INTRODUCTION

1.1 WILLIAMS COLLEGE DESIGN STANDARDS

A. 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.

B. Facilities manages and maintains Williams’ 100+ buildings as well as 450 acres of gardens, lawns and athletic fields. In addition, it supports and maintains 111 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 2.5 million square feet of structures on campus.

1.2 PRIMARY USE

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 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.

B. 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.

C. The term “Architect”, “Engineer”, and “Design Professional” are used interchangeably throughout these design standards and should be edited and assigned the appropriate designation(s) as required for the specific project.

1.3 UPDATES

A. The Williams College Design Standards will be updated periodically. 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 may be submitted directly to a Williams College Project Manager, or emailed to Michael Briggs, Senior Project Manager at mbriggs@williams.edu.

1.4 DISCLAIMER

A. 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.

Williams College Design Standards, copyright 2016 by Williams College. All rights reserved.
# WILLIAMS COLLEGE DESIGN STANDARDS

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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. Without limitation, items in red are particularly project-specific.

A. Summary

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

B. Architectural Design:

1. Design, facilities operation and maintenance are critical considerations for projects at Williams College.
2. The roofs of new buildings and substantial renovations shall be designed to prevent water, snow and ice from falling on adjacent pedestrian walkways and building entrances.
3. Where applicable, Designers shall diagram the flow of trash and recyclables through the building. Facilities shall advise on the specifics of Williams College’s programs.
4. Mechanical rooms and custodial closets are vital to the functioning of our buildings. As such they should be allotted adequate square footage for staff to comfortably perform their jobs. In the case of mechanical rooms, eventual equipment replacement shall be taken into account, and space provided for such replacement.

C. 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

Sleeved shirts and long pants must be worn while working on this project. Shorts and tank tops will not be allowed.

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.

DUST

Dust must be controlled by utilizing chutes and enclosed dumpsters when removing debris from the building. Water sprinklers and other methods shall be used as required to minimize dust.
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.

HAZARDOUS MATERIALS NOTIFICATION
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.

HOURS OF WORK
Hours of work shall be 8:00am until 6:00pm, Monday through Friday. Weekend and off-hours work will be allowed only by special arrangement with and at the sole discretion of the College.

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.

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”.

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. Shouting and unnecessary running or idling of equipment will not be allowed.
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, etc. Such devices are considered a hazard on the construction site.

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

Comply with Appendix – 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.

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.

STREET CLEANING

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

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 DRONES- FAA REQUIREMENTS

Civil Operations (Non-Governmental) Any operation that does not meet the statutory criteria for a public aircraft operation is considered a civil aircraft operation and must be conducted in accordance with all FAA regulations applicable to the operation.
Operators must provide the College with a copy of a current FAA certification. There are presently two methods, acknowledged by the College, of gaining FAA authorization to fly civil (non-governmental) UAS:

Section 333 Exemption – a grant of exemption in accordance with Section 333 AND a civil Certificate of Waiver or Authorization (COA); this process may be used to perform commercial operations in low-risk, controlled environments

Special Airworthiness Certificate (SAC) – applicants must be able to describe how their system is designed, constructed, and manufactured, including engineering processes, software development and control, configuration management, and quality assurance procedures used, along with how and where they intend to fly.

SAC in the experimental category – may be used for civil aircraft to perform research and development, crew training, and market surveys; however, carrying persons or property for compensation or hire is prohibited. FAA Order 8130.34 is used by FAA inspectors to issue experimental airworthiness certificates and special flight permits to UAS. For more information, please contact the Airworthiness Certification Service, AIR-113, at 202-267-1575.

USE OF COLLEGE SEAL

The use of the College Seal standing alone is restricted to the Office of the President and the Board of Trustees. It can also be used to brand formal invitations and formal institutional events, such as Commencement. Please adhere to these guidelines for seal usage:

The seal should always be used with reverence to what it represents, and never in an irreverent, playful, or disrespectful way. If the seal is used standing alone, the minimum height is 0.875", and a height of 1" is strongly recommended. The approved color for the seal in general is black.
DOCUMENT 00 02 00

SUSTAINABILITY POLICY AND GOALS

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.

For the most current sustainability policies and goals please see:


END OF SECTION
EMERGENCY PROCEDURES

1.1 CONTACTS

A. Police, Ambulance, Fire: These numbers should be used only in the case of an emergency – to save a life, report a fire, or stop a crime. Be prepared to identify yourself, your location, and the nature of the emergency; the appropriate emergency service(s) will respond

1. From Cell Phones: 413-458-5646
2. From Campus Phones: 9-911 or 911.

B. Williams College Campus Safety and Security Department:

1. Secretary (Business Hours): 413-597-4343 or from campus phones x4343
2. Dispatcher (24 hours a day): 413-597-4444 or from campus phones x4343
3. Email: security@williams.edu

C. Williamstown Police:

1. Phone: 413-458-5733
2. Address: 31 North Street, Williamstown 01267

D. Ambulance:

1. Village Ambulance 413-458-4889
2. North Adams Ambulance Service 413-664-6680

END OF SECTION
1.1 VARIANCES, CLARIFICATIONS OR EXCEPTIONS TO THE CONSTRUCTION GUIDELINES

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

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

C. Request:
   1. Date of request: ___________________________________________
   2. Response date requested: _________________________________________
   3. Project: ___________________________________________
   4. Williams project manager: _______________________________________
   5. Requestor: ___________________________________________
   6. Requestor email: ___________________________________________
   7. Standards section number: _______________________________________
   8. Standards section title: _______________________________________
   9. 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.

D. Response:
   1. Accepted: ___________________________________________
   2. Accepted with modification: _______________________________________
   3. Not accepted: ___________________________________________

E. Response completed by:
   1. Name: ___________________________________________
   2. Signed: ___________________________________________
   3. Date signed: ___________________________________________

END OF FORM
1.1 UPDATE REQUEST

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

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

C. Request:

1. Date of request: ___________________________________________
2. Response date requested: ___________________________________________
3. Project: ___________________________________________
4. Williams project manager: ___________________________________________
5. Requestor: ___________________________________________
6. Requestor email: ___________________________________________
7. Standards section number: ___________________________________________
8. Standards section title: ___________________________________________
9. 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.

D. Response:

1. Accepted: ___________________________________________
2. Accepted with modification: ___________________________________________
3. Not accepted: ___________________________________________

E. Response completed by:

1. Name: ___________________________________________
2. Signed: ___________________________________________
3. Date signed: ___________________________________________

END OF FORM
SECTION 01 10 00

GENERAL REQUIREMENTS

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.

************************************************************************************

Note to designer- Organizational Basis for General Requirements:

• Relation to other contract documents:
  o Conditions of the Contract: Legal provisions which relate to the entire project (e.g., Contractor shall pay for testing).
  o General Requirements and other Division 1 Sections: General work requirements that relate to the entire project (e.g., Use independent testing agency).
  o Divisions 2-49 Requirements relating to a specific product or system (e.g. Test soil load capacity).
• Division 1 must address separate requirements, such as substitutions after award of contract. Provisions of Procurement Requirements (Division 0) are not in force during Construction Phase. Procurement requirements should reference, but not repeat Division 1 Requirements
• Division 1 expands upon provisions of the agreement stated in the General Conditions in greater detail:
  o Summary of Work
  o Scheduling requirements
  o Payment Procedures
• General Conditions of the Contract vs. General Requirements in Division 1:
  o General Conditions are an inherent part of the Agreement. Together they govern the entire contract.
    ▪ Broad contractual conditions
    ▪ Constants
    ▪ Typically, are published standard documents.
    ▪ Supplementary Conditions are written for project specific modifications to clauses of the General Conditions.
  o General Requirements and other Division 1 sections are an inherent part of the specifications, divisions 2 through 49, expanding detail.
    ▪ Specific administrative and procedural requirements
    ▪ Variables specifically applicable to a specific project
    ▪ Written separately for each project. Choose what you require. Don’t require what you won’t insist on.
Incorporate in General Requirements of Division 1 (separate section for larger projects) only if needed:

- **Scope of Work**
- **Allowances, Alternates and unit prices**
- **Summary of Multiple Contracts** (General Conditions covers where-as and if; Division 1 states how to in the case of)
- **Work Restrictions**
- **Temporary Facilities**
- **Etc.**

This document provides a compilation of typical Williams College General Requirements, and may be used to develop General Requirements for a specific project. It is not intended to use without editing. There may be project specific requirements that need to be added, and those that are unnecessary for a specific project, which should be deleted. Review the content and use of this document with the Williams College Project Manager.

1.1 Related Documents
1.2 Project Requirements
1.3 Specification Information
1.4 Definitions
1.5 Industry Standards
1.6 Codes and Regulations
1.7 Progress Schedule
1.8 Schedule of Values
1.9 Payment Requests
1.10 Procedures and Controls
1.11 Submittals
1.12 Warranties
1.13 Cutting and Patching
1.14 Mold Control and Remediation
1.15 Temporary Facilities and Utilities
1.16 Products and Substitutions
1.17 Delivery, Storage and Handling
1.18 Williams College Furnished Products
1.19 Labels
1.20 Record Documents
1.21 Project Close Out
1.22 Final Cleaning and Repair

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. In all instances the written construction contract for construction phase services, or agreement for construction services (the “Agreement”) shall supersede without limitation all prior negotiations, representations, agreements, proposals, or requirements, including these Standards.

B. The requirements and provisions found in this administrative section should be included in construction Project Manuals for all individual projects and as applicable to the Project. Omissions and/or deviations from the requirements in this Section must be approved in writing by the Williams College Project Manager.
1.2 PROJECT REQUIREMENTS

A. Project Identification: ((enter name and location of the project))

B. All distribution, review, comments, and acceptance of all project documents, drawings submittals, etc. with the exception of physical samples and mockups, will be done through the Williams College e-Builder web portal.

C. Particular Project Requirements: ((enter project specific information or delete))

   1. Owner’s project requirements and basis of design: (())
   2. Sustainable design goals/LEED certification: (())
   3. Commissioning (Cx): (())
   4. Building Envelope Commissioning (BECx): (())
   5. Laboratory Systems Commissioning: (())
   6. Existing site conditions and restrictions: (())
   7. Requirements for sequencing, scheduling and completion date: (())
   8. Prior or concurrent work by Williams College or others: (())
   9. Pre-purchased and pre-ordered items: (())
  10. Williams College-purchased, Williams College-installed items: (())
  11. Williams College-purchased, Contractor-installed items: (())
  12. Williams College's early or partial occupancy: (())
  13. Occupancy of adjacent facilities: (())
  14. Contractor's use of new and existing facilities: (())
  15. Scope of separate prime contracts: (())
  16. Working at Williams: Comply with requirements of Section 00 01 00 – Working at Williams.

D. Project Requirements for Temporary Utilities and Facilities:

   1. Utility Costs: Williams College will typically allow the use of existing utility systems and pay for cost of utility services consumed, including electricity, water and gas per the terms of the contract. If applicable, the Contractor shall provide and pay for temporary heat prior to the complete enclosure of the building and availability of suitable permanent systems.
   2. Temporary Offices: A separate field office for the Architect and the Williams College Project Manager is not required.
   3. Toilet Facilities: For typical renovation projects, the Williams College Project Manager may allow designated toilet facilities within the building to be used by Contractor's personnel.
   4. Elevators: For typical renovation projects, the Williams College Project Manager may allow designated elevators within the building to be used by Contractor's personnel.
   5. Hazardous Materials: Williams College will typically abate areas prior to construction activities. If hazardous materials are suspected, stop work in that area and report in writing to the Williams College Project Manager.

A. Permits and Fees: ((verify)) The Contractor will apply for and obtain the Building permit and Williams College will pay for the Building Permit. The Contractor shall apply for, obtain and pay for other permits and fees required to perform the work. Submit copies of permit applications to the Williams College Project Manager prior to submittal in sufficient time for review and comment.
B. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect and Williams College Project Manager.

C. Tax-Exempt Status: Generally, Williams College is an exempt purchaser under MGL Chapter 64H. Purchases of tangible personal property or services are exempt from sales/use taxation to the extent that such property or services are used in the conduct of the business of Williams College. The Williams College Project Manager will provide a Massachusetts DOR Form ST-5 Sales Tax Exempt Purchaser Certificate upon request.

E. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.

F. Existing Conditions: Notify Architect of existing conditions differing from those indicated on the drawings.

1.3 STANDARDS INFORMATION

A. These Standards are a specialized form of technical writing edited from master standards and specifications and contain deviations from traditional writing formats. Capitalization, underlining and bold print is only used to assist reader in finding information and no other meaning is implied.

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(Note to designer: The following note is intended to “nail down” Division 2-49 Part 3 and in drawing notes, who’s supposed to carry out the work described.)

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B. Except where specifically indicated otherwise, the subject of all imperative statements is the Contractor.

C. Sections are generally numbered in conformance with Construction Specifications Institute MasterFormat System. Numbering sequence is not consecutive. Refer to the table of contents for names and numbers of sections included in this Project.

D. Pages are numbered separately for each section. Each section is noted with "End of Section" to indicate the last page of a section.

1.4 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract. (Refer to form of Contract)

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.5 INDUSTRY STANDARDS

A. Referenced standards are part of the Contract Documents and have the same force and effect as if bound with these standards.

B. Except where specifically indicated otherwise, comply with the current standard in effect as of the date of the ((Contract Documents)), ((Bid)), ((Williams College/Contractor Agreement)). Obtain copies of industry standards directly from publisher.

C. The titles of industry standard organizations are commonly abbreviated; full titles may be found in Encyclopedia of Associations or consult Architect.

1.6 CODES AND REGULATIONS

A. Comply with all applicable codes, ordinances, regulations and requirements of authorities having jurisdiction.

B. Submit copies of all permits, licenses, certifications, inspection reports, releases, notices, judgments, and communications from authorities having jurisdiction to the Architect and Williams College Project Manager.
1.7 CONSTRUCTION PROGRESS SCHEDULES – (refer to form of Agreement)

1.8 SCHEDULE OF VALUES – (refer to form of Agreement)

1.9 PAYMENT REQUESTS – (refer to form of Agreement)

1.10 PROCEDURES AND CONTROLS – (refer to form of Agreement)

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Note to designer: Edit the “(( ))” subsections in or out of the document as appropriate for the scope of the project. If there is any scope associated with the subject building element subsection, it should be incorporated in this section, unless otherwise directed by the Project Manager for minor scope.

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A. Project Meetings: Arrange for and attend meetings with the Architect and such other persons as the Architect or Owner requests to have present. The Contractor shall be represented by a principal, project manager, general superintendent or other authorized main office representative, as well as by the Contractor’s field superintendent. An authorized representative of any subcontractor or sub-subcontractor shall attend such meetings if the representative’s presence is requested by the Architect or Owner. Such representatives shall be empowered to make binding commitments on all matters to be discussed at such meetings, including costs, payments, change orders, time schedules and manpower. Any notices required under the Contract may be served on such representatives. Written reports of meeting minutes shall be prepared by the Contractor and distributed by the Contractor to attendees, the Architect, and Williams College Project Manager within three business days.

1. Pre-Construction Conference: Attendance by Owner, Architect, Contractor, major subcontractors. Agenda shall include: Quality of workmanship, coordination, interpretations, job schedule, submittals, approvals, requisition procedures, testing, protection of construction, indoor air quality, and construction waste management.

2. ((Exterior Envelope Meeting: Attendance by Owner, Architect, Contractor, major subcontractors. Agenda shall include as applicable: Review of exterior wall details, wall construction, sample panel preparation, cleaning, control and expansion joints, cold weather procedures.))

3. ((Roofing/Flashings Meeting: Attendance by Owner, Architect, Contractor, roofing subcontractor, and representative of roofing manufacturer. Agenda shall include as applicable: Preparation of roof decks, flashing and blocking details, roofing procedures and inspections, bonds and guarantees, weather conditions during roofing, protection of roof membrane during construction.))

4. ((Interior Finishes Meeting: Attendance by Owner, Architect, Contractor, major subcontractors. Agenda shall include as applicable: Quality of workmanship,
environmental conditions for application of finishes, drywall details, millwork details, condition of surfaces to receive finishes, tile work, painting work, samples and test areas and approvals, coordination with mechanical and electrical interfaces and penetrations, indoor air quality.))

5. Progress Meetings: Hold weekly before preparation of payment requests and additional meetings as requested by the Owner or Architect. Attendance by Architect, Contractor, and others as determined by Contractor. Agenda shall include work in progress and payment requests.

6. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction, as specified. Pre-installation Conferences may be part of Progress Meeting agenda. Attendance by Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow. Agenda shall include a review of progress of other construction activities and preparations for the particular activity under consideration.

B. Emergency Addresses: Prior to commencing work on site, furnish the Williams College Project Manager and Architect, in writing, the names addresses and telephone numbers of individuals to be contacted in the event of an out-of-hours emergency at the building site. Post a similar list readily visible from the outside of the field office or a location acceptable to the Architect.

C. Layout: Layout work and be responsible for all lines, elevations, and measurements of the building, grading, utilities and other work executed under the contract. Retain a registered professional engineer or registered land surveyor, acceptable to the Architect and the Williams College Project Manager, to initially establish exterior lines and required elevations of all buildings and structures to be erected on the site. The registered professional engineer or registered land surveyor shall certify the actual location of the constructed facilities in relation to property lines, building lines, easements, set-backs, and other restrictive boundaries.

D. Field Measurements: Verify measurements at the building prior to ordering materials or commencing work. No extra charge or compensation will be allowed because of differences between actual dimensions and measurements indicated on the Drawings. Differences which may be found shall be submitted to the Architect for decision before proceeding with the work.

E. Field Measurements for Fixed Equipment: Dimensions for fixed equipment to be supplied under this Contract or separate contracts shall be determined by field measurements taken jointly by the Contractor and the equipment supplier involved. A record of the field measurements shall be kept until time of substantial completion of the project, or until the equipment has been fully installed and accepted by the Williams College Project Manager, whichever is later. Responsibility for fixed equipment fabricated accurately to field measurements for proper fit and operation shall be that of the Contractor. Contractor shall pay all costs involved in correcting any mis-fitting fixed equipment as fabricated.
F. Project Limit Line: The boundaries of the site do not limit the responsibility of the Contractor to perform the work in its entirety. Make utility connections as indicated.

G. Matching: Where matching is indicated, the Architect shall be the sole and final judge of what is an acceptable match. Mockups and sample submissions are required.

H. Observation: Notify the Owner, Architect at least two working days in advance of concealing any work. The Contractor is solely responsible for coordinating all required inspections and receiving all required approvals from the authorities having jurisdiction.

I. Utilities: Prior to interrupting utilities, services or facilities, notify the utility Williams College Project Manager and obtain their written approval a minimum two working days in advance.

J. Furnishings, Fixtures, and Equipment: Cooperate and permit Williams College to install furnishings and equipment during the progress of the work. Williams College's installation of furnishings or equipment does not signify acceptance of any portion of the work.

K. Clean-Up: Frequently clean-up all waste, remove from site regularly, and legally dispose of off-site.

L. Installer's Acceptance of Conditions: All installers shall inspect substrates and conditions under which work is to be executed and shall report in writing to the Contractor all conditions detrimental to the proper execution and completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means installer accepts previous work and conditions.

M. Coordination: The Contractor shall be fully responsible for coordinating all trades, coordinating construction sequences and schedules, and coordinating the actual installed location and interface of all work.

1. Prior to beginning mechanical, electrical and fire protection work, the Contractor shall prepare coordination drawings showing the exact alignment, physical location and configuration of the mechanical, electrical and fire protection installations and demonstrating to the Contractor's satisfaction that the installations will clear all obstructions, permit proper clearances for the Work of other trades, and present an orderly appearance where exposed. The Contractor shall be solely liable and responsible for any costs and delays resulting from the Contractor's failure to prepare such coordination drawings or from the negligent preparation of such coordination drawings.

2. Exact locations and groupings of mechanical, electrical and fire protection fixtures, switches, heads and outlets shall be obtained from the Architect before the Work is roughed in. Work installed without such information from the Architect shall be relocated at the Contractor's expense if the Architect so requests.

N. Request for Interpretation (RFI):

a. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
b. ((RFI's shall be submitted in e-Builder, and all responses shall be tracked and forwarded through e-Builder.

2. Content of the RFI: Include a detailed, legible description of item needing interpretation.

3. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow a minimum of three working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

4. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

O. Existing Articles of Unusual Value: If during demolition, excavation, or disposal work articles of unusual value or of historical or archaeological significance are encountered, the ownership of such articles is retained by the Williams College, and information regarding their discovery shall be immediately furnished to the Architect. If the nature of the article is such that work cannot proceed without danger of damage to the article, work in the area shall be immediately discontinued until the Architect has determined the proper procedure to be followed. Delays in time thereby shall be a condition for which the time of the Contract may be extended. Costs incurred after discovery in the salvaging of such articles shall be borne by Williams College.

1.11 SUBMITTALS

A. Required Submittals: Submit shop drawings, product data, initial selection samples, verification samples, calculations, coordination drawings, schedules, and all other submittals as specified in individual specification sections. Provide submittals for cleaning and maintenance products to be used during construction and final cleaning.

B. Submittal Schedule: Within 30 days after award of contract and before first application for payment, prepare list of submittals in chronological sequence showing all submittals and proposed date first due at Architect's office and proposed date due to be returned to Contractor. Note relevant specification section number.

C. Contractor's Preparation of Submittals: Modify and customize all submittals to show interface with adjacent work and attachment to building. Identify each submittal with name of project, date, Contractor's name, subcontractor's name, manufacturer's name, submittal name, relevant specification section numbers, and Submittal Schedule reference number.

1. ((Stamp and sign each submittal to show the Contractor's review and approval of each submittal before delivery to Architect's office; unstamped and unsigned submittals will be returned without action by the Architect. Leave 4" x 6" open space for Architect's "action" stamp.))

GENERAL REQUIREMENTS
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2. ((Submittals shall be submitted through e-Builder. Approvals will be tracked in the same sequence as defined for paper submittals. Samples and mock-ups shall be registered in e-Builder for tracking dates and disposition of actions. Stamp and sign each sample to show the Contractor's review and approval of each, before delivery to Architect's office; unstamped and unsigned samples will be returned without action by the Architect.))

D. Product Data: Provide manufacturer's preprinted literature including, without limitation, manufacturer's standard printed description of product, materials and construction, recommendations for application and use, certification of compliance with standards, instructions for installation, and special coordination requirements. Collect data into one submittal for each unit of work or system; mark each copy to show which choices and options are applicable to project.

1. ((Submittal Quantities: Submit at least 1 reproducible copy and three additional copies.))

2. ((Submit in electronic form, with project specific information marked, to e-Builder.))

3. Installer Copy: Verify that the Installer has a current copy of the relevant product data, including installation instructions, before permitting installation to begin.

E. Shop Drawings: Provide accurately prepared, large scale and detailed shop drawings prepared specifically for this project on reproducible sheets. Show adjacent conditions and related work. Show accurate field dimensions and clearly note field conditions. Identify materials and products in the work shown. Note special coordination required.

1. ((Submittal Quantities: Submit at least 1 reproducible copy and three blackline prints of Shop Drawing submittals. After Architect's action, follow specified distribution procedure.))

2. ((Submit in electronic form, with project specific information marked, to e-Builder.))

F. Samples: Provide units identical with final materials and products to be installed in the work. Where indicated, prepare samples to match Architect's sample. Label each sample with description, source, generic name or manufacturer's name and model number. Architect will review samples for confirmation of visual design intent, color, pattern, texture and type only; Architect will not test samples for compliance with other Contract requirements which shall remain the exclusive responsibility of the Contractor.

1. Initial Selection Samples Submittal Quantities: For initial selection purposes, submit 1 set of samples showing the complete range of colors and finishes available.

2. Verification Samples Submittal Quantities: For verification of an initial selection, submit 3 sets of samples; one set will be returned to Contractor to be maintained at project site for quality control comparisons.
G. Timing of Submittals: Submit submittals in a timely fashion to allow at least 10 business days for each office's review and handling. This means that submittals which have to be reviewed by the Architect and one of his consultants require at least 20 business days for review and handling. Add ten business days for each additional consultant who must review a submission.

H. Architect's Action on Submittals: Architect will review submittals, stamp with "action stamp", mark action, and return to Contractor. Architect will review submittals only for conformance with the design concept of the project. The Contractor is responsible for confirming compliance with other Contract requirements, including without limitation, performance requirements, field dimensions, fabrication methods, means, methods, techniques, sequences and procedures of construction, coordination with other work. The Architect's review and approval of submittals shall be held to the limitations stated in the Williams College/Architect Agreement and the Conditions of the Contract. In no case shall approval or acceptance by the Architect be interpreted as a release of Contractor of his responsibilities to fulfill all of the requirements of the Contract Documents.

1. Required Resubmittal: Unless submittal is noted "reviewed and approved" or "reviewed and approved except as noted, resubmission not required," make corrections or changes to original and resubmit to Architect.

2. Distribution: When submittal is noted "approved" or "approved as noted, resubmittal not required," make prints or copies and distribute to the Williams College Project Manager, Subcontractors involved, and to all other parties requiring information from the submittal for performance or coordination of related work. Print shop drawings for distribution only from the final approved reproducible.

1.12 WARRANTIES

A. Warranties Required: Refer to individual trade sections for specific product warranty requirements.

B. Procurement: Where a warranty is required, do not purchase or subcontract for materials or work until it has been determined that parties required to countersign warranties are willing to do so.

C. Warranty Forms: Submit written warranty to the Williams College Project Manager through Architect for approval prior to execution. Furnish two copies of executed warranty to The Williams College Project Manager for his records; furnish two additional conformed copies where required for maintenance manual.

D. Work Covered: Contractor shall remove and replace other work of project which has been damaged as a result of failure of warrantied work or equipment, or which must be removed and replaced to provide access to work under warranty. Unless otherwise specified, warranty shall cover full cost of replacement or repair, and shall not be pro-rated on basis of useful service life.

E. Warranty Extensions: Work repaired or replaced under warranty shall be warranted until the original warranty expiration date or for ninety days whichever is later in time.
F. Warranty Effective Starting Date: Guarantee period for all work, material and equipment shall begin on the date of substantial completion, not when subcontractor has completed his work nor when equipment is turned on. In addition to the one year guarantees for the entire work covered by these Contract Documents, refer to the various sections of the specifications for extended guarantee or maintenance requirements for various material and equipment.

1.13 CUTTING AND PATCHING

A. Limitations: Do not cut and patch any work in a manner that would result in a failure of the work to perform as intended, decreased energy performance, increased maintenance, decreased operatio nal life, or decreased safety.

1. Structural Work: Do not cut structural work or bearing walls without written approval from Architect. Where cutting and patching of structural work is necessary and approved by Architect, perform work in a manner which will not diminish structural capacity nor increase deflection of member. Provide temporary shoring and bracing as necessary. Ensure the safety of people and property at all times.

B. Cutting and Patching Materials: Use materials identical to materials to be cut and patched. If identical materials are not available or cannot be used, use materials that match existing materials to the greatest extent possible. Provide finished work that will result in equal to or better than existing performance characteristics.

C. Inspection: Before cutting and patching, examine surfaces and conditions under which work is to be performed and correct unsafe and unsatisfactory conditions prior to proceeding.

D. Protection: Protect adjacent work from damage. Protect the work from adverse conditions.

E. Cutting: Cut work using methods least likely to damage adjoining work. Use tools designed for sawing or grinding, not hammering or chopping. Use saws or drills to ensure neat, accurately formed holes to sizes required with minimum disturbance to adjacent work. Temporarily cover openings; maintain weather tightness and safety.

1. Utilities: Locate utilities before cutting. Provide temporary utilities as needed. Cap, valve, or plug and seal ends of abandoned utilities to prevent entrance of moisture or other foreign matter.

F. Patching: Patch with seams and joints which are durable and not visible. Comply with specified tolerances for similar new work; create true even planes with uniform continuous appearance. Restore finishes of patched areas and, if necessary, extend finish restoration onto adjoining unpatched area to eliminate evidence of patching and refinishing. Repaint entire assemblies, not just patched area. Remove and replace work which has been cut and patched in a visibly unsatisfactory manner as determined by the Architect.
G. Qualifications: Retain experienced and specialized firms, original installers if possible, to perform cutting and patching. Workmen shall be skilled in type of cutting and patching required.

1.14 MOLD CONTROL AND REMEDIATION

A. Mold Control and Remediation During Construction: The Contractor shall protect construction materials and building systems from moisture damage and from conditions which promote mold growth during and after construction. The Contractor shall be responsible for mold remediation and replacement of materials which cannot be successfully remediated in accordance with the following requirements:

1. Materials which become wet prior to installation shall be cleaned, treated and dried in accordance with EPA Guidelines.
2. Materials which exhibit mold growth prior to installation shall not be installed and shall be removed from the site.
3. Materials which exhibit mold growth after installation shall be remediated in accordance with EPA Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water. The Contractor shall engage and pay for a qualified industrial hygienist acceptable to the Owner to determine the cause of the mold growth, and to certify in writing that materials have been successfully remediated. In the event that the industrial hygienist recommends methods of remediation in addition to those in the Guidelines, the Contractor shall also be responsible for the additional remediation. Materials which cannot be successfully remediated shall be removed and replaced with new materials at no additional expense to the Owner.
4. Prior to the start of construction, the Contractor shall submit the name of the person in the Contractor's organization responsible for ensuring compliance with these requirements for mold control and remediation.

B. Existing Mold-Contaminated Materials: In the event that mold-contaminated materials are encountered during remodeling operations, the Contractor shall stop work in that area and notify the Owner and Architect in writing. The Owner will engage and pay for an industrial hygienist to evaluate the situation to advise the Contractor on the proper course of action.

1.15 TEMPORARY FACILITIES AND UTILITIES

A. Scope of Temporary Work: This article is not intended to limit the scope of temporary work required under the Contract. Provide all temporary facilities and utilities needed.

B. Permits and Fees: Obtain and pay for all permits, fees and charges related to temporary work.

C. Codes and Authorities Having Jurisdiction for Temporary Facilities and Utilities: Comply with all requirements of authorities having jurisdiction, codes, utility companies, OSHA, and industry standards including, but not limited to the following:

2. ANSI-A10 Series, Safety Requirements for Construction and Demolition.
4. Electrical Service: NEMA, NECA, and UL.

D. Field Offices: Provide Contractor's field offices as needed. Keep current copies of all Contract Documents and project paperwork neatly on file at jobsite. Permit Architect's unrestricted use of Contractor's field office facilities including copiers, telephones, plan tables, and other equipment. Furnish, maintain, and pay for light, power, phone, fax, and other field office services.

E. Shops and Sheds: At Contractor's option, provide shops and sheds for Contractor's use as needed. Locate shops and sheds where acceptable to The Williams College Project Manager and authorities having jurisdiction. Prior to completion of construction, temporary storage facilities and surplus stored materials shall be removed from the site.

F. Temporary Heat: If building systems are not available, provide temporary heat as needed to protect the work and create a suitable work environment. Provide temporary heat to protect the exterior construction against injury or damage resulting from cold temperature and dampness, to heat materials, and to maintain the minimum temperatures specified herein and in individual specification sections. Protect building from soot, smoke and fire damage. Do not use heaters which would interfere with curing of mortar and grout or damage any materials.

1. Heaters for temporary heat shall be approved temporary steam generators or forced warm air heaters located outside the building or vented to the outside, or other safety type UL approved heating devices acceptable to the Architect.

2. Oil burning salamander type heaters will not be permitted. Non-vented, open flame heaters will not be permitted inside the building once the building is closed-in.

3. Propane type-heaters will not be permitted within the area of the building or near stockpiles of combustible materials.

4. Permanent building equipment shall not be used without written permission from the Williams College Project Manager. If the equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, and similar items. Prior to turnover to Williams College, the equipment shall be in a clean, like new condition. The guarantee period shall not start until the equipment is turned over to Williams College. Do not invalidate existing warranty by any action or failure to act. Clean and change air filters frequently to prevent construction dust and debris from contaminating system.

G. Pumping and Drainage: Protect excavations, trenches, buildings and materials from rain water, ground water, backup or leakage of sewers, drains and other piping, and from water of any other origin. Promptly remove any accumulation of water. Provide and operate all pumps, piping and other equipment necessary for pumping, drainage and protection from water.
H. Equipment and Tools: Provide all equipment including, but not limited to, hoists, lifts, scaffolding, machines, tools and the like, as needed for execution of the work. Provide safe access to all parts of the work.

I. Temporary Enclosures: Provide temporary enclosures to maintain proper temperatures and to prevent weather damage. Always maintain legal means of egress.

J. Snow and Ice: Remove all snow and ice which interferes with work or safety.

K. Streets, Walks and Grounds: Maintain public and private roads and walks clear of debris caused by construction operations. Repair all damage caused to streets, drives, curbs, sidewalks, fences, poles and similar items where disturbed or damaged by building construction and leave them in as good condition after completion of the work as before operations started.

L. Protection: Protect nearby property and the public from construction activities. Provide and maintain barricades, warning signs and lights, railings, walkways and similar items. Immediately repair damaged property to its condition before being damaged.

M. Public Services: Provide temporary public services such as, street lighting, night lighting, sidewalks, covered passages, signs, signals and the like, as requested by authorities having jurisdiction.

N. Construction Fencing: Provide construction fencing and barriers as applicable to the project and as required by code to protect personnel, the public, and to control access. Six-foot fencing with vertical privacy slats are the minimum required, typically supported on mounting blocks.

O. Security: Secure building against unauthorized entry at all times. Provide secure, locked temporary enclosures. Protect the work at all times. Provide watchman service, if necessary, to protect the work.

P. Signs: Except for safety and warning signs, no other signs are permitted. Location as acceptable to the Architect and the Williams College Project Manager.

Q. Fire Prevention: Take every precaution to prevent fire. Provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and comply with recommendations regarding fire protection made by the representative of the fire insurance company carrying insurance on the Work or by the local fire chief and Williams College Fire Safety Personnel. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

R. Egress: Maintain safe and legal means of egress at all times. At all times, provide at least two separate means of egress.

S. Contractor Parking: Parking is not provided by Williams College. Contractors, subcontractors and other employees shall park in legal locations in the community.
site parking in construction areas is subject to the approval of the Williams College Project Manager.

1.16 PRODUCTS AND SUBSTITUTIONS

A. Specified Products: In all cases in which a manufacturer's name, trade name or other proprietary designation is used in connection with materials or articles to be furnished under this Contract, whether or not the phrase "or equal" is used after such name, the Contractor shall provide the product of the named manufacturers without substitution, unless a written request for a substitution has been submitted by the Contractor and approved in writing by the Architect as follows.

B. Deviations from Williams College Construction Guidelines: Submit Document 00 90 10 - Construction Guidelines Variance Request Form. Substitutions or deviations from the Williams College Construction Guidelines without approval will be considered defective work, to be removed at the Contractor’s sole expense.

C. Deviations from Detailed Requirements: If the Contractor proposes to use material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the materials is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.

D. Approval of Substitutions: In requesting approval of deviations or substitutions, the Contractor shall provide evidence, including, but not limited to manufacturer's data, leading to a reasonable certainty that the proposed substitution or deviation will provide a quality of result at least equal to that attainable if the detailed requirements of the Contract Documents were strictly followed. If, in the opinion of the Architect, the evidence presented by the Contractor does not provide a sufficient basis for such reasonable certainty, the Architect may reject such substitution or deviation without further investigation.

E. Intent of Contract Documents: The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of the suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall furnish the substituted material in any color, finish texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to Williams College.

F. Additional Costs or Impact: Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the contractor, notwithstanding approval or acceptance of such substitution by the Williams College Project Manager or the Architect, unless such substitution was made at the written
request or direction of the Williams College Project Manager and the Architect. Any decrease in the cost of the substitution shall be returned to Williams College.

G. Manufacturers: To the greatest degree possible, provide primary materials and products from one manufacturer for each type or kind. Provide secondary materials as recommended by manufacturers of primary materials.

H. Substitution Requests: Identify product to be replaced by substitute by reference to specification sections and drawing numbers. Provide Contractor's certification and evidence to prove compliance with Contract Document requirements as acceptable to Architect.

I. Substitution Conditions: Substitution requests will be returned without action unless one of the following conditions is satisfied. The Contractor shall state which of the following conditions applies to the requested substitution:

1. Request is due to an "or equal" clause.
2. Specified material or product cannot be coordinated with other work.
3. Specified material or product is not acceptable to authorities having jurisdiction.
4. Substantial advantage is offered Williams College in terms of cost, time, or other valuable consideration.
5. Specified material or product is not available.

J. Invalid Substitutions: Contractor's submittal and Architect's acceptance of shop drawings, samples, product data or other submittal is not a valid request for, nor an approval of a substitution unless the Contractor presents the information when first submitted as a Request for Substitution.

K. Substitution Requests and Sustainable Design Intent:

1. Proposed substitutions may be rejected where data is not provided or where data that is significantly different than specified materials would negatively impact the project's sustainable design intent.
2. Data which impacts sustainable design intent includes, but is not limited to, location of manufacture, recycled content, and indoor air quality.

L. Compatibility of Materials Used in the Work:

1. Ensure complete compatibility between materials.
2. Compatibility shall include adhesion, erosion, solubility, differential thermal response, and galvanic action.
3. Provide evidence of compatibility.
4. Provide custom testing where evidence is not available.
5. Where materials are not compatible, provide necessary isolation or transition materials and provide details of same.
6. Correct defects resulting from incompatibility including de-construction and re-construction of assemblies – whether materials are part of a submittal and substitution process or not.
7. Proposed substitutions may be rejected where compatibility information is not provided; or where compatibility is not adequately addressed, according to the Architect’s judgment; or where incompatible materials would negatively impact the project’s success.

1.17 WILLIAMS COLLEGE FURNISHED, CONTRACTOR-INSTALLED PRODUCTS

A. Williams College will furnish products indicated. The Contractor’s Work includes providing support systems to receive Williams College’s equipment and making plumbing, mechanical, and electrical connections.

1. Williams College will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Williams College will arrange and pay for delivery of Williams College furnished items according to Contractor’s Construction Schedule.
3. After delivery, the Williams College Project Manager will inspect delivered items for damage. Contractor shall be present for and assist in the Williams College Project Manager’s inspection.
4. If Williams College furnished items are damaged, defective, or missing, the Williams College Project Manager will arrange for replacement.
5. The Williams College Project Manager will arrange for manufacturer’s field services and for delivery of manufacturer’s warranties to Contractor.
6. The Williams College Project Manager will furnish Contractor the earliest possible delivery date for Williams College furnished products. Using Williams College furnished earliest possible delivery dates, Contractor shall designate delivery dates of Williams College furnished items in Contractor’s Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Williams College furnished items at Project site.
9. Contractor is responsible for protecting Williams College furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Williams College furnished items are damaged as a result of Contractor’s operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Williams College furnished items into the Work.

B. Williams College Furnished Products: As determined on a per-project basis or as indicated.

1.18 DELIVERY, STORAGE AND HANDLING

A. Manufacturer’s Instructions: Strictly comply with manufacturer’s instructions and recommendations and prevent damage, deterioration and loss, including theft. Minimize long-term storage at the site. Maintain environmental conditions, temperature, ventilation, and humidity within range permitted by manufacturers of materials and products used.
1.19 LABELS

A. Labels, Trademarks, and Trade Names: Locate required labels on inconspicuous surfaces. Do not provide labels, nameplates, or trademarks which are not required. Provide permanent data plate on each item of equipment stating manufacturer, model, serial number, capacity, ratings and all other essential data.

1.20 RECORD DOCUMENTS

A. General: Keep record documents neatly and accurately. Record information as the work progresses and deliver to Architect at time of final acceptance. Include in record documents all field changes made, all relevant dimensions, and all relevant details of the work. Keep record documents up to date with all field orders and change orders clearly indicated.

1. All distribution, review, comments and acceptance of record documents, with the exception of samples and mockups, will be done through the Williams College e-Builder web portal.

2. Reference latest Williams College BIM standards and requirements.

B. Drawings: Keep four separate sets of blackline prints at the site, one set each for mechanical, electrical, plumbing, and architectural/structural disciplines. Neatly and accurately note all deviations from the Contract Documents and the exact actual location of the work as installed. Marked-up and colored prints will be used as a guide to determine the progress of the work installed. ((Maintain current record documents at the e-Builder website.)) Requisitions for payment will not be approved until the record documents are accurate and up-to-date.

1. Work Outside Building: Record data outside of building to an accuracy of plus or minus 1 inch and determine and record the invert elevation of all drain lines.

2. At completion of the work, submit one complete set of marked-up prints for review. After acceptance these marked-up prints shall be used in the preparation of the record drawings.

C. Specifications: Maintain one clean copy of complete specifications [including addenda, modifications, and bulletins] with changes, substitutions, and selected options clearly noted. Circle or otherwise clearly indicate which manufacturer and products are actually used.

1. ((Maintain current record documents at the e-Builder website.))

D. Operating and Maintenance Manuals: Manuals shall be submitted which contain the following: 

   Note: WC Facilities new O&M standards, being developed separately should be inserted here.

1. Description of the system provided, including final and approved submittal.

2. Handling, storage, and installation instructions.
3. Detailed description of the function of each principal component of the systems or equipment.
4. Operating procedures, including pre-startup, startup, normal operation, emergency shutdown, normal shutdown and troubleshooting.
5. Maintenance procedures including lubrication requirements, intervals between lubrication, preventative and repair procedures, and complete spare parts list with cross reference to original equipment manufacturer's part numbers.
6. Control and alarm features including schematic of control systems, control loop electric ladder diagrams, controller operating set points, settings for alarms and shutdown systems, pump curves and fan curves.
7. Safety and environmental considerations.

E. Copies of Operating and Maintenance Manuals: Three copies of the manuals shall be provided within sufficient time to allow for training of Williams College's personnel. Submit one copy of the manuals to the Architect for review no later than 90 calendar days prior to substantial completion, or building turn over, whichever comes first. Submit the remaining five copies within 15 days after first review set is returned to contractor. Progress payment may be withheld if this requirement is not met.

F. Additional Requirements for Operating and Maintenance Manuals: The requirements for manuals applies to each packaged and field-fabricated operating system. The manuals shall be provided in three-ring side binders with durable plastic covers. The manuals shall contain a detailed table of contents and have tab dividers for major sections and special equipment.

1. Information shall be sorted by CSI section number, and not by manufacturer or by contractor.

G. Framed Data: Provide charts and lists of all valves, circuits, switches, controls and equipment. Install on walls under glass at locations directed by Architect.

1.21 PROJECT CLOSE OUT

A. Complete the following prior to Substantial Completion ((communicating through e-Builder)):

1. Provide Contractor's Punch List of incomplete items stating reason for incompletion and value of incompletion.
2. Advise the Williams College Project Manager of insurance change over requirements.
3. Submit all warranties, maintenance contracts, final certificates and similar documents.
4. Obtain Certificate of Occupancy and similar releases which permit Williams College's full and unrestricted use of the areas claimed "Substantially Complete".
5. Submit record documents.
6. Deliver maintenance stocks of materials where specified.
7. Make final changeover of lock cylinders or cores and advise the Williams College Project Manager of change of security responsibility.
8. Complete startup of all systems and instruct Williams College's personnel in proper operation and routine maintenance of systems and equipment.
9. Complete clean up and restoration of damaged finishes.
10. Remove all temporary facilities and utilities that are no longer needed.
11. Request Architect's inspection for Substantial Completion.

B. Architect will either issue a Certificate of Substantial Completion or notify Contractor of work which must be performed prior to issue of certificate.

C. Complete the following prior to Final Acceptance and payment:

1. Obtain Certificate of Substantial Completion.
2. Submit final application for payment, showing final accounting of changes in the work.
3. Provide final releases and lien waivers not previously submitted.
4. Submit certified copy of final punch list stating that Contractor has completed or corrected each item.
5. Submit final meter readings, record of stored fuel and similar information.
6. Submit Consent of Surety for final payment.
7. Submit evidence of Contractor's continuing insurance coverage (if required by Contract Documents).

1.22 FINAL CLEANING AND REPAIR (Note to designer: The following is a guideline that should be edited to project specific conditions.)

A. Clean Up: Immediately prior to the Architect's inspection for Substantial Completion, the Contractor shall completely clean the premises and clean and prepare the completed work in order for it to be used for its intended purpose in accordance with the Contract Documents. Such work shall include, but not be limited to the following:

1. Concrete and ceramic surfaces shall be cleaned and washed.
2. Resilient coverings shall be cleaned, waxed and buffed as applicable.
3. Woodwork shall be dusted and cleaned.
4. Sash, fixtures and equipment shall be thoroughly cleaned.
5. Stains, spots, dust, marks and smears shall be removed from all surfaces.
6. Hardware and metal surfaces shall be cleaned and polished.
7. Glass and plastic surfaces shall be thoroughly cleaned by professional window cleaners.
8. Damaged, broken or scratched glass or plastic shall be replaced by the Contractor at the Contractor's expense.
9. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.
10. Use low-emitting, environmentally friendly cleaning agents and procedures.

B. Repairs: Repair and touch-up all damaged and deteriorated products and surfaces.
SECTION 01 74 00
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies requirements for the Contractor's implementation of waste management controls and systems for the duration of the Work.

B. The intent of this Section is to develop and implement a waste management plan, quantifying material diversion by either weight or volume to recycle and/or salvage at least 75 percent of non-hazardous construction and demolition debris. (verify percentage). For projects seeking LEED credits for Construction Waste Management, refer to the current applicable LEED requirements.

1.2 INTENT

A. The Owner and Architect have established that this Project shall generate the least amount of waste practical and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

B. Of the waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized to the greatest extent practical.

C. With regard to these goals the Contractor shall develop, for the Architect's review, a Construction Waste Management Plan (CWMP) for this Project.

D. Each Subcontractor shall be responsible for segregating his own waste into different dumpsters as directed by the Contractor.

E. Contractor shall be responsible for ensuring that debris will be disposed of at appropriately designated licensed solid waste disposal facilities, as defined by MGL Chapter 111, Section 150A.

1.3 SUBMITTALS

A. Waste Management Plan: Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall provide a plan containing the following:

1. Analysis of the proposed jobsite waste to be generated, including types and rough quantities.
2. Landfill Options: The name of the landfills where trash and building debris will be disposed of, the applicable landfill tipping fees, and the projected cost of disposing of all Project waste in the landfills.
3. Landfill Certification: Contractor's statement of verification that landfills proposed for use are licensed for types of waste to be deposited and have sufficient capacity to receive waste from this project.
4. Alternatives to Landfilling: A list of each material proposed to be salvaged or recycled during the course of the Project. Include the following and any additional items proposed:
   a. Cardboard.
b. Clean dimensional wood. If means of diversion is Wood Derived Fuel (WDF) refer to submittal requirements below.

c. Beverage containers.

d. Concrete.

e. Slurry wall materials.

f. Bricks and masonry.

g. Asphalt.

h. Metals from framing, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

i. Mechanical and electrical equipment.

j. Building components which can be removed relatively intact from existing construction.

k. Packaging materials.

l. Glass.

m. Scraps from new gypsum wall board.

n. Carpet and pad.

o. Acoustical ceiling panels.

p. Plastics.

q. Land clearing debris and vegetation.

5. Meetings: A description of the regular meetings to be held to address waste management.

6. Materials Handling Procedures: A description of the means by which any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

7. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.


C. Waste Management Final Report: Prior to Substantial Completion, submit a written Waste Management Final Report summarizing the types and quantities of materials recycled and disposed of under the Waste Management Plan. Include the name and location of disposal facilities. Quantity may be measured by either weight or volume; be consistent in calculations. Include the following:

1. Material category.

2. Generation point of waste.

3. Total quantity of waste, by weight.

4. Quantity of waste salvaged, both estimated and actual.

5. Quantity of waste recycled, both estimated and actual.

6. Total quantity of waste diverted (salvaged plus recycled).

7. Total quantity of waste diverted (salvaged plus recycled) as a percentage of total waste.

D. Other Submittals:

1. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

2. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

3. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
4. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

5. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

E. Commingling Waste Vendor Submittals: Provide annual report from local or state government authority and summary attachment of diverted materials with the average annual recycling rate. Figures in the summary must be derived from the annual reports in concise clear language.

1. Provide tipping invoices for commingled waste and the following:
   a. Vendor’s most recent annual report from local or state government authority.
   b. Vendor’s annual report summary attachment of diverted materials in tonnage, with the average annual recycling rate.
   c. Vendors must demonstrate compliance with current applicable LEED requirements.

2. If Alternative Daily Cover (ADC) was listed as a diverted material in the above, vendors must demonstrate compliance with current applicable LEED requirements.

3. If Wood Derived Fuel (WDF) was listed as a diverted material in the above, vendors must demonstrate compliance with current applicable LEED requirements.

1.4 CONTRACTORS

A. Contractor may subcontract work of this Section to a sub-contractor specializing in recycling and salvaging of construction waste, as approved by the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 RECYCLING

A. Metal, including but not limited to aluminum stairs, structural beams and sections, and reinforcing steel shall be recycled.

B. Wood that is not painted and does not contain preservatives (i.e. creosote, arsenic, and chromium-containing preservatives) shall be segregated and recycled.

C. Refer to the Massachusetts Recycling Directory available at the Massachusetts State Bookstore (617-727-2834) in the State Capitol Building for recycling operations within the State.

D. Commingling Waste: Commingling waste at the job site may be allowed, provided that the following conditions are met:
   1. Comminglers shall be included in the Construction Waste Management Plan (CWMP).
   2. Additional comminglers must be pre-approved by the Architect via CWMP addenda, prior to tipping on the job site.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.

C. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

D. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Location shall be acceptable to the Architect.

1. Waste commingling shall be approved prior to jobsite tipping, per requirements of this Section.

E. Hazardous Wastes: Any unforeseen hazardous wastes shall be separated, stored, and disposed of according to local regulations and as directed by the Owner.

END OF SECTION
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 RESPONSIBILITY 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 RESPONSIBILITY MATRIX

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<th>Task</th>
<th>Phase</th>
<th>Design Team</th>
<th>CM / GC</th>
<th>Williams Project Manager</th>
<th>Williams Operations</th>
<th>Consultant</th>
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<td>Eleven Month Warranty Review Meeting</td>
<td>Post Construction</td>
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</tbody>
</table>

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.
## WILLIAMS COLLEGE: DESIGN DELIVERABLE REVIEW SHEET

### Division 06: Wood, Plastics and Composites

<table>
<thead>
<tr>
<th>Item</th>
<th>Reference</th>
<th>Description</th>
<th>Action</th>
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</tbody>
</table>
## WILLIAMS COLLEGE: CONSTRUCTION INSPECTION REPORT

### Division 23: Heating Ventilating and Air Conditioning

<table>
<thead>
<tr>
<th>Item</th>
<th>Room</th>
<th>Location</th>
<th>Description</th>
<th>Action</th>
<th>Date</th>
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<tbody>
<tr>
<td></td>
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<td>Ceiling</td>
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<td>Floor</td>
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## WILLIAMS COLLEGE: PROJECT CLOSEOUT CHECKLIST

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Final Electrical Inspection</td>
</tr>
<tr>
<td>2</td>
<td>Final Plumbing Inspection</td>
</tr>
<tr>
<td>3</td>
<td>Final Gas Inspection</td>
</tr>
<tr>
<td>4</td>
<td>Final Sheet metal Inspection</td>
</tr>
<tr>
<td>5</td>
<td>Final Health Inspection</td>
</tr>
<tr>
<td>6</td>
<td>Final Elevator / Vertical Lift Inspection</td>
</tr>
<tr>
<td>7</td>
<td>Fire Suppression System Inspection</td>
</tr>
<tr>
<td>8</td>
<td>Fire Detection &amp; Warning System Inspection</td>
</tr>
<tr>
<td>9</td>
<td>90 minute Emergency Lighting Test</td>
</tr>
<tr>
<td>10</td>
<td>Zoning Inspection</td>
</tr>
<tr>
<td>11</td>
<td>Specialized Inspections</td>
</tr>
<tr>
<td>12</td>
<td>Final Construction Control Documents</td>
</tr>
<tr>
<td>13</td>
<td>Contractor Letter of Completion</td>
</tr>
<tr>
<td>14</td>
<td>Testing &amp; Balancing Report</td>
</tr>
<tr>
<td>15</td>
<td>Final Punchlist</td>
</tr>
<tr>
<td>16</td>
<td>Final Town Building Inspection (Scheduled by WC Project Manager)</td>
</tr>
<tr>
<td>17</td>
<td>Certificate of Occupancy</td>
</tr>
</tbody>
</table>

*All of the above items as applicable must be completed prior to scheduling final inspection with Building Department*

*The undersign certifies that all of the above-listed items are complete.*

---

Project Manager: ____________________  Date: ____________________
### REQUIRED FOR NOTICE OF SUBSTANTIAL COMPLETION

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>18</td>
<td>Contractor has submitted Final Punchlist with values for each item and schedule for completion</td>
</tr>
<tr>
<td>19</td>
<td>Removal of all temporary facilities</td>
</tr>
<tr>
<td>20</td>
<td>Final cleaning and removal of unused materials</td>
</tr>
<tr>
<td>21</td>
<td>All valve tags and corresponding charts are installed</td>
</tr>
<tr>
<td>22</td>
<td>All mechanical, electrical, plumbing &amp; fire protection systems have been labeled and clearly identified</td>
</tr>
<tr>
<td>23</td>
<td>All warranties as specified and required per the contract documents have been supplied with corresponding dates</td>
</tr>
<tr>
<td>24</td>
<td>Approved Operation &amp; Maintenance Manuals supplied</td>
</tr>
<tr>
<td>25</td>
<td>Approved and certified As-Built Documents supplied</td>
</tr>
<tr>
<td>26</td>
<td>Operations personnel has been properly trained</td>
</tr>
<tr>
<td>27</td>
<td>Contractor notice of Insurance change over requirements</td>
</tr>
<tr>
<td>28</td>
<td>Temporary lock cylinders / cores change over complete or Contractor has advised date for such to occur by Owner</td>
</tr>
<tr>
<td>29</td>
<td>Contractor advised of building security / alarm responsibility</td>
</tr>
<tr>
<td>30</td>
<td>Contractor formally requested Architect’s inspection for Certificate of Substantial Completion</td>
</tr>
</tbody>
</table>

### REQUIRED FOR RELEASE OF RETENTION

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>31</td>
<td>Completed equipment retrieval forms submitted</td>
</tr>
<tr>
<td>32</td>
<td>Complete spare parts / attic stock list provided with location</td>
</tr>
<tr>
<td>33</td>
<td>Clearly defined Landscape Maintenance Period</td>
</tr>
<tr>
<td>34</td>
<td>Oil Containing Equipment form completed</td>
</tr>
<tr>
<td>35</td>
<td>Refrigerant Containing Equipment form completed</td>
</tr>
<tr>
<td>36</td>
<td>Final B.O.L. documents provided for Hazardous Materials</td>
</tr>
<tr>
<td>37</td>
<td>Final Punchlist complete and certified by contractor</td>
</tr>
<tr>
<td>38</td>
<td>Final Commissioning Report complete, signed and certified by contractor necessary sub-contractor</td>
</tr>
<tr>
<td>39</td>
<td>Final Invoice / Requisition Submitted</td>
</tr>
<tr>
<td>40</td>
<td>Final Lien Waivers Submitted</td>
</tr>
<tr>
<td>41</td>
<td>Submit Consent of Surety for final payment</td>
</tr>
<tr>
<td>42</td>
<td>Evidence of Contractor’s continuing insurances coverage has been submitted (if required by Contract Documents)</td>
</tr>
<tr>
<td>43</td>
<td>Submit certification of completion for all LEED credit documentation requirements</td>
</tr>
<tr>
<td>44</td>
<td>11 month project warranty walk through scheduled with Contractor &amp; A/E Team: Anticipated Date__________</td>
</tr>
</tbody>
</table>

The undersign certifies that all of the above-listed items are complete.

Project Manager ___________________________ Date __________

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**PROJECT CLOSEOUT CHECKLIST**

Page 2 of 2
SECTION 01 81 20
CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Williams College requires a construction indoor air quality management plan prior to the start of construction. The primary goal of the IAQ management plan is the health and comfort of building occupants and construction personnel. This Section includes requirements for minimum indoor air quality (IAQ) performance standards during the construction period and before occupancy.

B. With regard to these goals the Contractor shall develop, for the Williams College Project Manager’s and Architect review, a Construction Indoor Air Quality Management Plan for this Project.

C. Sustainable Design Intent: Comply with project requirements intended to achieve sustainable design, measured and documented according to the LEED Green Building Rating System, of the US Green Building Council. For projects seeking LEED Certification, refer to Section 00 02 00, SUSTAINABILITY GOALS for certification level and certification requirements.

1.2 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 01 10 00 - GENERAL REQUIREMENTS; Submittal requirements.
2. Section 01 10 00 - GENERAL REQUIREMENTS; Construction facilities and controls.
3. Section 01 74 00 - CONSTRUCTION WASTE MANAGEMENT.
4. Section 01 90 00 - COMMISSIONING.
5. Division 23 – HVAC.
6. Divisions 02 through 48 Specification Sections; Specific requirements relating to indoor air quality for each Section.

1.3 PERFORMANCE REQUIREMENTS

A. Comply with minimum requirements of Sections 4 through 7 of ASHRAE 62.1-(Latest Version), Ventilation for Acceptable Indoor Air Quality and approved Addenda.

1. Coordinate with requirements of Section 01 90 00 - COMMISSIONING and Division 23 – HVAC.

B. Prevent exposure of building systems to environmental tobacco smoke during construction. At a minimum, take the following measures:

1. Do not allow smoking within the building footprint.
2. Locate exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows.

C. During construction meet or exceed the minimum requirements of the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, (Latest Edition), Chapter 3.
D. Protect absorptive materials from moisture damage when stored on-site and after installation.

E. During construction, comply with the following requirements:
   1. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2- (Latest Edition). Replace filtration media immediately prior to occupancy.

F. After construction ends but before occupancy, comply with one of the following requirements:
   1. Perform a building flush-out with outside air.
   2. Conduct IAQ testing for air contaminant levels in the building.

1.4 SUBMITTALS

A. Construction Indoor Air Quality (IAQ) Management Plan: With the completed Form of Bidder's Proposal, the Contractor shall submit a preliminary Construction IAQ Management Plan.
   1. Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit to the Williams College Project Manager a finalized Construction IAQ Management Plan.
   2. The proposed Plan shall comply with the requirements of these standards.
   3. The proposed Plan shall include, but not be limited to, the following:
      a. Protection of ventilation system components during construction.
      b. Cleaning and replacing contaminated ventilation system components after construction, including filtration media.
      c. Temporary ventilation.
      d. Protection of absorptive materials from moisture damage when stored on-site and after installation, including exterior wall rain protection.
      e. Sequence of finish installation plan.
      f. Selection of cleaning products and procedures to be used during construction and final cleaning.
      g. Other items as required by SMACNA IAQ Guidelines for Occupied Buildings under Construction, Chapter 3.
   5. Comply with the latest and applicable LEED requirements.

B. Indoor Air Quality (IAQ) Data: Submit emission test data as required, with testing laboratory and date clearly identified.

C. Material Safety Data Sheets (MSDS): Submit for materials as required, with date clearly identified. MSDS must contain specific chemical content data identifying the percent of the total product mass represented by each listed chemical.

D. Product Data: Submit for each type of filtration media used during construction and installed immediately prior to occupancy, with MERV values clearly identified.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of mold and mildew inside packaging and on products.

B. Immediately remove from site and properly dispose of materials showing signs of mold and mildew, including materials with moisture stains.
DIVISION 02 - 14 - ARCHITECTURAL GROUP

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PART 1 GENERAL

Low VOC Building Products: Notwithstanding the standards below, all building furnishings and construction materials, floor coverings and site-applied finishes, including sealants and adhesives, resilient flooring, carpeting and pad, site-applied paints, stains and varnishes, structural wood panels, hardwood veneer plywood, particle board and fiber board building products, and insulation shall meet specified volatile organic compound (VOC) emissions limits in accordance with GREENGUARD Environmental Institute GGPS.001 standard for building materials and finishes, or Green Seal® standards, whichever is more restrictive. Documentation demonstrating compliance shall be required with delivery of such materials and shall be available for inspection.

1.1 SECTION 02 41 00 - DEMOLITION
   A. Hazardous Materials: Consult with the Williams College Project Manager if hazardous materials are suspected. Comply with requirements of Williams College Safety and Environmental Compliance Office, 413-597-2406.
   B. For asbestos, abatement rather than encapsulation is preferred by Williams College.
   C. Salvageable Items – Finish door hardware, verify other on a by-project basis.

1.2 SECTION 06 40 00 - ARCHITECTURAL WOODWORK
   A. Interior Casework
      1. Construction: Typically plywood; no particleboard
      2. Counters: Solid surfacing with under mount sinks
   B. Interior Trim: Hardwood, Pine, or Poplar; no MDF.
   C. Exterior Woodwork:
      1. Acceptable Synthetic Materials: Boral, Azek, Trex
      2. Wood: Clear vertical Cedar preferred

1.3 SECTION 07 10 00 – WATERPROOFING
   A. Sheet Waterproofing: Required at locations where occupied space is below grade.

1.4 SECTION 07 72 00 - ROOF ACCESSORIES
   A. Roof Access Hatches: Access to roofs through windows is not acceptable. Always provide a door for roof access.

1.5 SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES
   A. Steel Doors and Frames:
      1. All interior and exterior doors to be 1-3/4” thick minimum.
      2. Interior Doors and Frames: ANSI/SDI-100 Grade II, heavy-duty model 1, minimum 18-gauge faces for doors, 16 gauge frames for single-swing
doors, 14 gauge frames for double-swing doors, with mitered and welded corners. Knock-down frames not acceptable


4. Steel/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.

5. 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.

1.6 SECTION 08 14 00 - WOOD DOORS

A. Wood Doors:
1. Construction: AWS Custom Grade; SCL-5 / LSL-5 (5-Ply Lumber Core). Particle Core (PC-5) will not be accepted unless otherwise indicated.
2. All doors must be a minimum of 1-3/4” thick.
3. Fabrication: Pre-drill doors prior to attaching hardware. Provide solid blocking for hardware; through-bolting is not acceptable.
4. 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.
5. 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.

1.7 SECTION 08 50 00 – WINDOWS

A. Exterior Windows: Operable, fiberglass-clad wood or aluminum-clad wood preferred.
1. Double-hung operation strongly preferred
2. Other operation (tilt-turn, casement, awning, etc.) must be approved on a per-project basis.
3. Full aluminum screens required.

1.8 SECTION 08 71 00 - DOOR HARDWARE

A. Door Hardware: For more detailed specifications, refer to Section 08 71 00 following this Section.
1. Campus System: Comply with Williams College Lockshop requirements.
2. Cores: Corbin/Russwin only. Cores to be installed after C of O is obtained and the Project turned over to the Owner.
3. Salvage: When remodeling, salvage all door hardware and transport to lockshop.
4. Punchlist: When cores are in, schedule punchlist inspection by Williams lockshop.

1.9 SECTION 09 21 10 - DRYWALL AND PLASTER

A. Walls:
1. Drywall: Fire-rated type; Gypsum Association Level 4 finish typical; veneer plaster typically not used; abuse-resistant board typically not required.

2. Corner Guards: At corners in halls and stairwells.

1.10 SECTION 09 60 00 – FLOORING

A. Flooring:

1. Public Areas: Stone or ceramic that does not require floor finish.
2. Student Rooms, Carpet: carpet tile; no light or uniform colors.
3. Student Rooms, Wood: Wood strip flooring, 2 coats Bona Traffic finish with Bonaseal or Bona Amberseal sealers.
4. Sand, vacuum and clean floor with a tack cloth before each coat.
6. Epoxy grout only.
7. Full setting bed, TCNA F114 assembly.
8. Concrete subfloor.
9. 1 ¼” to 2” cement mortar bed with waterproof membrane.
10. Epoxy grout.
11. At post-tensioned or pre-stressed concrete floor systems provide an anti-fracture membrane.
14. Elevator Floors: Rubber or hard surface.
15. Stairways: Hard surface or Rubber treads and risers. No carpet. Surface textures to be approved.
16. Entrance Mats: 3M Nomad Carpet Matting 4000 System; no stainless steel grids due to slip resistance.
17. Entrance Walk-Off Mats: Furnished and installed by Williams College.
18. Recessed Entrance Mats.

1.11 SECTION 09 90 00 - PAINTING AND COATING

A. Painting:

1. Exterior wood siding: Primer plus 2 coats exterior latex, eggshell finish. Benjamin Moore Exterior Alkyd All-Purpose primer #024 or approved equal.
2. Exterior Woodwork (wood buildings): Primer plus 2 coats exterior latex, satin finish. Benjamin Moore Exterior Alkyd All-Purpose primer #024 or approved equal.
3. Exterior Woodwork (brick buildings): Primer plus 2 coats Pratt & Lambert RedSeal Exterior Latex, satin finish or approved equal. Benjamin Moore Exterior Alkyd All-Purpose primer #024 or approved equal.
4. Dormitory Ceilings: Pratt & Lambert, flat finish, primer plus one coat; Skylight Color.
5. Dormitory Walls: Benjamin Moore UltraSpec 500 or approved equal, eggshell finish, primer plus two coats; color - Swiss Coffee or approved equal.
6. Exterior Parking Areas: Yellow, non-reflective color; not white.

1.12 SECTION 10 00 10 - DORMITORY SYSTEMS

A. Dormitory Showers:
2. Site-Fabricated Shower Floors: Slip-resistant porcelain or ceramic tiles, 2x2 or larger size, white color tile not allowed, slope to drain.

B. Prefabricated Shower Stalls: Fiberglass.

C. Dormitory Plumbing Fixtures:
   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.

D. Dormitory Bathroom Mechanical:
   1. Exhaust Fans: Required.

E. Dormitory Bathroom Electrical:
   1. Diffusers: Plastic only, not glass.
   2. Fixtures and Bulbs: Limit number of different types; provide stockroom with a list of fixtures, diffusers and bulbs.

1.13 SECTION 10 11 00 - VISUAL DISPLAY SURFACES

A. Visual Display Surfaces:
   1. Marker boards for teaching and administrative areas: White dry-erase type; Glass Whiteboard Company, 2453 American Lane, Elk Grove Village, IL 60007, info@glasswhiteboard.com, (877) 793-1011
   2. Marker boards for other uses when approved by the Williams College project manager: as manufactured by Claridge.
   3. Chalkboards: Black color, not green.

1.14 SECTION 10 14 00 – SIGNAGE

A. The design consultant shall be responsible design and specification of all building signage.
B. The construction manager/contractor shall be responsible for furnishing and installing all building signage.
C. See Appendix III for typical signage detailing and specifications.
D. Room Numbering Scheme: Subject to approval by Williams College. Numbering on construction documents shall match final approved numbering.

1.15 SECTION 10 21 00 – TOILET COMPARTMENTS

A. Dormitory Toilet Partitions:
   1. Partitions: Hiny Hiders by Scranton Products, high-density polyethylene (HDPE) toilet partitions.
   4. Fire Resistance: ASTM E84 Class A.
   5.

1.16 SECTION 10 28 13 - TOILET ACCESSORIES

A. Dormitory Bathroom Accessories:
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 – Stainless steel or solid material preferred; cushioned seats not acceptable.

1.17 SECTION 11 45 00 – APPLIANCES
A. Kitchen Stoves: Electric glass top preferred.

1.18 SECTION 12 20 00 - WINDOW TREATMENT
A. Dormitory Window Treatment:
   3. Draperies: Not acceptable

1.19 SECTION 12 56 10 - RECYCLING BINS
A. Recycling Bins:
   1. Design Requirement: One trash and one recycling container per dorm room or desk in E&G buildings. One trash recycling room per building with floor drain. Trash rooms to be fitted with bike hangers.
   2. Recycling Bins: Public Square by Bright Settings; 800-233-3360.

1.20 SECTION 14 20 00 – ELEVATORS
A. Elevators:
   1. Manufacturer: Thyssen Krupp.
   2. Type: Holeless hydraulic or machine-room-less traction elevators.
   5. Keys – All keys must be cut to #2252.

1.21 SECTION 14 42 00 - WHEELCHAIR LIFTS
A. Wheelchair Lift:
   1. Manufacturer: Garaventa.
   2. Operation: Massachusetts Code requirements.
   3. Keys – All keys must be cut to #2252.
PART 2 PRODUCTS

2.1 FILTRATION MEDIA

A. Filtration Media: Comply with ASHRAE 52.2-(Latest edition) and provide MERV as required.

PART 3 EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT PLAN IMPLEMENTATION

A. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the Job Site Foreman, each subcontractor, the Williams College Project manager, and the Architect.

C. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.

D. Preconditioning: Allow products, which have odors and significant VOC emissions, to off-gas in a dry, well-ventilated space for sufficient period to dissipate odors and emissions prior to delivery to Project.

1. Remove containers and packaging from materials prior to conditioning to maximize off-gassing of VOCs.
2. Condition products in ventilated warehouse or other building.

E. Coordinate Construction IAQ Management Plan with final cleaning as indicated in Section 01 10 00, GENERAL REQUIREMENTS.

END OF SECTION
SECTION 05 52 00

METAL RAILINGS

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PART 1  GENERAL

1.1  SUMMARY

A. Provide pipe and tube handrails and railing systems.

B. All gripping surfaces must be under-mount supported, allowing an uninterrupted grip along the entire length of the railing.

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 e-Builder web portal.

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

C. Shop Drawings: Submit shop drawings indicating material characteristics, details of 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.

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

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

PART 2  PRODUCTS

2.1  MATERIALS

A. Exterior Metal Railings: Refer to Figures 1, 2, and 3 at the end of this Section.

   1. Steel Pipe and Tube Railing Systems:
b. Steel Plates, Shapes and Bars: ASTM A 36.
e. Non-shrink Nonmetallic Grout: CE CRD-C621.
f. Exterior Steel Finish: Galvanized and shop powder coated, black color.

B. Interior Metal Railings:

1. Stainless Steel Pipe and Tube Railing Systems:
   a. Tubing: ASTM A 554, Grade TP 316.
   b. Pipe: ASTM A 312, Grade TP 316.
   c. Castings: ASTM A 743, Grade CF 8 or CF 20.
   d. Plate: ASTM A 666, Type 304 or 316.
   e. Stainless Steel Finish: AISI No. 4 bright directional polish.

2. Steel Pipe and Tube Railing Systems:
   b. Steel Tubing: ASTM A 500 or A 501.
   c. Steel Plates, Shapes and Bars: ASTM A 36.
   e. Interior Steel Finish: Shop primed for site finish.

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 in accordance 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 TYPICAL FIGURES

FIGURE 1:

VOLUTE END - CAST IRON
#13073 1-1/4" DIAM.
BY J.G. BRAUN CO.

STEEL POST - SQ. #13-113-8
BY KING ARCHITECTURAL METALS
CENTER TURNED ELEMENT OF POST 1" ABOVE CENTERLINE

1-1/2" SQ. X 11 GUAGE STEEL TUBING
POST SLEEVE. BOLT POST (2 REQ./PER)
IN SLEEVE & SHIM WITH NEOPRENE
TO ELIMINATE SHIFTING

CAST IRON BASE PLATE 'SHOE'
#45-234-112 BY KING ARCH METALS

1-1/4" DIAM SCH. 40
GALVANIZED PIPE - POWDER COAT
BLACK PAINT TYPICAL ON ALL.

EXPANSION JOINT AROUND PIPE SLEEVE
FINISHED GRADE - C.I.P. CONC.
GRANITE STAIR TREAD

* NOTE:
ONE HANDRAIL REQUIRED.
SEE PLAN FOR LOCATION ON NORTH SIDE OF STEPS.
FIGURE 2:

1-1/4" DIAM SCH. 40 GALVANIZED PIPE – POWDER COAT BLACK PAINT TYPICAL ON ALL.

VOLUTE END – CAST IRON #1073 1-1/4" DIAM.
BY J.G. BRAUN CO.

STEEL POST – SQ. #13-113-B
BY KING ARCHITECTURAL METALS

CAST IRON BASE PLATE "SHOE"
#45-234-112 BY KING ARCH. METALS
CORE & AND GROUT IN PLACE

TOP OF STAIRS

GRANITE STAIR TREADS
FIGURE 3:

- **Volute End — Cast Iron**
  #10073 1-1/4" Diam.
  By J.G. Braun Co.

- **Steel Post — Sq. #13-113-B**
  By King Architectural Metals
  Center turned element of post 1" above centerline.

- **Cast Iron Base Plate "Shoe"**
  #45-234-112 By King Architectural Metals
  Core & and grout in place

- **1-1/4" Diam Sch. 40**
  Galvanized Pipe — Powder Coat
  Black Paint Typical On All.

- **Finished Grade — C.I.P. Conc.**

- **Granite Stair Tread**

* NOTE: Two Handrails Required.

BOTTOM OF STAIRS

END OF SECTION
SECTION 08 71 00

FINISH HARDWARE (RESIDENTIAL AND NON-RESIDENTIAL)

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.

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. 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-openers 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:

FINISH HARDWARE
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FINISH HARDWARE

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 Operations. Equivalent products will not be accepted where "No Substitution" is listed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>(McKinney) Stanley</td>
</tr>
<tr>
<td>Locksets/Latchsets</td>
<td>(Corbin Russwin) No Substitution</td>
</tr>
</tbody>
</table>

FINISH HARDWARE
08 71 00 - 3
**Finish Hardware**

08 71 00 - 4

- 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:

<table>
<thead>
<tr>
<th>Door Width</th>
<th>Hinge weight</th>
<th>Hinge Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 42 inches</td>
<td>Regular Weight</td>
<td>4 ½ inches</td>
</tr>
<tr>
<td>42 inches and over</td>
<td>Heavy Weight</td>
<td>4 ½ inches</td>
</tr>
<tr>
<td>44 – 48 inches</td>
<td>Heavy Weight</td>
<td>5 inches</td>
</tr>
</tbody>
</table>

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.
   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. 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).

B. 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.

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.
SECTION 21 00 00
FIRE SUPPRESSION

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.

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 Contractor shall run a hydrant flow test for the project and shall pay all associated costs. The test must 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.


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 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.
   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

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 bypass 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 matching 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
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 models are LF909. 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.


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. Two copies of operations and maintenance manuals.

7. Hydraulic design placards.


9. Hydrostatic test of underground and aboveground piping.

10. Training of College personnel.

END OF SECTION
SECTION 22 00 00
PLUMBING

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.

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 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.
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.

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:
   a. Chilled water – dark blue
   b. Hot water – red
   c. Steam – orange
   d. Steam condensate – grey
   e. Pumped condensate – grey
   f. Domestic cold water – light blue
   g. Domestic hot water (including recirculation lines) – dark green

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### Preferred Manufacturers, Equipment and Materials Table

<table>
<thead>
<tr>
<th>Items</th>
<th>Manufacturer</th>
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<tbody>
<tr>
<td>Access panels/doors</td>
<td>Milcor</td>
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<tr>
<td>Water hammer arresters</td>
<td>Sioux Chief</td>
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<tr>
<td>Cleanouts</td>
<td>No hub: Josam</td>
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<td></td>
<td>Copper: Nibco</td>
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<tr>
<td></td>
<td>Polypropylene: Fuseal</td>
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<td></td>
<td>Flush floor: Josam</td>
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<td></td>
<td>Wall and concealed: Josam</td>
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<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Backflow preventers</td>
<td>Watts</td>
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<tr>
<td>Pressure reducing valves</td>
<td>Watts</td>
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<tr>
<td>Pressure gauges</td>
<td>Trrice</td>
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<tr>
<td>Valves</td>
<td>Domestic water ¾” to 2”: Apollo</td>
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<td></td>
<td>Domestic water 2” and greater: Quadax</td>
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<tr>
<td></td>
<td>Balancing valves: Apollo</td>
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<tr>
<td></td>
<td>Check valves: Nibco</td>
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<td></td>
<td>Drain valves: Apollo</td>
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<td></td>
<td>Shut-off valves: Apollo</td>
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<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Pipe, valve, and fittings covers</td>
<td>Johns Manville Zeston Hi-Lo, Truebro, or Brocar</td>
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<tr>
<td>Propress Type Fittings</td>
<td>Press Type Fittings for Piping: Viega ProPress and Viega MEGA Press 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</td>
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<tr>
<td>Material</td>
<td>Brand</td>
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<td>--------------------------------</td>
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<tr>
<td>Wall hydrants</td>
<td>Wade</td>
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<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Toilet room hose bib</td>
<td>Chicago</td>
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<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Floor drains</td>
<td>Jay R. Smith</td>
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<tr>
<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Tankless water heaters</td>
<td>Navien</td>
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<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Water closet</td>
<td>Wall mount: Kohler Kingston</td>
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<td></td>
<td>Floor mount: Kohler</td>
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<td>Or pre-approved equal</td>
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<td>Waterless urinal</td>
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<tr>
<td>Lavs</td>
<td>Kohler vitreous china; 4&quot; centers</td>
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<td></td>
<td>Or pre-approved equal</td>
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<tr>
<td>Lav faucets</td>
<td>Moen</td>
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<tr>
<td>Shower faucet</td>
<td>Moen</td>
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<tr>
<td>Mop receptor</td>
<td>Fiat; molded stone</td>
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<tr>
<td>Mop receptor utility faucet</td>
<td>Moen</td>
</tr>
<tr>
<td>Drinking fountain</td>
<td>Elkay bottle filler/water cooler combo</td>
</tr>
<tr>
<td>Shower basin</td>
<td>Panned with Choroloy and tiled Wedi system</td>
</tr>
</tbody>
</table>

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

All piping shall conform with the Massachusetts State Plumbing Code.

2. 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.

3. Type B: Type L hard drawn copper tubing with wrought copper sweat fittings joined with approved lead free solder.

4. Type C: Type L hard drawn copper tubing with Victaulic copper fittings to match.

5. Type D: No hub cast iron soil pipe and fittings joined with approved stainless steel...
mechanical couplings with neoprene gaskets.
6. Type E: (below grade only): Service weight bell and spigot cast iron soil pipe and fittings joined with neoprene resilient gaskets.
7. 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.
8. Type G: Type L hard drawn seamless copper tubing with wrought copper drainage fittings joined with lead free solder.
9. Type H: Schedule 40 black steel pipe with standard weight malleable iron fittings joined with threaded connections.
10. 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.
11. Steam condensate – Schedule 80
12. 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.
13. Pipe and fittings shall be in accordance with the following:
   a. Exterior Water Service
   b. Cold Water
   c. Hot Water Supply and Recirculation
   d. Sanitary Waste and Vent Inside Buried
   e. Sanitary Waste and Vent
   f. Waste and Vent Smaller than 2"
   g. Gas 2" and smaller
   h. Gas larger than 2"
   i. Water Heater Safe Pan Discharge
   j. Sanitary from Last Building Cleanout to 10'-0" beyond Foundation Wall
   k. Indirect Waste Piping smaller than 1-1/4"
   l. Indirect Waste Piping 1-1/4" and larger
   m. Gas Vents
   n. Sprinkler Piping
14. 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. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. All ball valves for installation in insulated piping shall have valve extensions to suit insulation thickness.
9. 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. 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. 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) Shower stall walls, drain pan, floor, soap dish and curtain rod shall be by the General Contractor. Plumbing Contractor shall provide Moen shower assembly. Panned and tiled with Choroloy a minimum of 6” up on walls.
   k. P-6A Shower (Handicapped Receptor by General Contractor):
      1). Shower stall walls, floor, soap dish, grab bars, seat and curtain rod shall be by the General contractor. Plumbing Contractor shall provide Moen shower assembly.
   l. P-7 Toilet Room Hose Bibb: Chicago No. 952 polished chrome plated hose bibb 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.

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. Furnish access 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. Access doors shall be prime coated of rust inhibitive paint, continuous hinge and manufactured by Inland Steel Products Company "Milcor" or approved equal. Provide screwdriver-operated latches only; no keyed latches.
SECTION 23 00 00
HEATING, VENTILATING AND AIR CONDITIONING

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.

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 e-Builder web portal.

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.

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.


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.

8. 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.

C. 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:

HEATING, VENTILATING AND HVAC

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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 gauges: 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.


9). Anti-microbial ultraviolet emitters for HVAC ducts and equipment: UV-C emitters.


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.

HEATING, VENTILATING AND HVAC

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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 circulating for smaller duty pumps.

18). Steam and condensate piping and pumps: See Preferred Manufacturers Table.

19). Refrigerant piping: ACR grade, brazed under nitrogen purge.


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.


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.


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.

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.

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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 Williams College Facilities Construction Department and/or 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 (OMM) in binders and on flash drive in PDF format.

END OF SECTION
SECTION 23 05 19

METERING STANDARDS

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.

PART 1 GENERAL

1.1 SUMMARY

A. All buildings that are served by the central heating plant, the chilled water plants, and 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, 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.

   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. BACnet or 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. BACnet or 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

E. Electric Meters:
      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 with appropriate 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. BACnet or 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.

END OF SECTION
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

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.

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

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.

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 e-Builder web portal.
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 e-Builder web portal.)

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 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

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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.

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.
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.
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, and 100 percent outside air mode of operation.

3.04 HYDRONIC SYSTEM PROCEDURE

A. Adhere to the following 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.

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 DISTRIBUTION EQUIPMENT

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.

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 Department.
   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 12 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 Operations Group.
   5. Other means for hot water generation during summer season must be provided.
   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 Operations Group.
   8. Steam Distribution piping is to be installed in tunnels, trenches, or direct bury (with approval of Williams Facilities Department).
   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.

PART 2 PRODUCTS

1.1 MATERIALS

A. Equipment Standards:
   1. Shutoff valves on Steam mains 4” and larger shall be Quadax four offset butterfly valve with flanged ends 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. Schedule 40 steam pipe: ASTM A53, Type S, Grade B carbon steel with standard weight fittings. Joints shall be butt welded (3” and larger) or socket welded 2 1/2” and smaller.

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 H2O 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. Traps in low pressure steam systems shall be float and thermostatic type: Sarco #FT-15 or approved equivalent by Illinois, Armstrong, or Hoffman.

8. 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.

9. Press-type fittings for piping are not acceptable for steam distribution.

END OF SECTION
NEW SYSTEMS SPECIFICATION
Updated: April 29, 2016

1.0 GENERAL

The contractor shall provide chemicals and labor for the pre-operational cleaning of all condensers, chilled water, hot water and related equipment.

First consideration for will be given to the owners existing water treatment firm.

2.0 PREPARATION FOR CLEAN-OUT

All systems must be prepared prior to the introduction of the chemical cleaner.

2.1 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.

2.2 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.

2.3 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.

2.4 The cleaner shall not require external heat to ensure its effectiveness.

2.5 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.

2.6 All Closed Loops will be cleaned with an alkaline cleaner except heating boilers with aluminum heating exchangers. Please speak to your treatment vendor.

2.7 Use the water meter to record the volume of each system during the first fill.
2.8 The system water will need to filtered and tested prior to system flushing. All testing results will need to be in compliance with the discharge permit: See Attached Discharge Limit Table.

3.0 PRE-CLEANING

3.1 For a cooling tower, maintain the lowest level possible in cooling tower sump.

3.2 Add recommended quantity of chemical directly to tower sump or closed system. Refer to MSDS sheets for safety information.

3.3 Circulate system for 48 - 72 hours (Confirm with Treatment Companies procedures). The system water will need to filtered and tested prior to system flushing. **All testing results will need to be in compliance with the discharge permit: See Attached Discharge Limit Table**

3.4 Open and drain mud legs and low points periodically during the cleaning process.

3.5 Once the Drain system completely paying particular attention to mud from drop legs and all low points. All testing results will need to be in compliance with the discharge permit prior to flushing: See Attached Discharge Limit Table

3.6 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.

3.7 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.

3.8 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.
Closed Loop Systems Treatment

1.0 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.

First consideration for will be given to the owners existing water treatment firm.

2.0 CHEMICAL FEEDING EQUIPMENT (HOT or CHILLEDD WATER)

For each closed system the contractor shall provide and install the following apparatus (including isolation and drain valves):

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

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.

One four-position corrosion coupon rack with coupon holders and flow meter.

3.0 WATER TREATMENT CHEMICALS

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 1,000 organisms per ml.

If copper materials are present in the system, the treatment will include azole levels of at least 5 ppm for the first 6 months.

Formulations shall not contain any ingredients, which may be harmful to system materials of construction. Provide MSDS sheets on all chemical products.
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.

The following chemicals will be used for mild steel and copper corrosion protection (For all systems with aluminum heat exchangers, please speak to your treatment vendor):

- Nitrite: For hot water systems. 400 – 800 PPM as Nitrite.
- Sodium Silicate: For chill water systems. 35 – 40 PPM as Total Silica
- Azole: Copper protection….used for copper protection in both systems. >10 PPM all Systems.

**NOTE:** All chemicals must be molybdenum / borate free.

### 4.0 TEST EQUIPMENT

Furnish basic 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.

### 5.0 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 will include:

- Installation and system start-up procedure recommendations.
- 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.
- Bi-monthly biological testing results verifying that the biological growth parameters have been met.
- Training of operating personnel on proper feeding and control techniques.
- 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.
- Any necessary log sheets and record forms.
• 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.
• Any required technical assistance

All services should be provided by Williams College’s Treatment Vendor.

**Condenser Water Systems Treatment**

1.0 **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.

First consideration for will be given to the owners existing water treatment firm.

1.1 **CHEMICAL FEEDING AND CONTROL EQUIPMENT – CONDENSER SYSTEM**

Contractor shall install the following apparatus (including all external piping and wiring):

1.2 One (1) -- complete microprocessor-based conductivity controller designed to control conductivity and chemical feed in cooling towers. The unit will have the following features:
   • Blow down of system water by valve control based on Conductivity set point.
   • Conductivity range should be 0 – 2,000 or greater.
   • Remote Communication Capabilities. TRACE Capabilities
   • Rising or Falling conductivity trip points
   • Feed of chemical (inhibitor) will be based on flow meter input.
   • Dual biocide addition accomplished by the use of two (2) individually programmable relays.
   • Biocide lockout timer.
   • 28-DAY programmable timer (1, 2, 3, or 4 week selectable cycle) for biocide addition.
   • 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).
   • The display is a 16-character backlit LCD (liquid crystal display) which is visible in all light conditions.
   • 4-20 mA non-isolated recorder output.
1.3 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-gasifying head.

1.4 One (1) -- water meter complete with dry contacting register sized to meter twice the volume of the maximum make-up of the system.

1.5 One (1) pre-piped bleed-off piping assembly consisting of inlet shut-off valve, wye strainer, flush valve, throttling valve and 0 PSI differential brass solenoid valve. Bleed-off piping assembly shall be sized to bleed twice the maximum bleed-off rate of the system.

1.6 One (1) -- Four-position corrosion coupon rack with coupon holders and flow meter.

1.7 New Chillers require the following cleaning / inspection:

- Drop both heads
- Punch using the correct brushes. Since nearly all tubes these days are enhanced tubes the new tubes need to be brushed with the “Christmas Tree Brushes”. Brushes should be changed every 5-10 tubes.
- Punching of the tubes need to be accomplished with a reversible tube brushing machine with the correct torque for that size tube.
- An alkaline phosphate cleaner is squirted into each tube as they are brushed to remove the oils of manufacture.
- The newly cleaned tubes should have a minimum of 3 tubes borescoped to insure the removal of the oils of manufacture. One hot, one high flow, and one low flow tube must be inspected.
- A base-line Eddy Current should be performed after cleaning to insure the integrity of the tubes.
- After tubes have been exposed to water they should not be left open to the atmosphere for more than 1 week.
- Upon flooding of the tubes, azole levels must be bumped to 20 PPM to insure re-passivation of the copper.
2.0 WATER TREATMENT CHEMICALS

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.

Biological populations must be maintained below 10,000 organisms per ml. No algae growth is permitted.

Formulations shall not contain any ingredients, which may be harmful to system materials of construction. Provide MSDS sheets on all chemical products.

No system shall be operated without the benefit of chemical protection.

If copper materials are present in the system, the treatment will include Azole levels of at least 5 ppm for the first 6 months.

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.

All Galvanized Cooling Towers should go through a 90 day passivation period. The treatment company should submit a passivation procedure for approval, prior to any start-up.

Any equipment that will be idle for an extended period of time will need to be layed up properly.

A dual, alternating biocide system is required. The primary biocide shall be fed (twice or three times) per week. The secondary biocide should be fed at least once per week. The following are the only biocides and minimum dosages that shall be accepted:

- Phosphonate/Polymer/Azole. **(No MO Trace)**
- Liquid Bromine fed 90 PPM 3x/ week.
- Glutataldehyde fed at 120 PPM once per week.

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.

To ensure operator safety all chemical products shall be provided in liquid form for direct feed from shipping container to cooling system.
3.0 TESTING EQUIPMENT

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.

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.

4.0 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:

- Installation and system start-up procedure recommendations.
- 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.
- Monthly biological testing results verifying that the biological growth parameters have been met.
- Training of operating personnel on proper feeding and control techniques.
- 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.
- 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.
- Any necessary log sheets and record forms.
- Any required technical assistance.
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 on site.

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.
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 automation system.
4. Controllers with inputs and outputs (I/O) for controlling central plant and air handling systems with customizable 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.
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,
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.
11. Provision of an 18-month warranty on all components.
12. Provision of 18 months of maintenance (to be included in project cost).
13. Demonstration and confirmation that all systems are programmed and operation correctly.
14. Submission of back-ups of up-to-date programs in each controller shall be submitted on flash drives and uploaded to e-Builder. 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.
15. Submission of one (1) printed copy and upload to e-Builder of the final programs and documented programmed sequences of operation.
16. 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.
17. 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.
18. Provide all the necessary software and interface devices for all BAS-based systems.
19. 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.)
20. Include the cost of a preventative maintenance service contract, during the one- (1) year, defects liability guarantee period. Include all parts and labor in the service contract during the one-year guarantee period. Provide two site visits of approximately one day each and two, quarterly remote access reviews of the system.
21. 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.
22. All control panels shall be labeled with engraved phenolic labels, mechanically secured, indicating components served.
23. In addition to project closeout requirements, a printed copy of as-builts of equipment served at each panel shall be provided and attached in protective sleeves.
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.

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 eBuilder 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

GENERAL REQUIREMENTS

1. 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
NFPA  National Fire Protection Association
MSBC  Massachusetts State Building Code
UL  Underwriters Laboratories, Inc.

2. Shop Drawings: All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College e-Builder web portal.

3. 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.

4. 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.

5. 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-builds will be done through the Williams College e-Builder web portal. O&M manuals shall include copies of all approved submittals. Electronic as-builds shall be provided in .dwg format for AutoCAD 2016.

6. Tests: The Electrical Subcontractor shall perform all tests at the completion of the work and the results furnished to the Owner and Architect in writing. Tests shall include but not be limited to:

   a. All systems test free of shorts or grounds,

   b. Proper neutral connections, ground system resistance, secondary voltages at main distribution panel.

   c. Emergency power/lighting shall pass a 90-minute pull-the-plug test.
7. Related Work.
   
   b. All automatic temperature control system components, wiring and interlock wiring
      associated with the heating, ventilating and air conditioning system.
   
   c. Finish painting, except factory finished items.
   
   e. Starters and control devices for other equipment.

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.
   
   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

2. Electro-Galvanized Steel Metallic Tubing (EMT) shall comply with UL Standard 797, and ANSI
   C 80.3. EMT shall be use 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 use as an alternate to
   EMT with the approval of Williams College. MC cable must have 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 concrete, rigid galvanized steel elbows shall be used where the conduit is run through concrete slab. Also a separate grounding conductor with green insulation shall be provided in these runs.

b. Underground telephone service duct bank encased in concrete.

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.

9. 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.

10. Where empty conduits are required to be installed, provide a continuous #12 nylon draw line with identification tag securely attached to both ends.

11. 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.

12. 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 Janitors 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.

**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: Manholes shall be provided with a drain to the storm sewer that will not backwash shall have 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. Manholes Covers located sidewalks or landscaped areas shall be heavy duty H-20 wheel loading. They shall be constructed of heavy duty fiberglass Model FL90 manufactured by
4. Ground: A copperweld ground rod shall be installed in each manhole for bonding of hardware and cable sheaths.

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 and 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 follow:

   For 120/208 Volt System
   - Phase "A": Black
   - Phase "B": Red
   - Phase "C": Blue
   - Neutral: White
   - Ground: Green

   For 277/480 Volt System
   - 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:
      1. Fire Alarm-Red
      2. Security-Blue
      3. Voice/Data-Yellow
      4. Power 120/208-Green
      5. Power 277/480-Brown
      6. Emergency 120/208-Orange
      7. Emergency 277/480-Orange w Brown strip
      8. Lighting 120/208-White
      9. Lighting 277/480 White with 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.
2. Primary Distribution:

   a. 15kV Distribution Switches: Used for all 114.16kV & 13.8kV distribution switch applications. Manufactured by G&W Electric. Unit shall have the following features: gas insulated, vacuum interrupters, 15kV Class, 12kA Interrupting, 600A bussing, 600A terminations (all ways), integral ground position (all ways), Type 3 Electronic trip unit (30-600A).

   b. 15kV Cable: Use for all 114.16kV & 13.8kV distribution system cable applications. Manufactured by Kerite or Okonite. Cable shall have the following features: EPR insulation, MY-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. Main Line tunnel runs shall be no less than 350KCM 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 Cooper Power Systems. Units shall be "Star Faulted Circuit Indicator", Current Reset type (2.4A minimum), High Trip rating (800A), Model# SCHI.

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; 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.

UNIT SUBSTATIONS

1. Buildings and their equipment shall be served by unit substations where applicable, as required for the load. Generally substations shall be single ended type, 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 Padmount Transformers: For all outdoor transformer applications. Manufactured by Cooper, 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.

b. 6kV Elbow Arrestors: Use on all 4.16kV padmount type transformers for surge protection. Manufactured by Cooper Power Systems. 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, Cooper, 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 in 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, system, 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.

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 the exothermic process to form solid metal joints. 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 PVC underground conduits to the poles.

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 shall 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 of 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.

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. Locking tabs shall be provided on all circuit breakers serving emergency lighting, fire alarm system, security systems and other emergency or critical equipment.

e. 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.

f. Circuit breakers feeding 120 volt lighting circuits that are not controlled by local wall switches shall be approved type "SWD" circuit breakers.
5. Panel boards shall be initially designed to that they are not loaded to more than 75% of breaker space capacity.

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.

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 in 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.

f. 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.

g. 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 effected by three element overload relays with adjustable heater element positions.

h. Engraved nameplates shall be provided for each unit of the motor control center as well as the assembly.

6. 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.

7. 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


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.
   (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
   (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.
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.

<table>
<thead>
<tr>
<th>Area/Room Name</th>
<th>Maintained Foot-Candles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices &amp; Secretarial Areas</td>
<td>55-60</td>
</tr>
<tr>
<td>Laboratories</td>
<td>75-80</td>
</tr>
<tr>
<td>Study Areas &amp; Classrooms</td>
<td>50-60</td>
</tr>
<tr>
<td>Conference Rooms &amp; Meeting Rooms</td>
<td>40-50</td>
</tr>
<tr>
<td>Lecture Hall, Auditorium/Multi-Purpose</td>
<td>35-50</td>
</tr>
<tr>
<td>Corridors &amp; Stairwells</td>
<td>15-20</td>
</tr>
<tr>
<td>Reception/Lobby, Lounge</td>
<td>30-35</td>
</tr>
<tr>
<td>Mechanical, Electrical, Telephone &amp; Elevator Machine Rooms</td>
<td>25</td>
</tr>
<tr>
<td>Receiving Areas</td>
<td>30</td>
</tr>
<tr>
<td>Storage Areas</td>
<td>10-15</td>
</tr>
<tr>
<td>Rest &amp; Locker Rooms</td>
<td>25-30</td>
</tr>
<tr>
<td>Critical work areas such as tissue labs, culture plate areas, Instrument rooms, etc.</td>
<td>90-100</td>
</tr>
<tr>
<td>Temporary site lighting for security purposes</td>
<td>1-3</td>
</tr>
<tr>
<td>Walkways for pedestrian security</td>
<td>2-2.5</td>
</tr>
<tr>
<td>Parking Lots</td>
<td>1-1.5</td>
</tr>
<tr>
<td>Parking Decks</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Interior Lighting:
   a) All lamps shall have a color temperature of 3500K.
      a. LED-based lighting is generally preferred. Fluorescent, incandescent, and other fixtures may be used only when approved by Williams College.
      b. Stairwells in buildings shall have sufficient fixtures so that loss of one lamp will not leave the area dark.
      c. Emergency exit signs shall Exitronix #602 and #603 series, or approved equal. Use Exitronix CT700 series or approved equal where identifying an accessible route or exit is required.
      d. Emergency lights shall be Lithonia ELM2 LED, or approved equal.

3. Exterior Lighting:
   a. Lighting for the entire site development of a building shall be included in the building contract documents.
a. All site and exterior building fixtures shall be tied to campus BMS. Any deviation from this standard must be requested in writing.

b. Occupancy sensors shall be utilized for interior lighting control for energy conservation that produces a payback in 7 years or less. The designer shall review the application of the required sensors for the various areas throughout a facility. Sensors shall not be used in areas such as corridors, stairwells, laboratories, public areas, lobbies, mechanical & electrical rooms, and any other area where a safety hazard may be created by lights going off automatically. Occupancy sensors shall be manufactured by Sensor Switch or approved equal.

c. The use of multiple switching shall be evaluated for each space and condition. Where possible, switching shall be used to effectively reduce artificial lighting near window, permit light reduction for non-critical tasks and during partial occupancy, and reduced lighting for custodial activity.

d. All exterior and security lighting shall be powered from one location in the building, namely the main electrical room.

e. Remote switching by means of campus BMS shall be evaluated for special areas.

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 faculties, 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, and in laboratory areas.
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.

END OF SECTION
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-2004).

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, 2004 Edition, “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 with a minimum arc thermal performance rating (ATPV) of 40 calories/cm².

1.3 SYSTEM ANALYSIS

A. A Comprehensive analysis of Williams College’s electrical system shall be performed for all equipment 480 volt and higher and 240 volt served by a 125kVA or larger transformer 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 1584-2004a, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70, "Standard for Electrical Safety in the Workplace", 2004 Revision, 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.

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 with a minimum arc thermal performance rating (ATPV) of 40 calories/cm2.
B. Safety practices that shall be followed include, but are not limited to, the following:
   1. Occupational Safety and Health Act
   3. Applicable state and local safety operating procedures
   4. Owner’s safety practices

C. Perform all work in accordance with the applicable codes and standards of the following agencies except as provided otherwise herein:
   2. ANSI/NFPA 70: National Electrical Code
   3. ANSI/NFPA 70B: Recommended Practice for Electrical Equipment Maintenance
   4. NFPA 70E: Electrical Safety Requirements for Employee Workplaces

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

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.

B. Product Standards

1. 15kV Distribution Switches: Used for all 4.16kV & 13.8kV distribution switch applications. Manufactured by G&W Electric. Unit shall have the following features: gas insulated vacuum interrupters, 15kV Class 12 kA interrupting, 600A bussing, 600 A terminations (all ways), integral ground position (all ways), Type 3 Electronic Trip unit (10-600 A).

2. 15 kV Cable: Use for all 4.16kV & 15 kV distribution system cable applications. Manufactured by Kerite or Okinite. 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 ductline runs shall be no less than 500 KCM with 1/0 Neutral. Main Line tunnel runs shall be no less than 350 KCM with 1/0 Neutral. Taps to serve single transformers shall be no less than 4/0 with 1/0 Neutral.

3. 6kV Elbow Arrestors: Use on all 4.16 kV padmount transformers for surge protection. Manufactured by Cooper Power Systems. Unit shall be a 200 A Elbow Mount, VariGap MOV, 5.1kV MCOV.

4. Dry Type Transformers: For use with indoor transformer vault applications. Manufactured by Square D, Cooper, 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), deenergized tap changer, air terminal chamber for primary terminations.

5. Oil Filled Padmount Transformers: For all outdoor transformer applications. Manufactured by Cooper, Carle, 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), deenergized tap changer, liquid level gauge.

6. Manholes: Use for all underground electrical ductline applications. Unit shall have the following features: Inside dimensions 7'H x 6'W x 14'L, 36" fiberglass manhole cover (by Fibrelite Corp.), 32 wall mounted fiberglass cable racks (by Underground Devices Inc)

C. Testing: 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. They must also be a member of the International Electrical Testing Association (IETA). Testing procedures shall be as described in IETA “Acceptance Testing Specifications”.

END OF SECTION
Williams College Office of Information Technology
Electronic Classroom Equipment Specifications

Latest update: February 17, 2016

Williams College has more than 100 rooms that include electronic presentation equipment and any new installations should be in line with existing standards.

All new installations are to be high definition/HDMI compatible rooms.

The control systems are Extron and new installs control interfaces should be based upon either the Extron MLC type push button control panel or, in the case of dual projection rooms, an Extron touch screen. GUI for touch screens should match existing Williams design.

Existing rooms fall into one of the three following configurations:

Registrar Scheduled Classrooms or other rooms:
- 1 projector/electric screen or flat screen, audio system, VGA and HDMI inputs for laptops etc. with MLC type push button control.

Registrar Scheduled Classrooms Only:
- 1 projector/electric screen or flat screen “TV”, audio system, VGA and HDMI inputs for laptops etc. with MLC type push button control, plus resident Mac and PC computers with optical drives and USB access, VCR/DVD combo player
- 2 projectors/electric screens, audio system, VGA and HDMI inputs for laptops etc, plus resident Mac and PC computers with optical drives and USB access, VCR/DVD combo player with MLC type push button control. (Dual projection venues will use new design utilizing Extron Crosspoint 84 and Extron touch screen to replace current dual Extron IN1606 model.) Dual projection systems provide for extended desktop presentation from both Mac and PC.

Specifications for installation

projector
- 5000 lumen minimum (up to 12K for larger venues).
- Panasonic EZ580 benchmark. (Panasonic LED/laser models in testing)
- HD
- RS232 control
- Cat6 capable for remote monitoring
- Cat6 network connection available
- 2 ganged duplex 20 Amp AC receptacle
screens
- Dalite Advantage Electrol w/built-In low voltage control.
- 16 x 9/10 aspect ratio
- locate to allow blackboard/whiteboard workspace when screen is down
- duplex 20 Amp AC receptacle adjacent to screen, screen AC terminated in standard 3 prong plug

wall plate inputs
- one HDMI/one VGA or two HDMI

control processor and rack location
- Extron IN1606 or IN1608
- 2 ganged duplex 20 amp AC receptacle
- 4 jacks to Williams network (2 for resident computers, 1 for remote monitoring)
- Mid-Atlantic rack, wood or metal side panels, no door (equipment visible and available)
- empty rack spaces finished with blanks
- user control, jacks for connecting to system, screen controls to be located near screen

projector control/signal path
- Extron DTP HDMI 230 Tx and Rx, shielded Cat6 wiring
- Extron Medialink MLC-226 or similar Extron MLC

sound system
- JBL control 28 or fuller range speaker
- JBL CSA-2120 amplifier, mono

special circumstances
- large venues require brighter projectors, larger sound systems, larger screens etc
- dual projection venues will use new design utilizing Extron Crosspoint 84 and Extron touch screen to replace current dual Extron IN1606 model
- touch screen design will be based on existing designs for standardization across campus
SECTION 28 31 00

FIRE ALARM SYSTEMS

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.

PART 1   GENERAL

1.1    SUMMARY

A. Fire alarm system with hardware and components manufactured by Notifier. 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.

B. Quality Assurance

1. D.B. measurements shall be made by fire alarm installer to ensure audibility in all sleeping rooms per NFPA.

2. Provide 2 separate category 6 cables from the Fire Alarm Control Panel to the nearest telecommunication closet. Terminate cable with modular ends at the FACP communicator. (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 110 candela ADA compliant xenon strobe in each room.

C. Submittals

1. All distribution, review, comments and acceptance of submittals, with the exception of samples and mockups, will be done through the Williams College e-Builder web portal.

2. Submit all components for approval prior to order.

3. Plans of system with device locations must be approved by Manager of Safety and Environmental Compliance Office & 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. Spare parts to be supplied with system:
   a. One smoke detector of each type.
   b. One base.
   c. One heat detector.
   d. One pull station.
   e. One horn strobe.
   f. One module of each type

7. System shall be warranted for parts and services for one year, commencing after system acceptance.

8. 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 (3 1/2 ft) and not more than 1.37m (4 1/2 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 approved, 75 candela xenon strobe flashing light and horn combination units and stand-alone strobes, except for sleeping areas and bathrooms which shall be 110 candela. 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.

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-speedNotifier 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.

B.   Cabling & 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.

<table>
<thead>
<tr>
<th>Red &amp; Black</th>
<th>Horn/Strobes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Magnetic door holders</td>
</tr>
<tr>
<td>Blue &amp; Yellow</td>
<td>Sounder Bases</td>
</tr>
<tr>
<td>Shielded Cable</td>
<td>Annunciator - Only</td>
</tr>
<tr>
<td>Fire Cable Non-Shield Twisted</td>
<td>SLC Loop</td>
</tr>
</tbody>
</table>

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

Cabling 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.

C.   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.
D. 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.

E. 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.

F. Audible/Visual Annunciation Devices

1. Audible devices shall be installed as shown on plans.

2. Provide one weatherproof audible/visual device on the exterior of the building above the entrance which leads to the Annunciator panel.

3. 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.
G. 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.

H. 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.

I. 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.

J. 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.

K. 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 random devices throughout the building.
4. Final acceptance test shall be conducted in the presence of the building official (chapter 9§901.5), the owner’s representative, and the architect/engineer. 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. Temporary signage is acceptable.
      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.
   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 the card reader doors perform as designed when the fire alarm activates.

7. Contractor to supply fire alarm control program on flash drive and uploaded into e-Builders.

END OF SECTION
SECTION 32 10 00

BASES, BALLASTS, AND PAVING

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.

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, with snow melting system.
4. Pre-cast concrete curbing.
5. Cast-in tactile strips for accessibility.

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.
3. AASHTO: American Association of State Highway and Transportation Officials.

1.4 REFERENCE STANDARDS

A. Traffic Calming Guidelines, prepared by the Institute of Transportation Engineers, New England Section – Technical Committee, for the Massachusetts Highway Department,
November, 2000, is incorporated into this section by reference. Note to Designer: The above noted reference standard should be used as a guide for the design of all vehicular access intersections with pedestrian traffic and roadways within the Williams College Campus. Refer to it for guidance in the comprehensive planning process, resource list, configuration and detailing of traffic calming devices. Refer to the Project Manager for specific design criteria.

1.5 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 e-Builder web portal.

B. At least thirty (30) days prior to intended use, the Contractor shall provide the following samples and/or submittals for approval in conformance with requirements of Section 01300, SUBMITTALS. Do not order materials until the College's approval of samples, certifications or test results have been obtained. Delivered materials shall closely match the approved samples.

1. Concrete design mix for all concrete pavements.
2. Shop Drawings indicating locations of expansion joints in concrete pavement.
3. Design Mix: Submit a design mix for all bituminous concrete for approval prior to ordering materials for the project.
4. Samples
   a. Submit product literature for the following items:
      1) Joint filler, removable plastic joint cap, primer and sealant for expansion joints.
      2) Concrete curing compound.

PART 2 - PRODUCTS

2.5 BITUMINOUS CONCRETE PAVEMENT

A. At least thirty- (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. The master range composition tolerances for bituminous concrete materials shall be as follows:

1. TABLE A (As Modified)

<table>
<thead>
<tr>
<th>Percent by Weight Passing Square Opening Sieves</th>
<th>Binder Course</th>
<th>Dense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Sieves</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1&quot;</td>
<td>80-100</td>
<td></td>
</tr>
<tr>
<td>¼&quot;</td>
<td>55-80</td>
<td></td>
</tr>
<tr>
<td>⅝&quot;</td>
<td>28-50</td>
<td>80-100</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>20-38</td>
<td>48-63</td>
</tr>
</tbody>
</table>
No. 16
No. 30
No. 50
No. 100
No. 200
Bitumen

36-49
24-38
14-27
6-18
4-8
4.5-5.5

1. For dense mix the maximum aggregate size allowable shall be 3/8".

2. Bituminous concrete for roadway shall consist of two (2) courses of bituminous concrete with a minimum finished pavement depth after rolling of three (3') inches.
   a. Binder course shall be two Inches (2") in thickness consisting of one lift of Binder Course bituminous concrete.
   b. Finished top course shall be one Inch (1') in thickness consisting of one course of Dense Mix bituminous concrete as modified herein.

C. Base materials shall be specified under Section 02200, Earthwork. Depths shall be as shown on the Drawings.

2.6 TACK COAT

A. Tack coat shall consist of asphalt emulsion, Type RS 1 as described in the Standard Specifications under M3.03.0 and M3.11.06.

2.7 CONCRETE PAVEMENT

A. 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.

B. Concrete mix shall be meet the following requirements:

Cement Type 11: 540# / cy
Coarse Aggregate (*): 1705# / cy (SSD)
Fine Aggregate (Sand): 1405# / cy (SSD)
Air entraining Agent:
(W R. Grace Daravalr): 6.1 oz. / cy
Water: 33 gal. / cy
Slump: 1" - 3"
Air: 6% +/- 1

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:

   BASES, BALLASTS, AND PAVING
   32 10 00 - 3
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 joints 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.

2.8 PRECAST CONCRETE CURBING

A. Pre-cast concrete curb units shall consist of castings conforming to a six inch by eighteen inch (6” x 18”) nominal profile size with a seven inch (7”) base dimension. Straight curb shall be cast in lengths of six feet (6’). Straight and curved curb may be cast in lengths of not less than three feet (3’) for closure sections only. Curb on a radius of one hundred feet (1 W) or less shall be cast in radius forms to the correct radius (radius measured to the outside face of the curb). All curbs shall have a ½ inch chamfered edge on both ends. Front top edge shall have 3/4-inch radius and back top edge shall have 1/4-inch radius. Footings shall be as dimensioned on the drawings and shall be three foot six Inches (3’ 6”) in depth. All edges of the footings shall match the curb edges as far as chamfers and radius corners are concerned. Front top edge and back top edge shall have same radius and ends that abut curb shall have same chamfered edges. The curb and footing shall form an integral curbing system.

B. Cement: Curb and footings shall be made of Portland cement types I or IN, conforming to ASTM C150 81. Admixtures shall meet ASTM C233 82. Forms shall be made of metal (wood not allowed) to tight, rigid construction with true surfaces.

C. Concrete mix for curb and footings shall be made of maximum three quarter inch (3/4”) aggregate, with a design strength of 5,000 psi at twenty-eight (28) days. An air entraining agent either Master Builders MBVR, Darex AEA, or approved equal shall be added at the mixer in accurately proportioned amounts to give air content to the concrete of not less than five percent (5%) and not more than seven percent (7%) by volume. A high range water reducing agent (super plasticizer) such as Master Builders Pozolith 400 N, Mighty BASES, BALLASTS, AND PAVING
WILLIAMS COLLEGE DESIGN STANDARDS

WILLIAMS COLLEGE DESIGN STANDARDS

750 or approved equal shall be added at the mixer in accurately proportioned amounts to meet design strength requirements and maintain a smooth, dense surface on the curb and footing units.

D. Surface Treatment: Upon removal from the forms, the surfaces of the curb and footings shall have all surfaces rubbed with a carborundum stone to fully remove any rough or imperfections in the cast finish. All curbing sections shall have a uniform color and finish appearance and shall be approved by the College Representative. An approved sample shall be standard for entire lot.

1. Curb shall be reinforced with rebar conforming to ASTM A615.
2. Sleeves for footings shall be 4-inch dia., length as shown on the drawings. EZ Removable sleeve 1/16" thick tapered plastic sleeve with base as manufactured by Auciello Iron Works, 550 Main St., Hudson, MA. Telephone (508) 568 8382, or an approved equal.

E. Grout for fence post shall be non-shrink grout as specified and installed as part of steel picket fence specified under SECTION: SITE IMPROVEMENTS.

F. Expansion joint material for use in closure pieces of curb or footing as necessary to install section of curb that abuts an existing or stationary element shall be a pre-molded wood fiber strip meeting the requirements of ASTM D-1751, US FED. SPEC HH-F-341 e Type 1, and ASSHTO M213 65, without the bituminous additive. Color shall be light gray to match the curbing. Expansion joint material shall be Homex 300 as manufactured by Homasote Company (609) 883 3300 or an approved equal. This material shall be installed as part of the work of this Section.

1. Crushed stone and gravel borrow for base under the curb and footings shall be as specified in SECTION: EARTHWORK.

2.9 BITUMINOUS CONCRETE CURB

A. Bituminous concrete for curb shall be Class I conforming to the applicable requirements for "dense mix". Paragraph M3.12.0 and M3.11.03, Table A of the Standard Specification.

B. Asphalt tack coat shall conform to M3.11.06 of the Standard Specifications.

PART 3 - EXECUTION

3.5 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. The College Representative may require the Contractor to remove and replace at his own expense any defective mix not conforming to the specified Job mix formula.

D. After the bituminous base has hardened, a tack coat of bituminous material as specified shall be uniformly applied by mechanical means to the base surface at the rate of 1/20 gallon per square yard immediately prior to laying the top course of new pavement.

E. If at any time before the final acceptance of the work, any soft, imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new materials and then compacted until the edges at which the new work connects with the old become invisible.

F. Bituminous Concrete Placement: General Requirements

1. The mixtures shall be placed and compacted only at such times as to permit the proper inspection and checking by the College Representative.

2. The mixtures shall be placed only upon approved surfaces that are clean and dry; and when weather conditions are suitable. No bituminous material shall be applied when the temperature is below 32°F.

3. The temperature of bituminous concrete mixture when delivered to the site shall conform to the following, with a tolerance of plus or minus 20°F.

<table>
<thead>
<tr>
<th>Air Temperature</th>
<th>Project Delivery Temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>35°F</td>
<td>300°F</td>
</tr>
<tr>
<td>40°F</td>
<td>290°F</td>
</tr>
<tr>
<td>65°F</td>
<td>280°F</td>
</tr>
<tr>
<td>90°F or over</td>
<td>275°F</td>
</tr>
</tbody>
</table>

4. The contact surfaces of curbing, manholes, catch basins or other appurtenant structures in pavement shall be pointed thoroughly with a thin uniform coating of tack coat just before any bituminous is placed against them.

G. Machine Spreading

1. The equipment for spreading and finishing shall be mechanical, self-powered pavers, capable of spreading and finishing the mixture true to lines, grade, width and crown by means of fully automated controls for both longitudinal and transverse slope.

2. All mixtures shall be deposited in an approved mechanical spreader and immediately spread thereby, and then struck off in a uniform layer to the full width required and of such depth that each course, when compacted shall have the required thickness and shall conform to the grade and cross section contour specified.

H. Hand Spreading

1. Spreading by hand methods will be permitted only for particular locations in the work which because of irregularity, inaccessibility or other unavoidable obstacles do not allow mechanical spreading and finishing.
I. Compaction:

1. After the paving mixture has been properly spread, compaction shall be obtained by the use of power rollers of approved design and weight per inch of roller. The rollers shall be steel wheeled supplemented with pneumatic tired rollers where required.

2. Along curbs, structures and all places not accessible with a roller, the mixture shall be thoroughly compacted with mechanical tamping devices. The surface of the mixture after compaction shall be smooth and true to the established line and grade.

3. The densities of the completed pavement shall be not less than 95% of the density obtained from laboratory compaction of a mixture composed of the same materials in like proportions.

J. All areas of finished paving on which water stands or which are found excessively uneven shall be promptly brought to the correct grade and line. When tested with a ten foot (10') straightedge there shall be no deviation from true surface planes represented by the grade elevations shown on the drawings in excess of one quarter inch (3”).

K. Do any repair or patching to pavements outside the project site damaged by work of the contact. All patching work required shall be in accordance with requirements for new construction.

L. 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.

3.6 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.

3.7 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.

3.8 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 (55EF). In addition to the above requirements, an additional three (3) days of protection from freezing shall be maintained.
3.9 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.

3.10 BITUMINOUS CONCRETE CURB

A. Bituminous concrete curb shall consist of machine formed bituminous concrete to the dimensions and details shown on the Drawings.

B. Immediately prior to laying the curb, the underlying bituminous pavement surface shall be cleaned of all foreign or objectionable matter with power blowers, power brooms or hand brooms. The portion of the surface prepared for immediate treatment shall be dry and in a satisfactory condition. Immediately following the preparation of the surface, the bituminous material for tack coat as specified herein shall be applied either by means of a pressure distributor or by hand methods.

C. Upon arrival at the site, the mixture shall be transferred from the truck to the hopper of an automatic curbing machine and the mixture shall be kept clean and free from dirt or foreign materials at all times. The automatic curbing machine shall be the self-propelled type, equipped with a hopper, distributing screw and an interchangeable forming mold which can be raised or lowered and shall be capable of shaping hot bituminous mixtures to the cross section, as shown on the plans, without tearing, shoving or gouging. It shall produce a finished surface of uniform evenness. The machine shall be either wheel or skid mounted and shall be capable of forming curb to a radius of forty-seven feet (47). Size, weight and speed shall be synchronized so as to produce a smooth, even distribution of mixture. The machine shall be propelled entirely by the pressure resulting from the asphaltic mixture being forced into the mold by the worm feed.

D. Asphalt mixtures that have a temperature of less than 225E F when dumped into the hopper will be rejected. The mold or compaction chamber of the curb machine shall be so adjusted as to be not greater than one quarter inch (1/4”) above the surface of the underlying pavement. The mechanical curb machine shall be adjusted and the speed regulated in order to obtain the maximum degree of compaction and density and to insure that the surface will be smooth and in conformance to the cross section, line, and grade.
as shown on the Drawings. Placing of the mixture shall be as nearly continuous as possible. The surface of the curbing shall be tested with a ten foot (10') straight edge and any variations from a hue line exceeding one quarter Inch (1/4") shall be satisfactorily corrected.

E. After the completion of curbing, traffic shall be kept at a safe distance for a period of not less than twenty-four (24) hours and until the curbing has set sufficiently to prevent injury to the work.

F. If at any time before acceptance of the work any soft or imperfect spots develop in the exposed surface of the curb, such material shall be removed and replaced with new curb, without additional compensation to the Contractor.
SECTION 32 00 00

LANDSCAPE WORK

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, 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 “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 each tree and shrub with securely attached waterproof tag bearing legible designation of botanical and common name.

7. 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.

8. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and label with number to assure symmetry in planting.

9. 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 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 approves the following local sources of topsoil:

   Vermont Natural Soils, Stamford, VT
   Galusia 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 6%, and not to exceed 10% 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.

5. For lawn areas where topsoil pH is below 5.0, limestone shall be added at a rate of 2-1/2 (two and one half) pounds per cu. yd. of topsoil to raise the pH value one full point.

   a. Limestone: Shall be raw, ground agricultural limestone containing not less than 85% calcium carbonate and shall be ground to such a fineness that 50% shall pass through a 100 mesh sieve, and 90% through a 20 mesh sieve.

6. Where topsoil pH is above 7.0, aluminum sulfate shall be added at a rate of 2-1/2 pounds per cu. yd. of topsoil to lower the pH value one full point.

   a. Aluminum sulfate: In dry powder form.

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 trees and shrubs, provide fertilizer with not less than 5% total nitrogen, 10%
available phosphoric acid and 5% soluble potash.

2. 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 “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 for type and species required. Provide
single stem trees except where special forms are shown or listed.

1. Provide balled and burlapped (B&B) 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 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. 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, Bordeaux, 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 perenne) 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.
5. 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.


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. Fertilizer shall be complete, partially organic, containing by weight: 10% nitrogen, 10% phosphorous, 10% potash.

3. For pit and trench type backfill, mix planting soil prior to backfilling, and stockpile at site.

4. For planting beds and lawns, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.
a. Mix lime with dry soil prior to mixing of fertilizer.

b. Prevent lime from contacting roots of acid-loving plants.

c. Apply phosphoric acid fertilizer (other than that constituting a portion of complete fertilizers) directly to subgrade before applying planting soil and tilling.

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, completely remove 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 for lawns.

   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 within 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.

4. Mix with specified soil amendments and fertilizers to a depth of not less than 12" (twelve inches).

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

1. 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. 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.

2. 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.
3. Dish top of backfill to allow for mulching.

4. 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.

   a. Provide a 3" (three inch) thickness of mulch. Mulches are not to be applied against collar of trees and shrubs.

5. If deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.

6. 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.

7. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

8. 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 of 5-6 lbs per 1000 square feet of soil surface. Increase by 20% for new seeding on slopes in excess of a 3:1 ration.

   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
glass.

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 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 substantial completion.

2. If seeded in Fall continue maintenance the following Spring until lawn is established
and accepted, IN WRITING, by Architect.

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" (two 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 will, upon request, make an inspection to determine acceptability.

1. Landscape work may be inspected for acceptance in parts agreeable to Architect, 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 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 Grounds Supervisor, in writing, before final turn over.
SECTION 33 61 00
CHILLED WATER DISTRIBUTION SYSTEM

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.

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 Supply (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.

Valve and Gauge Chart

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Requirements</th>
<th>Acceptable Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valve</td>
<td>1/2” to 2&quot;</td>
<td>Two piece with Stainless Steel Trim</td>
<td>Sharpe High-Performance Ball Valves or approved equal.</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>21/2&quot; to 5&quot;</td>
<td>Iron Body class 125,200# WOG</td>
<td>Quadax or approved equal</td>
</tr>
<tr>
<td>Globe Valve</td>
<td>21/2&quot; to 5&quot;</td>
<td>Iron Body class 125,200# WOG</td>
<td>Quadax or approved equal</td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>21/2&quot; to 12 &quot;</td>
<td>Ductile Iron Body,200# WOG, Lug type, 316 Stainless disk,17-4 PH shaft,PTFE seat and seal</td>
<td>Quadax or approved equal</td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>14&quot; and Larger</td>
<td>Ductile Iron Body,200# WOG, Lug type, 316 Stainless disk,17-4 PH shaft,PTFE seat and seal</td>
<td>Quadax or approved equal</td>
</tr>
</tbody>
</table>
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/
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 H2O) (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.
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 not interfere with the pressure independency function of the PIV.

Figure B
Appendix II
Belimo Pressure Independent Valve Flow Verification and Commissioning

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 design system 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 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 ∆P (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 electronic 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 ∆P by using P/T ports #1 and #2 as referenced in Figure A.

5. Formula to calculate flow is:
   
   \[ \text{Actual GPM} = \text{Design GPM} \times \sqrt{\left(\frac{\text{Measured Coil } \Delta P}{\text{Design Coil } \Delta P}\right)} \]

   NOTE: Coil ∆P and design ∆P 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.

Appendix III

Williams College - Weston Hall

Number: 101400-0001-01
Title: Signage - Revised Sign Shops - See Comments on Transmittal

Project ID: 955 Main Street
Owner: Williams College
Construction Team: Whiting-Turner
Design Team: ARC

Date Due: 02/11/2016
Date Issued: 01/28/2016
Date Returned: 
Substitution: No
Review Status: Accepted: No

INFORMATION
Types: Shop Drawings
Trades: Architectural
Categories: N/A
Subcontractor/Manufacturer:

STAMPS

WE HEREBY STATE THAT THIS DOCUMENT HAS BEEN REVIEWED FOR CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS. THIS APPROVAL IN NO WAY RELEASES THE SUBCONTRACTOR/SUPPLIER FROM HIS RESPONSIBILITY TO ADHERE TO THE REQUIREMENTS OF THE CONTRACT DRAWINGS, INCLUDING ALL DIMENSIONS AND QUANTITIES

APPROVED
APPROVED AS NOTED
NOT APPROVED
CORRECT & RESUBMIT

WT SUBMITTAL NUMBER 101400-0001-01
THE WHITING-TURNER CONTRACTING CO.
BY CMC DATE 01/28/2016

2/1/2016 Roll Barresi & Associates
APPROVED AS NOTED

This is an automated cover sheet generated by Newforma Project Cloud. It will update when the construction team issues the submittal to the design team and when the design team returns the submittal to the construction team. It is important not to download this PDF and upload a new version as it will not be automated and it will cause duplication of data.
Appendix III

REVIEW COMMENTS

[(pending) Project Admin (Design) - Amelia Thrall ]
[01/28/2016 Project Admin (Contractor) - Chase Cote ]

REFERENCES

This is an automated cover sheet generated by Newforma Project Cloud. It will update when the construction team issues the submittal to the design team and when the design team returns the submittal to the construction team. It is important not to download this PDF and upload a new version as it will not be automated and it will cause duplication of data.
# Submittal Cover Sheet

<table>
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<tr>
<th>Submittal ID#</th>
<th>Project ID</th>
<th>Project Name</th>
<th>Date</th>
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<tbody>
<tr>
<td>Williams College</td>
<td>Whiting-Turner / Roll Barresi</td>
<td>Williams College</td>
<td>January 28, 2016</td>
</tr>
<tr>
<td>Shop Drawing Submittal #3</td>
<td>WO 11738, W-T PO 14961-10B</td>
<td>Weston Hall</td>
<td></td>
</tr>
</tbody>
</table>

**To:**
Chase Cote  
*Project Manager*  
The Whiting-Turner Contracting Company  
One Speen Street, Suite 120, Framingham, Massachusetts 01701  
Office: 508-875-4100  
Mobile: 508-958-5571

**From:**  
Sibley D. Muschinsky  
*Project Manager*  
AdamsAhern Sign Solutions, Inc.  
30 Arbor Street  
Hartford, CT 06106

**Type of Submittal:**  
- Revised Shop Drawing Package

**Description of submittal:**  
- Shop Drawing Package

**List of attachments:**  
11738_W-T_Williams College-Weston Hall_Shop Drawing Package_Rev2.pdf

**Remarks:**  
Shop Drawing package is not complete.  
Rev. 2 addresses changes to exterior sign types 100A, 100B, 102 & 103

Additional Art or Information is needed:  
- Sign Type 101: Campus Map Art  
- Sign Type 200 / 201: Arch / Design to review sample submittal #2 & specify final choice in material to be used.  
- Sign Type 202: Arch / Design to review sample submittal #2 & specify final choice in material to be used.  
- Sign Type 203: Revised Art received 1-27; revised drawings to submitted as partial package by end of business 1-29. Arch / Design to review sample submittal #2 & specify final choice in material to be used.  
- Sign Type 204: Revised art received 1-26; revised drawings, requiring V.I.F. prior to fabrication, to be submitted as partial package by end of business 1-29.

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**Appendix III**

Revisions to Sign Types 202, 203, 204 received 2/1/2016 and are now in this document.
Williams College - Weston Hall; Sign Type 100A

**Note:**
- Sign Type 100A - Vehicular Wayfinding Large
- Double sided aluminum post and panel sign, Howard Industries, with painted finish and concrete sono-tube footing.
- Install at location EX.01, per SLP-1

**Panel:**
- 24" x 40-1/2" x 2-1/8" Bleed Body with .080" aluminum faces. Howard HED-225
- Header portion (upper 4-1/4"h of panel) & returns to be painted to match PMS 267C, Purple (MP 18107).
- Williams Logo to be applied vinyl, GSP 220/225-20, Matte White
- Accent strip of GSP 220/225-15, Bright Yellow
- Main portion of panel & returns to be painted to match BM 2133-20, Charcoal Grey (MP 27799)
- Copy to be 3M White Reflective vinyl
  - Decorative finial: O.D. 0.5" x 2.56" w x 3.0"L x 3.0"F x 1.25"P PVC core, arched top @ 2-3/4" radius. Clad with 1/8" copper sheet.
  - Cladding extends 1-1/2" below base of PVC Core, legs of cladding to encase top of post assembly, mechanical fasteners for attachment to top of post
- Posts: Howard HED-300 91/2"h x 2-1/4"w x 3"d, 1/2" reveal to sign panel, Posts & Reveal painted White, (MP N202)
- Installed via direct burial / sono-tube footing.

**Posts & Reveal:**
- Howard HED-300 91/2"h x 2-1/4"w x 3"d, 1/2" reveal to sign panel, Posts & Reveal painted White, (MP N202)

**Decorative Finial:**
- O.D. 0.5" x 2.56" w x 3.0"L x 3.0"F x 1.25"P PVC core, arched top @ 2-3/4" radius. Clad with 1/8" copper sheet.
- Cladding extends 1-1/2" below base of PVC Core, legs of cladding to encase top of post assembly, mechanical fasteners for attachment to top of post
- Posts: Howard HED-300 91/2"h x 2-1/4"w x 3"d, 1/2" reveal to sign panel, Posts & Reveal painted White, (MP N202)
- Installed via direct burial / sono-tube footing.

**Specifications:**
- fabricated and installed by Howard Industries
- cladding extends 1-1/2" below base of PVC Core
- Arched top of decorative finial
- painted finish
- direct burial
- sono-tube footing

**Recommended Suppliers:**
- Howard Industries
- GSP Industries
- 3M
- PVC Core

**Resources:**
- PMS 267C, Purple
- BM 2133-20, Charcoal Grey
- MP 27799, Matte White
- MP 18107, Bright Yellow
- MP N202, White Reflective vinyl
- MP N212, White painted vinyl

**Dimensions:**
- 24" x 40-1/2" x 2-1/8"
- 91/2"h x 2-1/4"w x 3"d
- 1/2" reveal

**Additional Information:**
- Williams Logo
- Accent strip
- Decorative finial
- Posts
- Reveal
Williams College - Weston Hall; Sign Type 100A

Header, painted PMS 267C (MP 18107, Purple)
Williams Logo, GSP 220/225-20, Matte White
Accent Stripe GSP 220/225-15 Br. Yellow
Panel Graphics to be 3M Reflective White vinyl
Reveal to be painted MP N202, White
Body of Panel, painted BM 2133-20 (MP 27799, Charcoal Grey)
Posts to be painted MP N202, White

Weston Hall
Admission & Financial Aid
Detail View_A: Post & Panel Section

Howard Industries HED-225 Sign body frame

Howard Industries HED-300 Sign post
- Painted MP N202, White
- Copper Finial to sleeve over top

1/2" Reveal
- Painted MP N202, White

.080" Aluminum Panel

Chemically Welded faces

Detail View_B: Finial Section, 200% of Scale

1/16" soldered copper cladding

PVC interior reinforcement

Molded rectangular post cap

4-40 x 1/4" S.S. Machine Screw (x3 per cap)

HED-300 Rectangular post
Williams College - Weston Hall; Sign Type 100B

Note:
Sign Type 100B - Vehicular Wayfinding Large Double sided aluminum post and panel sign, Howard Industries, with painted finish and concrete sono-tube footing.
Install at location EX.02, per SLP-1

Panel: 34"h x 33-1/2"w x 2-1/4" Bleed Body with .080" aluminum faces. Howard HED-225
-Header portion (upper 4-1/4"h of panel) & returns to be painted to match PMS 267C, Purple (MP 18107).
-Williams Logo to be applied vinyl, GSP 220/225-20, Matte White
-Ascent strips of GSP 220/225-15, Bright Yellow
-Main portion of panel & returns to be painted to match BM 2133-20, Charcoal Grey (MP 27799)
-Copy to be 3M White Reflective vinyl
Decorative finial: O.D. 4"h x 2-3/8"w x 3-1/8"d 3-7/8"h x 2-1/4"w x 3"d PVC core, arched top @ 1-1/2" radius. Clad with 1/16" copper sheet. Cladding extends 1-1/2" below base of PVC Core, legs of cladding to encase top of post assembly, mechanical fasteners for attachment to top of post
Posts: Howard HED-300 88"h x 2-1/4"w x 3"d, 1/2" reveal to sign panel. Posts & Reveal painted White, (MP N202)
-Installed via direct burial / sono-tube footing.
Williams College - Weston Hall; Sign Type 100B

Header, painted MP 18107, Purple

Accent Stripe GSP 220/225-15 Br. Yellow

Panel Graphics to be 3M Reflective White vinyl

Body of Panel, painted MP 27799, Charcoal Grey

Reveal to be painted MP N202, White

Posts to be painted MP N202, White

Williams Logo, GSP 220/225-20, Matte White

Admission Parking

Layout View_Side A
Note:
Sign Type 101, Campus Map.
Bent S.S. plate with exterior grade digital print on adhesive matte ControlTac vinyl, applied directly to plate. Face plate to mechanically fasten to coordinating mounting stand. Mounting stand to be set into granite wall.
Install at location EX.09, per SLP-1
Face Panel, O.D. @ 24" x 48" x 3/8" Stainless Steel; face to be 24", displayed at 30° angle (from horizontal), with additional 1-1/2" vertical "reveal" at bottom.
Digital print to wrap face & reveal. Back of panel to be finished with 150 gr. horizontal brushing, drilled & tapped holes for mounting hardware, aligned with mounting stand holes.
Mounting stand to be 3/8" Stainless Steel; vertical height @ 16-3/4" with additional 6" attachment panel bent to 120° angle (from vertical) with countersunk holes for face attachment. Mounting stand to be finished with 150 gr. horizontal brushing.
Template & install to be coordinated with stone mason. Bottom 8" of mounting stand to be inset into stone sections, affixed via epoxy & mortar.
Appendix III

Williams College - Weston Hall; Sign Type 100B

Countersunk Fasteners
-Flat Head Phillips S.S. Machine Screw: 1/4-20, 5/8"

Mounting Stand

Face Plate

S.S. Mounting Plate inset into 3/4" gap between stone sections.

Section View_C

Countersunk Fasteners
-Flat Head Phillips S.S. Machine Screw: 1/4-20, 5/8"

Mounting Stand

Face Plate

S.S. Mounting Plate inset into 3/4" gap between stone sections.

Section View_C

Countersunk Fasteners
-Flat Head Phillips S.S. Machine Screw: 1/4-20, 5/8"

Mounting Stand

Face Plate

S.S. Mounting Plate inset into 3/4" gap between stone sections.

Section View_C

Countersunk Fasteners
-Flat Head Phillips S.S. Machine Screw: 1/4-20, 5/8"

Mounting Stand

Face Plate

S.S. Mounting Plate inset into 3/4" gap between stone sections.

Section View_C
Williams College - Weston Hall; Sign Type 101

Layout View: Map Graphic

Appendix III

2/1/2016 Roll Barresi & Associates
AWAITING MAP GRAPHIC FROM WILLIAMS

Williams
SHOP DRAWINGS
Whiting-Turner / Roll Barresi
Williams College
Weston Hall

Note:
Detail View:
-Graphic Placement & Dimensioning

Adams|Ahern
Adams|Ahern Sign Solutions, Inc.
30 Arbor Street | Hartford, CT 06106

Architectural Graphics, Wayfinding
Signage Design and Manufacturing

Date: July 15, 2015
Scale: 3" = 1'-0"
Title: Shop Drawing, Sign Type 101
Page: 08
Note:
- Sign Type 102 - Parking Lot Identification
- Double-sided aluminum post and panel sign, Howard Industries, with painted finish and concrete sono-tube footing.
- Install at location EX.03, per SLP-1

Panel: 34” x 33-1/2” w x 2-1/4” Bleed Body with .080” aluminum faces. Howard HED-225
- Header portion (upper 4-4/16” h of panel) & returns to be painted to match PMS 225C, Purple (MP 18107).
- Williams Logo to be applied vinyl, GSP 220/225-20, Matte White
- Accent strips of GSP 220/225-15, Bright Yellow
- Main portion of panel & returns to be painted to match BM 2133-20, Charcoal Grey
  (MP 27799)
- Copy to be 3M White Reflective vinyl
- Decorative finial: 0.4” h x 2-3/8” w x 2-1/8” d
  - 2-3/8” h x 2-1/4” w x 2” d PVC core, arched top @ 1-1/2” radius. Clad with 1/16” copper sheet.
  - Cladding extends 1-1/2” below base of PVC Core, legs of cladding to encase top of post assembly, mechanical fasteners for attachment to top of post
- Posts: Howard HED-300 88” h x 2-1/4” w x 3” d, 1-2” reveal to sign panel. Posts & Reveal painted White, (MP N202).
- Installed via direct burial / sono-tube footing.
Williams College - Weston Hall; Sign Type 102, EX.07

Weston Hall
Admission & Financial Aid
Visitor Parking Only

Elevation View_Side A, Location EX.03
Profile
Elevation View_Side B, Location EX.03
Williams College - Weston Hall; Sign Type 102, EX.03

Williams Logo, GSP 220/225-20, Matte White

Header, painted PMS 267C (MP 18107, Purple)

Accent Stripe GSP 220/225-15 Br. Yellow

Panel Graphics to be 3M Reflective White vinyl

Reveal to be painted MP N202, White

Body of Panel, painted BM 2133-20 (MP 27799, Charcoal Grey)

Brooks Lot
Admission, Faculty & Staff Parking

Layout View_Side A, Location EX.03
Williams College - Weston Hall; Sign Type 102, EX.07

Willams

Weston Hall
Admission & Financial Aid
Visitor Parking Only

Layout View_Side A, Location EX.07

Appended III
Williams College - Weston Hall; Sign Type 103

Note:
- Sign Type 103 - Parking Space Identification
- Single-sided painted aluminum post & panel sign with concrete footing.
- Qty. varies: Install at location
  - EX.04 (Qty. 1), 05 (Qty. 2), 06 (Qty. 1) & 08 (Qty. 1) per SLP
- Panel: 15" x 10" x 1/8" Aluminum.
  - Header portion (upper 1-3/4" of panel) & returns to be painted to match PMS 267C, Purple (MP 18107).
  - Accent stripe of GSP 220/225 - 15, Bright Yellow
  - Main portion of panel, returns & back to be painted to match BM 2133-20, Charcoal Grey (MP 27799)
  - Copy to be GSP 220/225-20, Matte White
- Post: 96" h x 2" w x 2" d, painted MP N202, white.
- Mounting hardware to be S.S. threaded bolt with head painted to match sign panel, acorn fastener and washer painted to match post.
- Installed via direct burial / sono-tube footing.

Elevation View _ Location EX.04  _ Location EX.05  _ Location EX.06  _ Location EX.08  new_Location EX.09  TBD
Williams College - Weston Hall; Sign Type 103

Header, painted MP 18107, Purple
Accent Stripe GSP 220/225-15 Br. Yellow
Panel Graphics to be GSP 220/225-20, Matte White
Body of Panel, painted MP 27799, Charcoal Grey

Admission Parking Only

Admission Parking Only

Admission Parking Only

High Efficiency Vehicle Only

1/4-20 Acorn Nut, S.S.
1/4" I.D. S.S. Washer
2" x 2" Square Post
1/8" Aluminum Panel
1/4-20 x 2-1/2" Carriage Bolt, S.S., 2x per panel
-Heads painted to match sign panel, top to be Purple, Bottom to be Charcoal Grey

Section View_D: Post & Panel Section, 200% of Scale
Williams College - Weston Hall; Sign Type 103

Accessible Parking Only

Accessible Parking Only

J.R.C. Parking Only

Sheet: 2

Layout View_Location EX.08

(Qty. 1)

Layout View_Location TBD

Note:

Detail View:

- Graphic Placement & Dimensioning

Please have Jason Miner review and approve this layout.

Appendix III

Adams|Ahern
Adams|Ahern Sign Solutions, Inc.
30 Arbor Street | Hartford, CT 06106

Architectural Graphics, Wayfinding
Signage Design and Manufacturing

Rev: 2 | January 25, 2016
Page: 15

3" = 1'-0"

Shop Drawing, Sign Type 103
Williams College - Weston Hall; Sign Type 105 / 106

Note:
- Sign Type 105 - Building Identification
- Sign Type 106 - Regulatory Information
- Applied Vinyl Graphics

Sign Type 105: 3" x 21"
- GSP 220/225-20, Matte White
  Applied to 1st surface (exterior) panel of glass door
  Install at location S.01, 04, 06 per SLP-1

Existing Conditions:
S.01: Glass @ 24" w.
S.04: Glass @ 53" w.
S.06: Glass @ 9-3/4" w.

Existing Conditions:
S.02: Glass @ 9-3/4" w.
S.03: Glass @ 9-3/4" w.
S.05: Glass @ 9-3/4" w.

Elevation_Sign Type 105, S.01

Elevation_Sign Type 106, S.02
Williams College - Weston Hall; Sign Type 105 / 106

Notes:
Sign Type 105 - Building Identification
Sign Type 106 - Regulatory Information
Applied Vinyl Graphics

Sign Type 105: 3” x 21”
- GSP 220/225-20, Matte White
Applied to 1st surface (exterior) panel of glass door
Install at location S.01, 04, 06 per SLP-1
Existing Conditions:
S.01, 04, 06: Glass @ 24” w.

Sign Type 106: 6-1/2” x 12”
- GSP 220/225-20, Matte White
Applied to 1st surface (exterior) panel of glass.
Install at location S.02, 03, 05 per SLP-1
Existing Conditions:
S.02: Glass @ 53” w
S.03: Glass @ 9-3/4” w
S.05: Glass @ 9-1/4” w

Appendix III

Adams/Ahern
Adams/Ahern Sign Solutions, Inc.
30 Arbor Street | Hartford, CT 06106

Architectural Graphics, Wayfinding
Signage Design and Manufacturing
Williams College - Weston Hall; Sign Type 105 / 106

Detail View_Sign Type 105

Please, no smoking in or within 25 feet of this building.

Detail View_Sign Type 106

Appendix III
Williams College - Weston Hall; Sign Type 200

Note:
ALL CONDITIONS V.I.F.

Sign Type 200 - Reception Signage
Vinyl lettering applied to painted wall surface and fabricated stainless steel letters stud mounted to wall.
Install at location S.10, per SLP-1

Vinyl lettering: 27.85/16" x 169.125/16"
Note: Wall length @ 152 5/8". graphic wraps wall corner; see Drawing Page 18 for side views.

GSP 220/225-114, Clear Enamel Receptive HP.

Williams logo.
Installation via direct application to finished (by others) wall.
Note: graphics wrap corners,

Fabricated letters: 8.93/32" x 53.3/4" x 1/8".
Stainless Steel.
Faces to be finished as 150gr. horizontal brush; returns to be painted to match to PMS 109C (MP 120) semi-gloss.

Installation via flush stud mount to finished (by others) wall.

Appendix III
Williams College - Weston Hall; Sign Type 200

Side View, West Elevation

Side View, East Elevation

Note: ALL CONDITIONS V.I.F.
Baseline of Fabricated Letters to be aligned with baseline of applied vinyl lettering.

Applied Vinyl, Clear

Diaphragm with threaded insert for stud mounting

Stainless Steel Letter, Return Painted MP 120, match to PMS 109C

Stainless Steel Letter
Face finished as 150 gr. brush, horizontal grain

Diaphragm with threaded insert for stud mounting

Stainless Steel Stud 10-24

Sloped Stainless Steel
Face finished as 150 gr. brush, horizontal grain

8 9/16" Williams

52 1/4" Williams

Detail View_Fabricated Lettering

Section View_E, 200% Scale

Isometric View_F, No Scale

Note:
ALL CONDITIONS V.I.F.

Detail: Fabricated Letters
“It would be no small advantage if every college were thus located at the base of a mountain.”

HENRY DAVID THOREAU, AFTER VISITING WILLIAMS IN 1844
Williams College - Weston Hall; Sign Type 201

Side View, East Elevation

Side View, West Elevation

Note: ALL CONDITIONS V.I.F.
"It would be no small advantage if every college were thus located at the base of a mountain."

HENRY DAVID THOREAU, AFTER VISITING WILLIAMS IN 1844

Detail View_Thoreau Quote
Note:

ALL CONDITIONS V.I.F.

Sign Type 202 - Floor Directory
Painted acrylic directory signs with cut vinyl text and graphics.
Install 1x at location: S.08

S.08, Stair: 48” x 14” x 18”
(1/4” acrylic face with 1/8” acrylic backer panel)
Panel faces & returns to be painted Metallic Grey, Scuffmaster EM8271R.
Level Copy to be GSP 220/225-20, Matte White HP, Stair Symbol to GSP 220/225-15, Bright Yellow HP, “Weston Hall” to be 3M 7725SE Dusted Crystal

Installation to be via DF Tape & Silicone
Williams College - Weston Hall; Sign Type 202, S.09

Shop Drawing, Sign Type 202, S.09

1. Welcome Center
2. Office of Admissions
3. Office of Alumni

- 4"
- 74"

Elevation_Sign Type 202, S.09

Note:
ALL CONDITIONS V.I.P.

Sign Type 202 - Floor Directory, Elevator
Painted acrylic directory signs with cut vinyl text and graphics.
Install at location: S.09

- S.09, Elevator: 40" x 14" x 3/8".
  - (1/4" acrylic face with 1/8" acrylic backer panel)
  - Panel faces & returns to be painted Metallic Grey, Scuffmaster EM8371R.
  - Level Copy to be DSP 220/225-20, Matte White HP.
  - Stair Symbol to be DSP 220/225-15, Bright Yellow HP.
  - "Weston Hall" to be 3M 7725SE Dusty Crystal
  - Installation to be via DF Tape & Silicone.

Adams|Ahern Sign Solutions, Inc.
30 Arbor Street | Hartford, CT 06106

Architectural Graphics, Wayfinding
Signage Design and Manufacturing

Date: Rev 2: February 1, 2016
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Scale: 1" = 1'-0"
Title: Shop Drawing, Sign Type 202
Williams College - Weston Hall; Sign Type 203, Section 1

Elevation_Sign Type 203, Section 1

Appendix III

SHOP DRAWINGS
Whiting-Turner / Roll Barresi
Williams College
Weston Hall

Note:
ALL CONDITIONS V.I.F.

Sign Type 203 - Stenciled Frieze
Stenciled lettering on wall surface
Copy to be applied Translucent Vinyl (Die-cut)
Silver 230-121

ARCHITECTURAL GRAPHICS, WAYFINDING
SIGNAGE DESIGN AND MANUFACTURING

Date: Rev: 2 January 29, 2016
Scale: 1/8" = 1'-0"
Title: Shop Drawing, Sign Type 203

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Adams|Ahern
Adams|Ahern Sign Solutions, Inc.
30 Arbor Street | Hartford, CT 06106

2/1/2016 Roll Barresi & Associates
APPROVED PENDING WILLIAMS’ FINAL APPROVAL

Williams
Williams College - Weston Hall; Sign Type 203, Section 2

Note:
ALL CONDITIONS V.I.F.

Sign Type 203 - Stenciled Frieze
Stenciled lettering on wall surface
Copy to be applied Translucent Vinyl (Die-cut)
Silver 230-121

Elevation_Sign Type 203, Section 2
Elevation_Sign Type 203, Section 3

Note:
ALL CONDITIONS V.I.F.

Sign Type 203 - Stenciled Frieze
Stenciled lettering on wall surface
Copy to be applied Translucent Vinyl (Die-cut)
Silver 230-121
Appendix III

Williams College - Weston Hall; Sign Type 203, Section 4

Note:
ALL CONDITIONS V.I.F.

Sign Type 203 - Stenciled Frieze
Stenciled lettering on wall surface

Copy to be applied Translucent Vinyl (Die-cut)
White 230-20

Elevation_Sign Type 203, Section 4
Williams College - Weston Hall; Sign Type 203, Section 5

Elevation_Sign Type 203, Section 5

Note:
ALL CONDITIONS V.I.F.

Sign Type 203 - Stenciled Frieze
Stenciled lettering on wall surface

Copy to be applied Translucent Vinyl (Die-cut)
White 230-20

Appendix III
Williams College - Weston Hall; Sign Type 203, Section 6

Elevation_Sign Type 203, Section 6

Note:
- ALL CONDITIONS V.I.F.
- Sign Type 203 - Stenciled Frieze
- Stenciled lettering on wall surface
- Copy to be applied Translucent Vinyl (Die-cut)
- Silver 230-121

Appendix III

2/1/2016 Roll Barresi & Associates
APPROVED PENDING WILLIAMS’ FINAL APPROVAL
Appendix III

Williams College - Weston Hall; Sign Type 203, Detail

Detail_Sign Type 203, Section 1

Detail_Sign Type 203, Section 2

Detail_Sign Type 203, Section 3
Williams College - Weston Hall; Sign Type 203

JAMES MACGREGOR BURNS '39 • WILLIAM H. CURTIS, JR. '40 • EARLE WAYNE WILKINS, JR. '41 • DAVID KNOX PEET, JR. '43 • C. GORHAM PHILLIPS '43
PAMELA G. CARLTON '74 • FREDERICK M. LAWRENCE '77 • LISA C. CAPALDINI '79 • SALLY A. KRAFT '79 • MARK LANIER '80 • CHRISTEL ALBRITTON '81
KRISTA M. PICKETT '13 • TERENCE A. COLBERT '94 • LONG P. DANG '15

3 3/4" 3 3/4" 3 3/4"

RICHARD G. KING '44 • DICKINSON R. DERVOISE '46 • ROBERT C. ZABOR '46 • WILLIAM A. EAMES '47 • EDWIN P. MAYNARD, III '49 • ANDREW D. HEINEMAN '54
CHERYL M. MARTIN '82 • MEREDITH L. MCGEE '83 • BLAKE A. MARTIN '84 • JAN F. VAN ECK '85 • DAVID P. G'KEEFE '86 • GAIL N. HENDERSON '87

3 3/4" 3 3/4" 3 3/4"

PAUL E. SHORB '51 • J. HODGE MARKGRAF '52 • ROBERT H. SHORB '53 • WALTER N. CREER, JR. '54 • WILLIAM A. MONTGOMERY '55 • DAVID J. KLEINBAUD '56 • WARREN K. MCGOMBER '57
NICOLE MELCHER '88 • JOSE M. CALERO '89 • LIN R. GRAY '90 • LAURIE A. BURNETT '91 • SIMON D. STOLZBERG '92 • DEBORAH V. MARRIEM '93 • MICHAEL C. STRAUSS '94

3 3/4" 3 3/4" 3 3/4"

Appendix III

2/1/2016 Roll Barresi & Associates
APPROVED PENDING WILLIAMS' FINAL APPROVAL

Williams

SHOP DRAWINGS
Whiting-Turner / Roll Barresi
Williams College
Weston Hall

Note:

Detail_Sign Type 203, Section 4

Detail_Sign Type 203, Section 5

Detail_Sign Type 203, Section 6

Appendix III
Williams College - Weston Hall; Sign Type 204

**William Bradford Turner Citizenship Prize**

The William Bradford Turner Citizenship Prize was established in the memory of William Bradford Turner, Class of 1914, who was killed in action in France in September 1918. The prize is awarded annually to a member of the graduating class who, in the opinion of fellow seniors, the faculty, and the dean of the college, and the president, has rendered the most exemplary service to the college and to students. The line above represents recipients of the William Bradford Turner Citizenship Prize from 1918 to the present.

**Elevation_Detail, 200% of scale**

MDO Backer, by GC
- Painted to match wall

Plaque, face flush with surface of wall.
Install via VHB Tape & Silicone

3/8” Reveal
All Sides

Drywall, by GC

**Section View_Mounting, 200% of scale**

Drywall, by GC

54”, V.I.F.

**24”**

**24”**

**72”**

**2”**

**24”**

**Appendix III**

2/1/2016 Roll Barresi & Associates
APPROVED PENDING WILLIAMS’ FINAL APPROVAL