Plant
HRV	Heat Recovery Ventilation Unit
HTR	Heater
HVA	HVAC
HVU	Heating and Ventilation Unit
HWT	HVAC Water Expansion Tank
ICE	Ice Machine
IND	Interior Doors
INF	Interior Finishes
INS	Instrumentation
LCK	Locks
LDR	Loader
LNS	Landscape
LTG	Lighting
MCC	MCC
MCQ	McQuay

MDP	Main Distribution Panel
MIS	Miscellaneous
MIV	Mini-Van
MOW	Mower
MTR	Motor
MUA	Make Up Air Unit
MVE	Medium Voltage Electrical
OCG	Off Campus Grounds
OVS	Overseeder
OXI	Oxidizer
PLM	Plumbing
PMP	Pump
PMT	Pumped Meter
REC	Rental Commercial
REF	Refrigerator
REH	Rental Housing
RTF	Return Fan
SEC	Security
SED	Sedan
SER	Service
SNO	Snowmobile
SOL	Solar
SPA	Sprayer
SPB	Spray Booth
SPE	Special Events
SPN	Sub Panel
SPP	Submersible Pump
SPR	Sprinkler
SPT	Sub Panel Parent
STD	Steam Distribution
STG	Steam Turbine Generator
STH	Student Housing
STM	Steam Meter
STS	Street Sweeper
SUV	Sport Utility Vehicle
SWP	Sweeper
TEL	Telecom
TEN	Tennis Roller
TMV	Thermostatic Mixing Valve
TNK	Tank
TOD	Topdresser
TOG	Town Gown
TRA	Transformer
TRC	Tractor

TRK	Truck
TRN	Transit
TRP	Trap
TRR	Trap Rake
UNC	Utility Cart
UNH	Unit Heater
UNV	Uni-Vent
UVL	UV Light
VAC	Vacuum
VAN	Van
VAV	Vav
VEH	Vehicle
VFD	Variable Frequency Drive
WIN	Window
WOS	Wood Splitter
WTS	Water Treatment System

R.6 - BOMA DEFINITIONS

- Gross Measured Area is measured to the INSIDE dominant face of the building and includes all interior area.
- Gross Building Area is measured to the OUTSIDE face of the building and includes all interior area.
  - only used for leased buildings
  - Aka 'construction area'
- Floor Rentable Area – inside face of building including all interior EXCEPT vertical penetrations.
  - Fire stairs, elevator shafts, plumbing and ductwork shafts
  - BOMA provides no means for landlord to charge rent on vertical penetrations
  - Gross Measured Area – Vertical Penetrations = Floor Rentable Area
- Floor Common Areas
  - Shared among the floor's tenants
  - Include toilet rooms, corridors, electrical rooms, tel\data closets etc.
  - Floor common is proportionally shared among the floor's tenants
- Floor Usable
  - Gross Measured Area – Floor Common – Vertical Penetrations
- Floor Loss Factor – Rentable Area\Usable Area
- Building Common Areas – spaces that provide services to all building tenants
  - Lobby, Mechanical Rooms, Building Management office, Fire Pump rooms, Exit corridors that serve stairs
  - Shared proportionally to all building tenants
- Ground Floor Usable Area – Gross Measured Area – Floor Common Area – Vertical Penetrations
- Building Loss Factor – ratio of Building Usable Area to Building Common Area
- DOMINANT face shall mean the portion of the inside FINISHED SURFACE of the permanent outer building wall that is 50% or more of the vertical floor-to-ceiling dimension, at the given point being measured as one moves horizontally along the wall.

R.7 – CAD POLYLINE RULES

- All rooms should be polylined to BOMA standards – centerline of internal walls except for core elements which are polylined to the outside of the core wall. Exterior walls are measured to inside of dominant face.
  - Core spaces include

- Vertical Circulation
  - 1) Shafts
  - 2) Stairs\Elevators
- Floor or Building Common
  - 3) Elevator Lobbies – Public Corridors
  - 4) Electrical\Tel\Data\Mechanical\Fire Alarm
  - 5) Bathrooms\Shower Rooms\Janitor Closets
- When core spaces area adjacent to other core spaces polylines go to the outside of the spaces in the order listed above.
- Create a polyline for each individual elevator cab.
- When stairs and elevators are adjacent generally divide the space equally - but it's doesn't have to be exactly equal. Draw line at 'convenient' location approximately midway.

- Private corridors are part of tenant space and measured like all other tenant spaces.
- Workstations – Measure to center of Panels.
  - When a workstation is up against an interior wall – move workstation boundary to center or wall.
  - When a workstation is up against an exterior wall – move workstation boundary to face of wall.
- Free standing columns – are not polylined – area is reported as part of space in which column is located.
- Engaged Columns – polylines go around face of column. Columns on corridor walls typically end up included in corridor areas. Columns on Exterior walls typically don't get reported.
- Alcoves\storage areas off a corridor are measured as separate spaces.

- Dead Space - there will be no 'dead-space' in the area measurements. Any non-usable spaces taken up by structure or voids need to be allocated to adjacent core spaces (corridor or mechanical)
- Interior Gross total should equal sum of all rooms.

R.8 – FILE EXCHANGE\DELIVERY

Files will be exchanged\delivered using eBuilder software. eBuilder is a web based project management software and is used by Williams College for management of all construction projects.

1. Projects can be accessed by going to https://app.e-builder.net
2. Once connected select your appropriate project

Williams College

Stormwater Management Policy

June 2014

1 Purpose

The Williams College Stormwater Management Policy provides an integrated framework to address local, state, and federal stormwater regulatory requirements for campus construction projects and facility operations. The primary goal of this policy is to achieve greater consistency and effectiveness in meeting stormwater management requirements associated with project planning, design, and construction, as well as long-term operation and maintenance of stormwater best management practices (BMPs). This document will be referenced by the Williams College Design Standards for new projects, renovations, and ongoing maintenance on campus.

2 Scope

The Williams College Stormwater Management Policy:

- Identifies local, state, and federal stormwater regulatory requirements for campus construction projects.
- Describes general guiding principles for construction and post-construction stormwater management at Williams College.
- Includes performance standards for the planning, design, construction, and operation and maintenance of stormwater management systems.
- Promotes Low Impact Development principles (environmental site design and LID BMPs) and green infrastructure techniques where feasible.

This policy will be updated periodically to reflect changes to campus conditions, new or modified stormwater management regulations, or new developments in stormwater management techniques.

3 Applicability

The Williams College Stormwater Management Policy applies to all construction projects, as well as the operation and maintenance of stormwater management systems, on Williams College property, including the main campus and outlying parcels. In general, projects that involve earth-disturbing activities, new construction, or renovation of existing buildings are subject to this policy.

4 Roles and Responsibilities

Responsibility for administering and complying with this policy is shared by Williams College staff, project design teams, and contractors. The policy is administered and implemented primarily by the Williams College Facilities Planning and Construction Group and Office of Safety & Environmental Compliance. The policy will be used by Williams College to guide the planning, design, and review of campus projects. Project design teams, including architects, engineers, and other design professionals, are responsible for the selection, design, and construction of stormwater management controls for new projects and renovations. General contractors and subcontractors are responsible for all activities on their construction sites, including compliance with construction-phase stormwater regulatory requirements and stormwater pollution prevention.

Appendix A of this policy contains a Stormwater Management Design Review Checklist and Certification to be completed for campus projects by the Wiliams College Project Manager and certified by the Wiliams College Project Manager and Engineer of Record.

5 Stormwater Regulatory Requirements

Development projects at Williams College are potentially subject to various local, state, and federal regulatory requirements related to stormwater management. The following sections summarize these regulatory requirements and their applicability to campus projects, which is also shown graphically in the flow chart at the end of this section. The descriptions presented in this section are provided for informational purposes only. The regulations should be consulted for clarification on regulatory requirements and applicability for a specific project.

5.1 Local

Applicability – Town of Williamstown Zoning Bylaw

The Town of Williamstown Zoning Bylaw applies to any building, structure or land that is proposed to be constructed, altered, enlarged, repaired or moved, occupied and used.

Development plan review by the Planning Board is required for development proposals which, under a single building permit, involve: (1) Construction of a new nonresidential nonagricultural building, or an addition to such a building of 2,500 square feet or more gross floor area, (2) Creation of, substantial alteration to, or addition to parking facilities resulting in 10 or more parking spaces, (3) Removal of existing vegetative ground cover from more than 20,000 square feet of site area, unless for agricultural use, or (4) If the proposal is located in the Upland Conservation District.

Additional standards also apply to projects within certain districts such as the Rural Residence District 1, Village Business District, Floodplain District, and the Wellhead Protection District.

According to the Town of Williamstown Zoning Bylaw (Chapter 70), all development shall be designed so that resulting stormwater conditions resemble, as nearly as possible, pre-existing conditions of volume, velocity, quality, and location of runoff. However, an increase in peak flow rates may be allowed by special permit. Under the bylaw, impervious coverage limits also apply based on the average site slope (except for the Village Business District, which is exempt).

The erosion control requirements under the bylaw generally follow the requirements of the EPA Construction General Permit, as described below, with several exceptions. The bylaw requires an erosion control plan to be submitted for projects that would expose more than 60,000 square feet of bare earth during development and for projects exposing 20,000 to 60,000 square feet of bare earth where the Planning Board deems such plan to be necessitated by slopes in excess of 10%, highly erodible soils, or other unusual conditions. Projects are required to implement best management practices to reduce potential erosion and sedimentation from the construction site including minimizing exposed soil, temporarily stabilizing bare soil, and using structural controls such as sediment basins.
These requirements apply to all construction projects, regardless of the size of disturbance.

The Williamstown Zoning Bylaw is available at

http://williamstown.ws/wp-content/uploads/2010/09/chapter70zoning.pdf.

Applicability – Massachusetts Wetlands Protection Act

Wetlands Protection Act jurisdiction includes any activity within a wetland resource area (including bank, bordering vegetated wetlands, land under water bodies or waterways), land subject to flooding, Riverfront Area (200 feet from a perennial stream bank), and/or Buffer Zone (within 100 feet of a wetland resource area), which will remove, fill, dredge or alter that area. A Notice of Intent must be filed with the Town of Williamstown Conservation Commission for projects that are within WPA jurisdiction, with the exception of minor activities within the Buffer Zone or Riverfront Area, for which a an Abbreviated Notice of Resource Area Delineation or a Request for Determination of Applicability may apply. Refer to the regulations at 310 CMR 10.00.

The Town of Williamstown does not have a Wetlands Bylaw. The Town relies upon the state requirements for wetlands protection under the (Massachusetts) Wetlands Protection Act. Projects subject to the Wetlands Protection Act are also subject to the Massachusetts Department of Environmental Protection Stormwater Management Standards. The Wetlands Protection Act regulations are available at http://www.mass.gov/eea/agencies/massdep/water/regulations/310-cmr-10-00- wetlands-protection-act-regulations.html.

5.2 State

Applicability – Massachusetts Stormwater Management Standards

The Massachusetts Stormwater Management Standards apply to projects that are subject to jurisdiction under the Wetlands Protection Act Regulations (310 CMR 10.00) or require a Water Quality Certification pursuant to 314 CMR 9.00. A Water Quality Certification is generally required for projects that involve greater than 5,000 square feet cumulatively of bordering and isolated vegetated wetlands and land under water impacts and/or a dredging project that involves greater than 100 cubic yards of material. The Massachusetts Stormwater Handbook includes detailed information on stormwater BMP design and how to apply the Stormwater Management Standards.

The Massachusetts Stormwater Management Standards and the Massachusetts Department of Environmental Protection's Stormwater Management Handbook establish minimum stormwater management standards for new development and redevelopment projects. The revised Stormwater Management Standards have been incorporated in the Wetlands Protection Act Regulations, 310 CMR 10.05(6)(k) and the Water Quality Certification Regulations, 314 CMR 9.06(6)(a). The standards were updated in 2010, placing greater emphasis on the use of Low Impact Development (LID), stormwater recharge using infiltration techniques, and long-term operation and maintenance of stormwater controls.

The Stormwater Management Standards address water quality (pollutants) and water quantity (flooding, base flow and recharge) by establishing standards that require the implementation of a variety of stormwater management strategies. These strategies include environmentally sensitive site design and LID techniques to minimize impervious surface and land disturbance, source controls, and the long-term operation and maintenance of stormwater management systems. The Massachusetts Stormwater Handbook and Stormwater Management Standards are available at http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater- handbook.html.

5.3 Federal

Applicability – EPA Construction General Permit

The U.S. EPA 2012 Construction General Permit (2012 CGP) applies to projects that will disturb (alter the existing vegetation and/or underlying soil of a site, such as clearing, grading, site preparation (e.g., excavating, cutting, and filling), soil compaction, and movement and stockpiling of top soils) 1 or more acres of land, or will disturb less than 1 acre of land but is part of a "common plan of development or sale" that will ultimately disturb 1 or more acres of land.

For the purposes of the 2012 CGP, a "larger common plan of development or sale" is a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan. For Williams College, multiple concurrent campus projects are only considered part of a "larger common plan of development" if they were included in the original site development plan. A Campus Master Plan or similar planning-level conceptual development program for the campus is not considered a "larger common plan of development" for the purposes of the 2012 CGP.

Stormwater discharges from construction activities (such as clearing, grading, excavating, and stockpiling) that disturb one or more acres, or smaller sites that are part of a larger common plan of development or sale, are regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program. Prior to discharging stormwater, construction operators must obtain coverage under the EPA 2012 Construction General Permit (2012 CGP). The 2012 CGP requires compliance with effluent limits and other permit requirements, including the development of a Stormwater Pollution Prevention Plan (SWPPP). Construction operators intending to seek coverage under the 2012 CGP must submit a Notice of Intent (NOI) to EPA certifying that they have met the permit's eligibility conditions and that they will comply with the permit's effluent limits and other requirements. The 2012 CGP is available at http://www.epa.gov/npdes/pubs/cgp2012_finalpermit.pdf.

Williams College has developed a SWPPP Template for construction activities on its main campus and outlying properties. The purpose of the template is to assist project designers and contractors develop a SWPPP that addresses the requirements of the 2012 CGP and the Williams College Stormwater Management Policy. The template addresses the required elements and format of a construction SWPPP consistent with the 2012 CGP, but is designed to be customized to reflect project-specific information such as work descriptions, site plans, and erosion and sediment controls.

[INSERT FLOW CHART 11x17 page]

6 Guiding Principles

Williams College promotes the following guidig principles related to stormwater management for development and redevelopment projects:

1. **Reduce existing impervious cover, runoff volume, and soil disturbance to the extent practical through effective site planning and environmentally sensitive site design.** Effective site planning and environmentally sensitive site design consists of preventive measures that address the root cause of stormwater problems by attempting to maintain pre-development site hydrology. Stormwater programs that rely heavily on structural stormwater controls can miss opportunities to reduce stormwater impacts because they collect and treat runoff after it has already been generated. Managing stormwater close to its source through infiltration and treatment also reduces the demand on the campus storm drainage infrastructure.

   The following site planning and design techniques are recommended for consideration in campus projects:

   - Reducing impervious surfaces to the extent practical
   - Disconnecting impervious surfaces from the storm drainage system by directing runoff to pervious areas (i.e., lawns, filter strips, vegetated swales, etc.) or structural stormwater Best Management Practices (“BMPs”) such as bioretention systems, drywells, and other infiltration or vegetation based practices
   - Minimizing site disturbance including grading and clearing
   - Avoiding compaction of porous soils and disturbance of erodible soils
   - Lengthening flow paths and promoting overland flow
   - Preservation of sensitive natural areas
   - Preservation of riparian buffers and floodplains

2. **Use structural stormwater BMPs to collect, store, infiltrate and treat stormwater runoff after first applying effective site planning and environmentally sensitive site design techniques.** Structural practices can be used to meet multiple objectives such as attenuating peak flows, reducing runoff volume, capturing and treating runoff, and providing groundwater recharge. Stormwater management can be accomplished through Low Impact Development (LID) or Green Infrastructure (GI) techniques, which are small-scale, distributed practices close to the source of runoff such as the use of rain gardens, filter strips, and permeable pavement, in combination with effective site planning and design. Traditional end-of-pipe or larger centralized controls such as stormwater basins should only be used, if necessary, after considering LID and GI approaches.

The Williams College Stormwater Best Management Practices Guidelines provide guidance on the selection, design, and maintenance of BMPs recommended for use on the Williams campus. These guidelines are available on the Williams College Facilities website at http://facilities.williams.edu/.

Additional BMP design guidance is available in the Massachusetts Stormwater Handbook at http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater- handbook.html.

The following structural LID and GI BMPs are recommended for consideration in campus projects.

Structural LID/GI BMPs

- Rainwater harvesting (e.g., rain barrels, cisterns) for landscape irrigation and gray water reuse
- Bioretention systems including rain gardens, tree filters, stormwater planters, and curb extensions
- Drywells and subsurface infiltration systems (decentralized, small-scale practices distributed throughout the site)
- Green roofs
- Permeable pavement
- Vegetated filter strips
- Vegetated swales/channels
- Compost-amended soils to increase permeability of compacted soils or fill material

Other Structural BMPs

- Large-scale infiltration and filtration practices
- Stormwater basins and underground detention
- Constructed stormwater wetlands including gravel wetlands
- Proprietary BMPs (hydrodynamic separators, media filters, catch basin inserts)

3. **Implement source controls and pollution prevention practices to reduce the generation of runoff pollutants.** Source control and pollution prevention practices (e.g., sweeping of parking lots and driveways, minimizing the use of road sand and salt to the extent feasible considering safety, drainage system inspection and maintenance including catch basin cleaning and sediment removal from structural BMPs, turf management, landscape waste management) should also be implemented after construction of campus projects and as part of routine campus operations to reduce or eliminate the exposure of pollutants to rainfall and runoff.

4. **Continue stormwater system operation and maintenance to ensure that structural stormwater controls are functioning properly.** Long-term operation and maintenance plans should be developed and implemented to ensure that stormwater management systems function as designed. **Appendix B** of this policy contains a Stormwater Operation and Maintenance Plan describing recommended stormwater infrastructure maintenance activities for Williams College.

5. **Implement construction-period erosion and sedimentation controls to minimize the discharge of pollutants from earth-disturbing activities.** Contractors should implement BMPs on construction sites including minimizing the amount of soil exposed during construction activities and installing downgradient structural sediment controls such as buffers or equivalent sediment controls, perimeter controls, exit point controls, and storm drain inlet protection, as specified in a construction SWPPP.

7 Stormwater Management Standards

The stormwater management standards in this section address stormwater quantity and quality objectives for construction activity and post-construction stormwater management. These standards promote the use of structural and non-structural LID and GI techniques and other stormwater BMPs to protect water quality, reduce peak flows and runoff volume, and maintain groundwater recharge. The standards are consistent with local, state, and federal standards including the Town of Williamstown Zoning Bylaw, the Massachusetts Stormwater Management Standards contained in the Massachusetts Stormwater Handbook, and the EPA 2012 Construction General Permit.

7.1 General Design Standards

The following general design standards are applicable to all new projects and building renovations on campus. These standards reflect the minimum requirements of Williams College and the Town of Williamstown Zoning Bylaw.

Standard Number	Standard
General Stormwater Standards	
A.1	Connection of storm drainage lines to the sanitary sewer system is strictly prohibited.
A.2	The design of all storm drainage systems shall minimize ponding and promote positive drainage in all cases.
A.3	When tying into an existing storm drainage structure or system, the designer shall verify the capacity of the existing system, and its ability to receive flow from the proposed project.
Low Impact Development and Green Infrastructure	
A.4	The design shall minimize runoff flow and volume from impervious areas to the maximum extent practicable through the use of environmentally sensitive site design techniques.
A.5	The design engineer is strongly encouraged to utilize LID/GI stormwater design elements to address stormwater quality, flow, and volume attenuation. Examples would include the use of rain gardens, infiltration basins, underground infiltration, and roof runoff infiltration or harvesting.
A.6	Stormwater management design should, to the extent practical, mitigate increases in runoff volume and loss of groundwater recharge through effective site planning and environmentally sensitive site design, as well as LID/GI and conventional BMPs. In some cases, a reduction in existing runoff volumes may be warranted depending on the existing capacity and known capacity issues of the receiving drainage system. See design guidance for infiltration BMPs following this table.
A.7	The Town of Williamstown Zoning Bylaw requires on-site recharge of all stormwater runoff from impervious surfaces other than roofs within Water Resource Districts (See Town Zoning Map). Stormwater recharge shall be by surface infiltration through vegetative surfaces unless otherwise approved by the Planning Board during development plan review. Where dry wells or leaching basins are used, they shall be preceded by oil, grease and sediment traps. Drainage from loading areas for toxic or hazardous materials shall be separately collected for safe disposal. (Reference: Section 70, Town of Williamstown Zoning Regulations)

Standard Number	Standard
Illicit Discharges	
A.8	All illicit discharges to the storm drainage system are prohibited. Illicit discharges are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: • Landscape irrigation, • Uncontaminated groundwater discharges such as pumped groundwater, foundation drains, water from crawl space pumps, and footing drains, • Irrigation water and lawn watering runoff, • Residual street wash water, • Discharges of uncontaminated air conditioner condensate, • Discharges of flows from fire fighting activities (except training), • Discharges containing no chemical additives (including chlorine) from the flushing of fire protection systems, and • Naturally occurring discharges such as rising groundwater, uncontaminated groundwater infiltration, springs, and flows from riparian habitats and wetlands.
Erosion and Sedimentation Controls	
A.8	All projects, regardless of the area of disturbance, must implement erosion and sedimentation controls prior to and during construction, including at a minimum: • Inlet protection (silt sacks or equivalent) • Perimeter controls to prevent sediment runoff from the site • Construction entrance track pad • Sediment removal from off-site streets, paved areas, and sidewalks via sweeping or other methods • Stabilization when work has temporarily or permanently stopped Temporary controls shall be removed from a site and disposed of properly after the site has been fully stabilized.

Design Guidance for Infiltration BMPs

Runoff volume reduction is an important component of the effectiveness of a site's overall design and stormwater management system. LID site planning and design and stormwater BMPs can eliminate runoff volume that would otherwise discharge directly to downstream drainage systems, reducing demand on system capacity and mitigating the hydraulic/sediment entrainment and transport impacts of increased runoff volume. Reduction of runoff volume also plays an important role in reducing pollutant loads to surface waters. Runoff reduction can be achieved through canopy interception, infiltration, evaporation, rainfall harvesting, engineered infiltration, extended filtration or evapotranspiration.

Runoff reduction performance varies by BMP type and the underlying soils. Research findings on runoff reduction rates for various types of stormwater BMPs indicate that infiltration systems, bioretention, soil amendments, permeable pavement, green roofs, and vegetated swales are the most effective BMPs for reducing stormwater runoff volumes (Center for Watershed Protection and Chesapeake Stormwater Network 2008).

The Williams College main campus has primarily moderate to slow infiltrating underlying soils (NRCS Hydrologic Soil Group Type B and C soils). Type B soils are well-suited to infiltration. Type C soils have lower infiltration rates but are still conducive to stormwater infiltration. Stormwater infiltration using LID/GI and conventional infiltration BMPs is recommended to meet the applicable stormwater management standards. Stormwater infiltration can be accomplished through the use of rain gardens and bioretention, permeable pavement, or underground recharge systems combined with detention storage, including below parking lots. The campus offers many potential locations where stormwater infiltration can be effective for runoff reduction/groundwater recharge, pollutant reduction, and peak flow attenuation for smaller storms.

When designing infiltration BMPs, adequate subsurface information should be obtained to field-verify soil type, depth to seasonal high groundwater and bedrock, and infiltration rates at the actual locations where infiltration is proposed. Infiltration systems must be able to drain fully within 72 hours. In addition, a minimum 2-foot separation distance is recommended from the bottom of the infiltration structure to seasonal high groundwater or bedrock/ledge. A 3-foot separation distance is recommended from the bottom of the infiltration structure to seasonal high groundwater for areas or uses with higher potential pollutant loads.

Runoff should be pretreated through the use of a sediment forebay, vegetated filter strip, hydrodynamic separator, or similar practice prior to its entrance into most infiltration BMPs to remove materials that could clog the system and/or underlying soils. Pretreatment is also recommended for most stormwater BMPs to facilitate sediment removal and prolong the lifespan of the treatment mechanism. Pretreatment shall be designed to accommodate a minimum of one-year’s worth of sediment, capture anticipated pollutants, and be easily accessible to facilitate inspection and maintenance.

7.2 Projects Subject to Williamstown Zoning Bylaw

All development projects are subject to Standard B.1, B.3, B.4, B.9 and B.11. Other standards apply based on the specifics of the proposed project, with consideration of the size of the project, the amount of impervious area proposed, and the zoning or overlay district in which the activity is proposed.

<table>
<tr><th>Standard Number</th><th>Williamstown Zoning Bylaw Citation</th><th>Standard</th></tr>
<tr><td colspan="3">Post-Construction Stormwater Requirements</td></tr>
<tr><td>B.1</td><td>§70-5.3 (B)</td><td>All development shall be designed so that resulting stormwater conditions resemble, as nearly as possible, preexisting conditions of volume, velocity, quality and location of runoff (except in the RR-1 District and by special permit.)</td></tr>
<tr><td>B.2</td><td>§70-5.3 (C)(4)</td><td>Impervious coverage shall not exceed the following percentages of site area.
<table>
<tr><th>Average Site Area Slope</th><th>Maximum Impervious Coverage</th></tr>
<tr><td>8% or less</td><td>80%</td></tr>
<tr><td>10%</td><td>70%</td></tr>
<tr><td>12%</td><td>60%</td></tr>
<tr><td>14%</td><td>50%</td></tr>
<tr><td>16%</td><td>40%</td></tr>
<tr><td>18%</td><td>30%</td></tr>
<tr><td>20%</td><td>20%</td></tr>
<tr><td>22%</td><td>10%</td></tr>
<tr><td>24% or more</td><td>0%</td></tr>
</table>
(See Zoning Regulations for calculation of impervious coverage and site area. The Village Business District is exempt from this impervious coverage standard and higher coverage may be authorized by special permit.)</td></tr>
<tr><td>B.3</td><td>§70-6.1 (C)(5)</td><td>Drainage shall be by means of catch basins with suitable inlets and underground pipes except where overland flow distance is less than 300 feet or porous surfaces are employed.</td></tr>
<tr><td>B.4</td><td>§70-5.3 (A)(2)</td><td>Drainage facilities shall employ sediment basins, oil and gas traps and other facilities as necessary to assure maintenance of the quality of surface and ground waters.</td></tr>
<tr><td colspan="3">Zoning District-Specific Requirements</td></tr>
<tr><td>B.5</td><td>§70-3.4 (A)(2)</td><td>All construction in the Rural Residence District 1 (RR1) shall conform to the following requirements: (a) The total of all construction and paving of all kinds shall</td></tr>
</table>

Standard Number	Williamstown Zoning Bylaw Citation	Standard
		render a total of not more than 5% of the total lot area substantially impervious to the infiltration of water and (b) Site grading shall result in no unretained slope greater than 25%. All slopes shall be vegetated or otherwise protected in such a manner as to prevent erosion both during construction and in long-term use.
B.6	§70-4.1 (C)(c)	Within the Village Business District, for properties fronting on Spring Street, an increase over predevelopment runoff peak is permitted, provided the system is connected to the municipal storm drainage system; and approval to connect the system has been obtained, in writing, from the Director of the Department of Public Works.
B.7	§70-7.4 (A)(3)(2)	Projects in the Floodplain District must comply with Wetlands Protection Act Regulations.
B.8	§70-7.4 (D)(5)(d) and §70-7.4 (E)(4)(d)	Projects in the Water Resource District or Wellhead Protection District must recharge of all stormwater runoff from impervious surfaces other than roofs on-site (some exceptions via Planning Board review). In these districts, stormwater recharge shall be by surface infiltration through vegetative surfaces unless otherwise approved by the Planning Board. Where dry wells or leaching basins are used, they shall be preceded by oil, grease and sediment traps. Drainage from loading areas for toxic or hazardous materials shall be separately collected for safe disposal.
Construction/Erosion and Sedimentation Control Requirements		
B.9	§70-5.3 (C)(3)	All construction must comply with the following: a. Stripping of vegetation, regrading or other development shall be done in a way which will minimize soil erosion. b. Whenever practical, natural vegetation shall be retained, protected and supplemented. c. The disturbed area shall be kept to a minimum. d. Where necessary, temporary vegetation and/or mulching shall be used to protect areas exposed during development. e. Sediment basins (debris basins, desilting basins or silt traps) shall be installed and maintained where necessary to remove from runoff waters any sediment from land undergoing development. f. The angle of graded slopes and fills shall be no greater than the angle which can be retained by vegetative cover or alternative proposed erosion control devices or structures. In any event, slopes left exposed must immediately be planted or otherwise provided with permanent ground cover or other means sufficient to retain erosion. g. A ground cover sufficient to retain erosion must be planted or otherwise provided within 30 working days, season permitting, on any portion of the tract upon which further active construction is not being undertaken. h. The development plan or land-disturbing activity shall be fitted to the topography and soils so as to create the least erosion potential.
B.10	§70-5.3 (C)(2)	An erosion control plan shall be submitted for every development which will expose more than 60,000 square feet of bare earth during development through either removal or filling on the same parcel or on contiguous parcels in the same ownership, and for developments exposing 20,000 to 60,000 square feet of bare earth where the Planning Board deems such plan to be necessitated by slopes in excess of 10%, highly erodible soils or other unusual conditions. Such plan shall have sufficient information on existing and proposed topography, vegetation and control measures to allow determination of compliance.

Standard Number	Williamstown Zoning Bylaw Citation	Standard
B.11	§70-5.3 (C)(1)	Any area of bare earth exposed through nonagricultural building development must be permanently stabilized through replanting, paving or other means of eliminating wind or water erosion. Such stabilization must be completed prior to building occupancy, or a performance bond must be posted in an amount sufficient to assure completion of such work.
B.12	§70-5.3 (C)(5)	The Inspector of Buildings, Planning Board, or the SPGA in acting on a special permit may require a report on the erosion control proposals by the Soil Conservation Service or others expert in soil mechanics in cases where doubt as to adequacy of proposed measures exists. Selection of techniques and determination of adequacy of measures shall, unless otherwise specified, be consistent with Guidelines for Soil and Water Conservation in Urbanizing Areas of Massachusetts, U.S. Department of Agriculture (USDA) Soil Conservation Service, 1975.

7.3 Projects Subject to MA Stormwater Standards

Campus projects that are under the jurisdiction of the Wetlands Protection Act Regulations (310 CMR 10.00) or require a Water Quality Certification pursuant to 314 CMR 9.00 are subject to the Massachusetts Stormwater Standards, which are summarized below.

Standard Number	Standard
Massachusetts Stormwater Management Standards	
C.1	No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth[1].
C.2	Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.
C.3	Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type.
C.4	Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).
C.5	For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.
C.6	Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by MADEP to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.
C.7	A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable, consistent with the Massachusetts Stormwater Management Standards: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.
C.8	A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.
C.9	A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.
C.10	All illicit discharges to the stormwater management system are prohibited.

[1] "Waters of the Commonwealth" means all waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, coastal waters and groundwaters.

7.4 Projects Subject to EPA Construction General Permit

Campus projects that disturb one acre of land or more are required to obtain coverage under the EPA Construction General Permit (CGP) and prepare a Stormwater Pollution Prevention Plan (SWPPP).

Standard Number	Standard
EPA Construction General Permit Standards	
D.1	The contractor or construction operator must submit a Notice of Intent (NOI) and prepare a Stormwater Pollution Prevention Plan (SWPPP). Refer to the Williams College Facilities website at http://facilities.williams.edu/ to download the Williams College SWPPP Template to be used for projects subject to the CGP.
D.2	The contractor or construction operator must follow the requirements in Part 2 of the CGP and in accordance with the project-specific SWPPP, including requirements for erosion and sediment control, stabilization, and pollution prevention.
D.3	The contractor or construction operator must have a qualified person conduct the site inspections required under Part 4 of the CGP.
D.4	The contractor or construction operator must submit to EPA a Notice of Termination (NOT) once the project has been completed.

7.5 Runoff Determination and Hydrologic Analysis Methods

Storm system capacity shall be evaluated using the Rational Method, Standards E.1 though E.4. Hydrologic analysis for pre- and post-development conditions must be calculated using standards E.5 through E.9 using the USDA Natural Resource Conservation Service (NRCS) hydrologic methods (i.e. TR- 55).

Standard Number	Standard
Runoff Determination Methods	

Standard Number	Standard
E.1	The Rational Method is used to calculate the peak discharge from a small watershed area. In the Rational Method the following equation is used: Q = CiA where: Q = peak rate of runoff (cubic feet per second) C = runoff coefficient representing a ratio of runoff to rainfall i = average rainfall intensity for a duration equal to the time of concentration (Tc), for a selected return period, (inches/hour) A = drainage area tributary to the design location (acres)
E.2	The Runoff Coefficient (C) is a function of the type of land cover within the contributing drainage area. The contributing drainage area must be divided into sections determined by the type of land cover. For each section of land cover, an area must be calculated and a C value assigned. The final C is the weighted average of each section. To determine the weighted average C value for a contributing drainage area, use the following equation: $WWWWWWWWhttWWtt\ AAAAWWAAAAWWWW\ CC = \frac{TTTTTTTTT\ CC}{TTTTTTTTTT\ AAAAAATT}$ where: C = Runoff Coefficient Total C = ($Area_1$ * C_1) + ($Area_2$ * C_2) +…+ ($Area_n$ * C_n) Total Area = area of the section
E.3	The rainfall intensity (i) is the average rainfall rate (inches per hour) for a duration equal to the time of concentration for a selected return period. The rainfall intensity for the design storm is dependent upon the time of concentration, Tc. Once a particular return period has been selected for design and a time of concentration calculated for the drainage area, the rainfall intensity can be determined from the rainfall Intensity-Duration-Frequency (IDF) curves. IDF values shall be obtained from the on-line web tool for extreme precipitation analysis developed as a joint collaboration between the Northeast Regional Climate Center (NRCC) and the USDA Natural Resources Conservation Services (NRCS), http://precip.eas.cornell.edu.

Standard Number	Standard
E.4	The time of concentration (Tc) is the time required for water to flow from the hydraulically most remote point of the drainage area to the point under investigation. Factors that affect the time of concentration are the length of flow, the slope of the flow path, and the roughness of the flow path. For flow at the upper reaches of a watershed, rainfall characteristics, most notably the intensity, may also influence the velocity of the runoff. The time of concentration equals the sum of the travel times on each segment of the principal flow path. Sheet flow occurs in the upper reaches of a watershed. Such flow occurs over short distances and at shallow depths prior to the point where topography and surface characteristics cause the flow to concentrate. Concentrated flow is runoff that occurs in rills and swales and has depths on the order of 1.5 inches to 4 inches. Part of the principal flow path may include pipes or small streams. The travel time through these segments would be computed separately. Velocities in open channels are usually determined assuming bank-full depths. The following equation represents the time of concentration (Tc) which is the sum of the travel time for each flow regime along the principal flow path. Tc = To + Tsc + Tch where: Tc = time of concentration (hours) To = travel time for overland flow (hours) Tsc = travel time for shallow concentrated flow (hours) Tch = travel time for channel/pipe flow (hours) There are numerous methods used to calculate the travel time for each of the flow regimes, including various equations and nomographs. The designer should refer to the TR-55 manual for recommended methods for calculating travel times for overland (sheet) flow, shallow concentrated flow, and channel flow. For design purposes, the minimum time of concentration is 5 minutes for paved areas and 6 minutes for all other analyses.
Hydrologic Analysis Methods	
E.5	Projects must include a hydrologic analysis for pre- and post-development conditions. This analysis must ensure the post-development peak flows do not exceed the pre-development peak flows.
E.6	Pre-development and post-development peak flows shall be calculated using the USDA Natural Resource Conservation Service (NRCS) hydrologic methods[2]. The 24-hour type III storm must be utilized.

[2] Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55) presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for flood water reservoirs. These procedures are applicable to small watersheds, especially urbanized watersheds. The primary functions of the program are for peak runoff computations using the Graphical Peak Discharge Method, the Tabular Hydrograph Method, and Temporary Storage. Support functions include the computation of the runoff curve number, the time of concentration, and travel time.

Standard Number	Standard
E.7	Calculations for the 2, 10, 25 and 100-year frequency storm events must be included. Design rainfall depths for storms with recurrence intervals of 2, 10, 25, 50, and 100 years must be obtained from the Northeast Regional Climate Center (NRCC) Web Tool for Extreme Precipitation in New York & New England (http://precip.eas.cornell.edu/). The 24-hour type III rainfall pattern should be used as recommended by NRCS TR-55.
E.8	Curve Numbers and Times of Concentration shall be calculated using TR-55.
E.9	Soil types shall be based on the latest mapping produced by NRCS.

7.6 Drainage System Standards

The following table provides general drainage system design standards for detention and retention systems, pipes, inlets/catch basins, manhole structures, and proprietary or manufactured stormwater treatment structures. General design guidance for infiltration BMPs on the Williams College campus is also provided at the end of this section.

Standard Number	Standard
Detention Systems	
F.1	Detention shall be designed to meet the 10-year storm and the detention overflow shall accommodate a 100-year storm.
Retention Systems	
F.2	Retention shall be designed at a minimum to retain the full volume of the 1” storm, with an overflow capable of passing all storms through the 100-year storm event. If no overflow is proposed, the retention structure must accommodate the 100-year design storm.
Pipes and Inlets/Catch Basins	
F.3	Pipes and inlets/catch basins shall be sized using the Rational Method. Drainage pipes must be sized to adequately convey the 10-year storm.
F.4	Maximum ponding at inlets shall be limited to ½ width of the adjacent roadway, or a maximum depth of 4 inches.
F.5	Storm drain pipe shall be either High Density Polyethylene Pipe with Smooth Interior, Precast Concrete Pipe or Schedule 80 Polyvinyl Chloride (PVC). A minimum pipe size of 12 inches for surface runoff and 6 inches for roof drain lines, footings and subdrains shall be used. Use of alternative materials must be reviewed and approved by Williams College.
F.6	Minimum pipe slope for pipes 12 inches and larger in diameter is 0.5%
F.7	Minimum pipe slope for pipes less than 12 inches in diameter is 1%

Standard Number	Standard
F.8	Footing drains, subdrains, and any other perforated drain systems are designed to collect runoff, and shall not be used to convey collected runoff. In addition, connection of roof drain piping to footing drains or foundation drains is prohibited.
F.9	Inlets/catch basins shall be precast concrete constructed in accordance with the Massachusetts Stormwater Handbook. Catch basins shall have minimum four (4) foot inside diameter. Catch basins shall have an oil separator/hood and minimum four (4) foot sump. Manhole ladder rungs shall be installed in catch basins. Catch Basin Inlet grates shall be standard MassDOT cast iron grate.
Manholes	
F.10	Manholes shall be pre-cast concrete and constructed in accordance with the Massachusetts Stormwater Handbook and the Town of Williamstown requirements. Manhole structures must have a minimum 4-foot inside diameter.
F.11	Manhole covers shall be iron, class no. 30 for gray iron castings. Shall have the word “DRAIN” cast into the cover.
Proprietary or Manufactured Stormwater Treatment Systems	
F.12	Proprietary or manufactured stormwater treatment systems shall be designed in accordance with the Massachusetts Stormwater Standards. Proposed use of proprietary stormwater treatment systems shall be reviewed and approved by Williams College. The applicant shall submit the Massachusetts Stormwater Technology Evaluation Project (MASTEP) (http://www.mastep.net/) data on each proposed treatment structure to assist Williams College in its evaluation.

8 Operation and Maintenance

Structural stormwater BMPs require regular maintenance to perform successfully. Williams College is responsible for maintaining all stormwater structures on the Williams campus. In general, required maintenance needs are often more easily identified for aboveground BMPs than for underground BMPs. Further, BMPs that incorporate natural vegetation as part of the pollutant removal process, such as bioretention areas, generally require less maintenance than engineered and pre-fabricated systems.

An Operation and Maintenance (O&M) Plan must be prepared and implemented for campus projects to ensure that stormwater management systems function as designed. The O&M Plan should address how and when inspections and maintenance are to be performed, the departments and individuals who will be responsible for operation and maintenance, the routine and non-routine maintenance tasks to be undertaken after construction is complete, and a schedule for implementing those tasks.

O&M requirements for selected post-construction and pollution prevention stormwater BMPs are included in the Williams College Stormwater Best Management Practices Guidelines, which can be found on the Williams College Facilities website at http://facilities.williams.edu/.

Campus-wide maintenance activities and maintenance activities for structural stormwater BMPs maintained by Williams College are included as **Appendix B** of this policy.

9 References

MassDEP (2008). *Massachusetts Stormwater Handbook*. Massachusetts Department of Environmental Protection, Boston, MA. Accessed at: http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html

USEPA (2011). *EPA Construction General Permit*. United States Department of Environmental Protection, Washington, DC. Accessed at: http://cfpub.epa.gov/npdes/stormwater/cgp.cfm

Town of Williamstown (2010). Chapter 70 - Zoning revised May 18, 2010. Accessed at http://williamstown.ws/?page_id=46

Appendix A

Stormwater Management Design Review Checklist and Certification

Appendix B

Stormwater Operation and Maintenance Plan

Stormwater Operation and Maintenance Plan

Williams College

Stormwater Management Policy

June 2014

1 Introduction

An essential component of a successful stormwater system is the ongoing operation and maintenance of the various components of the stormwater drainage, control, and conveyance systems. Failure to provide effective maintenance can reduce the hydraulic capacity and the pollutant removal efficiency of stormwater practices. Williams College is responsible for maintaining the stormwater infrastructure on the main campus and outlying properties. The major stormwater infrastructure maintained by Williams includes:

- Catch basins, trench drains, and yard drains
- Paved surfaces (parking lots, roads, driveways, etc.)
- Subsurface detention/infiltration systems
- Proprietary or manufactured stormwater treatment devices (Stormceptor, Vortechs, CDS, etc.)

This Operation and Maintenance Plan outlines recommended stormwater infrastructure maintenance activities for Williams College.

2 Campus-Wide Maintenance Activities

The following campus-wide maintenance activities will be performed by Williams College:

- Annual inspection and cleaning of all catch basins, trench drains, and yard drains, including grates sumps, and outlets. Catch basins should be cleaned such that they are less than 50% full.
- Annual inspection of campus stormwater outfalls to receiving waters, wetlands, or other municipal/state storm drainage systems.
- Annual pavement sweeping to minimize the introduction of pollutants into the drainage system.

December through March (ongoing as appropriate)

- Maintenance activities during the winter months are primarily limited to snow removal activities and removal of debris and trash throughout the campus. Snow removal operations will adhere to the Massachusetts Department of Environmental Protection Snow Disposal Guidance, Guideline No. BRPG01-01 (Effective Date: March 8, 2001), located at http://www.mass.gov/eea/agencies/massdep/water/regulations/snow-disposal-guidance.html.
- After all snow fall events:
  - Clear catch basin and trench drain grates of snow and ice.
- After major snow falls or after snow accumulations, when it becomes necessary to haul snow:
  - Store snow in designated storage areas.
  - Clear catch basin and trench drain grates of snow and ice.

April – May

- Sweep paved areas after the final snow melt.
- Remove accumulated trash, litter and discarded materials from the campus. No disposal of materials will be permitted within wetlands. This prohibition includes fill material; construction debris, grass clippings, collected leaves and cut branches from landscaped areas.

June – August

- Clean all catch basins, trench drains, and yard drains at least once per year. Catch basins should be cleaned such that they are less than 50% full. Also inspect for structural damage, cracks or obstructions. Manage and dispose of catch basin cleanings in accordance with applicable regulatory requirements.
- Inspect campus stormwater outfalls to receiving waters, wetlands, or the municipal/state drainage system at least once per year during dry weather. Inspect the condition of the outfall and look for evidence of illicit discharges and other pollutant discharges to receiving waters, wetlands, or municipal/state drainage system.

November – December

- Remove leaves from catch basins, trench drains, yard drains, and drainage outfalls and paved areas after the last leaf-fall. Manage and dispose of leaves in accordance with applicable regulatory requirements.

Construction Sites (ongoing)

- Perform routine inspection of catch basins in the vicinity of construction sites and remove sediment if sumps are more than 50% full.
- Perform routine inspection of paved areas in the vicinity of construction sites and remove sediment as needed.

3 Maintenance Activities for Structural Stormwater BMPs

Structural stormwater BMPs on the Williams Campus will be inspected annually and after storm events greater than or equal to the 1-year, 24-hour, Type III precipitation event (2.3 inches). The following inspection procedures will be followed. O&M inspection checklists are provided at the end of this section.

Subsurface Detention/Infiltration Systems

Subsurface detention and/or infiltration systems will be inspected a minimum of twice annually for accumulation of silt and debris.

Proprietary or Manufactured Stormwater Treatment Devices

- Hydrodynamic Separators: Hydrodynamic separators stormwater treatment systems shall be inspected in accordance with manufacturer recommendations. For example, a Vortechs system manufactured by Contech should be inspected twice per year (i.e. spring and fall) and cleaned when inspection reveals that the sediment depth has accumulated to within 12 to 18 inches of the dry-weather water surface elevation.

Stormwater Management Design Review Checklist and Certification

Williams College
Stormwater Management Policy

1. Project Information

Project Name: ____

Project Street/Location: ____

Williamstown Zoning/Overlay District(s): ______________________________

Estimated Area to be Disturbed (ft²): ______________________________

	Existing	Proposed
Total Area of Impervious Surfaces: (buildings, parking, sidewalks, etc.) (ft²):	______________	____________

____

2. Williams College Project Manager

Name: ______________________________

Address: ______________________________

Telephone: ______________________________

E-Mail: ______________________________

Fax: ______________________________

3. Engineer of Record

Name: ______________________________

Address: ______________________________

Telephone: ______________________________

E-Mail: ______________________________

Fax: ______________________________

4. Other Applicable Regulatory Requirements (check all that apply, refer to flowchart)

Town of Williamstown

- ☐ Conservation Commission – Wetlands Protection Act
- ☐ Planning Board – Zoning Bylaw
- ☐ Other (Board of Health, Department of Public Works, etc.)

State – Massachusetts Department of Environmental Protection

- ☐ Massachusetts Stormwater Management Policy
  - ☐ Wetlands Protection Act
  - ☐ 401 Water Quality Certification

Federal

- ☐ EPA Construction General Permit

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5. Submittal Requirements

- ☐ Stormwater Management Plan
  - ☐ Contact information
  - ☐ Locus map
  - ☐ The existing zoning and land use and proposed land use at the site
  - ☐ The location(s) of existing and proposed easements
  - ☐ The location of existing and proposed utilities
  - ☐ The site's existing & proposed topography with contours at 2 foot intervals
  - ☐ Proposed limits of disturbance
  - ☐ Estimate of the total area expected to be disturbed by excavation, grading or other construction activities
  - ☐ A description of the existing site hydrology
  - ☐ A description & delineation of existing stormwater conveyances, impoundments, and wetlands on or adjacent to the site or into which stormwater flows
  - ☐ A delineation of 100-year floodplains, if applicable
  - ☐ Habitats mapped by the Massachusetts Natural Heritage & Endangered Species Program within five hundred (500) feet of any construction activity
  - ☐ Estimated seasonal high groundwater elevation in areas to be used for stormwater retention, detention, or infiltration
  - ☐ The existing and proposed vegetation and ground surfaces with runoff coefficients for each
  - ☐ A drainage area map showing pre- and post-construction watershed boundaries, drainage area and stormwater flow paths, including municipal drainage system flows
  - ☐ Drainage patterns and approximate slopes anticipated after major grading activities
  - ☐ Description and drawings of all components of proposed stormwater management systems
  - ☐ Hydrologic and hydraulic design calculations for pre- and post-development conditions
  - ☐ Soils information from test pits performed at the location of proposed stormwater management facilities, including soil descriptions, depth to seasonal high groundwater, depth to bedrock, and infiltration rates.
  - ☐ Planting plan for stormwater management systems and adjacent areas
  - ☐ A description of provisions for project phasing
- ☐ Erosion & Sedimentation Control Plan (SWPPP for projects subject to EPA CGP)
- ☐ Stormwater Operation & Maintenance Plan
- ☐ Documentation of Other Local, State, and Federal Approvals:
  - ☐ Planning Board
  - ☐ Conservation Commission
  - ☐ MADEP 401 Water Quality Certification

☐ EPA Construction General Permit Coverage

6. Certification

I have read the Williams College Stormwater Management Policy and have identified the applicable local, state, and federal stormwater regulatory requirements for the proposed project. The project design conforms to the requirements of the Williams College Stormwater Management Policy and applicable regulations. I hereby certify that the information contained herein including all attachments is true, accurate and complete to the best of my knowledge.

____________________________________ ____________________
Williams College Project Manager Signature Date

____________________________________ ____________________
Engineer of Record Signature Date

Appendix IX

WILLIAMS COLLEGE – FACILITIES May 2016 CONSTRUCTION CLOSE-OUT PROCESS

A close-out process that delivers the value our customers expect while also allowing us to be proud of our work.

The Williams College close-out process has been developed with the following goals in mind; Cost Effective Seamless for All Involved
Streamlined Easily Understood by All Involved
Efficient Timely
COMPLETE – It must include all necessary training and documentation for Staff

We often hear the phrase "**Close-out starts on Day One**!" However, it is our experience here at Facilities that shortly after the ink has dried on the various contracts with everyone involved with our construction projects this catch phrase has been forgotten. Williams College is now setting the standard for the close-out process and intends to hold everyone involved accountable for starting project close-out on day one.

A seamless transition from the Planning, Design & Construction team to the Operations team is vital to the success of any project for Williams College. The Operations team will maintain the building long after construction has finished, and it is imperative the building is designed and constructed in a way that allows for preventative maintenance and service of all equipment in an easily accessible manner.

Initial Project Planning and Material Salvage Period

At the initial project planning phase Williams College's Project Manager along with the Furniture Procurement Department and Operations team will conduct an existing building evaluation and survey involving the furniture procurement department as well as Operations. A clearly defined set of expectations for what the operations team intends to salvage for reuse on campus as well as any FF&E (furniture, fixtures and equipment) which can be repurposed will be identified and documented in writing. If the project requires long term storage this will be evaluated and determined during this phase as well.
Prior to any construction the College requires a one week period to salvage and remove all items as identified in the planning phase. Williams will provide formal approval for construction activities to commence once all items identified for salvage are removed.

Building Information Modeling (BIM) & MEP / FP Coordination

Building Information Modeling (BIM) & MEP / FP Coordination meetings will be utilized as necessary on most projects for Williams College. The Operations staff must be invited to attend these meetings, but may not necessarily attend every one. Two meetings prior to the formal trade "sign-off" review meeting, the Williams Operations staff will have individuals attend the meeting to get an overview of the upcoming area(s) which should be ready for formal submission to the design team. Williams Operations staff will also attend all meetings in which an area is to be "signed-off" by the various subcontractors involved so their concurrent review with the design team will be beneficial to the overall success of achieving our goal for serviceability and easily accessible equipment.

Construction Inspection Tours

The Williams Project Manager assigned to the project will conduct tours with the operations staff at various stages of construction. To this end, a minimum 3 days' notice from the Construction Manager or General Contractor to Williams College is required prior to installing any insulation within walls and ceilings and also prior to installation of drywall and/or finished wall and ceiling surfaces to the framing. It’s important the Operations team has conducted a detailed review of all walls prior to covering with the finished product. Upon completion of such inspections, a detailed, written construction inspection report will be issued within one day if not sooner by the Operations staff to the Williams Project Manager outlining any concerns with access to equipment, or deficiencies that are not in accordance with the previously agreed upon design. Construction inspection tours will also be conducted with the various operations departments once the formal punch list has been generated by the construction and design team to ensure any concerns are documented and ultimately addressed to their satisfaction.

Office for Information Technology
An approved set of test results for Telephone / Data / Video wiring must be submitted in accordance with the specifications to the Williams College assigned Project Manager at least 7 days prior to connection of system equipment. The college will review and advise if it's acceptable for connection of system equipment within 4 days after receipt of test results.

Equipment Training and Final Walk Through
Williams College requires that all training for use of equipment and a final walk through with the Operations staff is to be scheduled a minimum 7 days in advance and shall take place 10 days prior to the scheduled certificate of occupancy date as published by the Contractor. A detailed training schedule must be developed by the contractor and submitted to the Williams Project Manager for review and approval prior to scheduling the final walk through. It is also a requirement that the Foreman who was directly responsible for the as-installed work conduct the walk through and training session(s).

Master Punchlist Format
Williams College requires that once the various punch lists are developed by either the General Contractor, Construction Manager, Architect, Engineer, Consultant, Owner, etc. that all punch lists' are combined into one project "Master Punchlist" . Upon the first issuance of the Master Punchlist, the team will agree on the formatting and overall keeper of the list to assist with execution of the punch list.

ARC Flash Modeling
Williams College has defined ARC Flash standards for our campus, and due to the complexity involved with modeling, this work cannot be completed until a complete, accurate set of Electrical Record Drawings are provided for the project. Electrical Record Drawings are required to be submitted 30 days prior to the contractual substantial completion date. The ARC flash model will then be updated and breaker settings provided for adjustment by the Electrical Contractor responsible for the project.
The ideal scenario for development of the ARC Flash model is a 3 stage approach;

> The first stage would be completed after all electrical related submittals have been approved. The second stage would be completed following the MEP/FP Coordination drawing approval. The third and final stage is after submission of the Electrical Record Drawings.

One Year Warranty Period
During the standard one-year warranty period, all project related service calls shall be directed to the Williams College assigned Project Manager. Maintaining this one point of contact during the first year of building operation will ensure the warranty period, as purchased through the contractor, is achieved and the full benefits of this are realized. Williams College also understands that under certain circumstances some warranty related items cannot afford to wait and must be addressed immediately by the Operations staff. These type of items will be dealt with immediately, as may be required, and Williams College reserves the right to evaluate the

costs associated with such items and pass the expenses along to the contractor.

Three Month Post-Project Review Meeting

3 months following the occupancy of any building, the assigned Williams College Project Manager will conduct a post-project review meeting with the Contractor, Design Team and Operations staff to gather information and develop a project specific lessons learned log and reevaluate the initial goals set forth during the Schematic & Design Development stages of the project. This meeting will also be an open discussion to review what processes went well for the various stakeholders and team members involved as well as what processes should be improved on the next project. Any approved deviations from the Williams design standards will be evaluated for their initially performance from an operations' perspective at this time.

Eleven Month Warranty Review Meeting

The 11 month warranty walk through with Operations, the Contractor, and the Design Team will be similar to the 3 month post-project review meeting. This walk through will be conducted with the Operations staff members who have been directly overseeing the operation and maintenance of the building. The intent is to review the building strictly from an operational standpoint in an effort to better ourselves and use any lessons learned to put forth on the next project, and also review items which may be under warranty that need to be addressed prior to the warranty expiring. Approved deviations from the Williams design standards will be re-evaluated for their performance and if acceptable for operation will be incorporated into the design standards.

The following documents are attached for information and knowledge sharing to outline the processes developed to assist with project close-out. For the close-out process to be effective it must start as early as possible during design and construction and constantly be updated and confirmed to ensure all of the fluid pieces remain aligned with our end goal of a seamless transition from Project Design & Construction to Building Operation & Maintenance.

The attached "**WILLIAMS COLLEGE: PROJECT CLOSEOUT RESPONSIBILTY MATRIX**" has been established to assign responsibilities to the various team members to ensure the project closeout goals which are established are achieved. The matrix is intended as a guide and must be reviewed early in the project to ensure each specific task has the correct individual assigned to guarantee completion.

The attached "**WILLIAMS COLLEGE: DESIGN DELIVERABLE REVIEW SHEET**" has been established to assist the various operations staff in clearly documenting concerns noted during the various stages of design deliverables, including but not limited to Schematic Design, Design Development, Early Packages & Construction Documents. This is a valuable tool to ensure the close-out process is in fact starting as early as possible and during the "paper" phase of construction.

The attached "**WILLIAMS COLLEGE: CONSTRUCTION INSPECTION REPORT**" has been established to assist the various operations staff in clearly documenting concerns noted during the various tours conducted during the construction process.

The attached "**WILLIAMS COLLEGE: PROJECT CLOSEOUT CHECKLIST**" has been established to assist the project team with the all-inclusive process as well as achieving the 7 goals identified for the close-out process.

WILLIAMS COLLEGE: PROJECT CLOSEOUT RESPONSIBILTY MATRIX

Task	Phase	Design Team	CM / GC	Williams Project Manager	Williams Operations	Consultant
Construction Close-out Process						
Material Salvage / Re-Use Documentation	Pre-Construction	X		X	X	
Design Deliverable Reviews	Schematic Design	X		X	X	
	Deign Development	X		X	X	
	Construction Documents	X		X	X	
Building Information Modeling (BIM) & MEP / FP Coordination	Pre-Construction	X	X	X	X	X
Construction Inspection Reports	Construction		X	X	X	
Office for Information Technology - Tel / Data Test Results	Construction		X	X	X	
Equipment Training and Final Walk Through	Construction / Operations		X	X	X	
Master Punchlist	Construction	X	X	X	X	X
ARC Flash Modeling	Pre-Construction	X	X	X	X	X
	Construction	X	X	X	X	X
Project Closeout Checklist	Construction		X	X		
One Year Warranty Period	Post Construction		X	X	X	
Three Month Post-Project Review Meeting	Post Construction	X	X	X	X	X
Eleven Month Warranty Review Meeting	Post Construction	X	X	X	X	X

The above responsibility matrix is intended as a guide, this should be reviewed and agreed upon early in the project to ensure each specific task has the correct individual assigned to ensure completion.

Project ____________________
Date ____________________
Design Stage ____________________

Architect ____________________
Engineer ____________________
WC Reviewer ____________________

WILLIAMS COLLEGE: DESIGN DELIVERABLE REVIEW SHEET

Division 06: Wood, Plastics and Composites

Item	Reference		Descriptio n	Action	Date		WILLIAMS COLLEGE VERFICATION
	Dwg	Spec			Complete	Verified	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Project ______________________ Contractor ______________________
Date ______________________ Sub-Contractor ______________________
Construction Stage ______________________ WC Reviewer ______________________

WILLIAMS COLLEGE: CONSTRUCTION INSPECTION REPORT

Division 23: Heating Ventilating and Air Conditioning

Item	Room	Location			Description	Action	Date		WILLIAMS COLLEGE VERFICATION
		Ceiling	Floor	Wall			Complete	Verified	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Project ____________________ Project No. ____________________

Contractor ____________________ Date ____________________

Architect ____________________

WILLIAMS COLLEGE: PROJECT CLOSEOUT CHECKLIST

	Item	VERIFICATION Date Completed	VERIFICATION Initials	WILLIAMS COLLEGE VERIFICATION
	REQUIRED FOR CERTIFICATE OF OCCUPANCY			
1	Final Electrical Inspection			
2	Final Plumbing Inspection			
3	Final Gas Inspection			
4	Final Sheet metal Inspection			
5	Final Health Inspection			
6	Final Elevator / Vertical Lift Inspection			
7	Fire Suppression System Inspection			
8	Fire Detection & Warning System Inspection			
9	90 minute Emergency Lighting Test			
10	Zoning Inspection			
11	Specialized Inspections			
12	Final Construction Control Documents			
	Architectural			
	Civil			
	Electrical			
	Fire Protection			
	Structural			
	Mechanical			
	Plumbing			
	Structural			
13	Contractor Letter of Completion			
14	Testing & Balancing Report			
15	Final Punchlist			
	All of the above items as applicable must be completed prior to scheduling final inspection with Building Department			
16	Final Town Building Inspection (Scheduled by WC Project Manager)			
17	Certificate of Occupancy			

The undersign certifies that all of the above-listed items are complete

____

Project Manager Date

		VERIFICATION Date Completed	Initials	WILLIAMS COLLEGE VERIFICATION
REQUIRED FOR NOTICE OF SUBSTANIAL COMPLETION				
18	Contractor has submitted Final Punchlist with values for each item and schedule for completion			
19	Removal of all temporary facilities			
20	Final cleaning and removal of unused materials			
21	All valve tags and corresponding charts are installed			
22	All mechanical, electrical, plumbing & fire protection systems have been labeled and clearly identified			
23	All warranties as specified and required per the contract documents have been supplied with corresponding dates			
24	Approved Operation & Maintenance Manuals supplied			
25	Approved and certified As-Built Documents supplied			
26	Operations personnel has been properly trained			
27	Contractor notice of Insurance change over requirements			
28	Temporary lock cylinders / cores change over complete or Contractor has advised date for such to occur by Owner			
29	Contractor advised of building security / alarm responsibility			
30	Contractor formally requested Architect's inspection for Certificate of Substantial Completion			

REQUIRED FOR RELEASE OF RETENTION				
31	Completed equipment retrieval forms submitted			
32	Complete spare parts / attic stock list provided with location			
33	Clearly defined Landscape Maintenance Period			
34	Oil Containing Equipment form completed			
35	Refrigerant Containing Equipment form completed			
36	Final B.O.L. documents provided for Hazardous Materials			
37	Final Punchlist complete and certified by contractor			
38	Final Commissioning Report complete, signed and certified by contractor necessary sub-contractor			
39	Final Invoice / Requisition Submitted			
40	Final Lien Waivers Submitted			
41	Submit Consent of Surety for final payment			
42	Evidence of Contractor's continuing insurances coverage has been submitted (if required by Contract Documents)			
43	Submit certification of completion for all LEED credit documentation requirements			
44	11 month project warranty walk through scheduled with Contractor & A/E Team: Anticipated Date______			

The undersign certifies that all of the above-listed items are complete

Project Manager ______________________ Date ______________