Clarkson™

Construction Standards/Design Manual

Chapter 4

Construction Products and Activities

Division 01 – General Requirements

01 10 00 Summary

1. The Summary section shall provide the following general items (as well as those listed below) that are pertinent to the project: General Project Information, a general description of the Work covered by the contract documents, type of contract, any phasing or critical dates, Work by University (if any), Work under separate contracts (i.e. furniture), Purchase contracts (if any), University-furnished, Contractor installed products (i.e. toilet accessories), Contractor-furnished, University-installed products (if any), Access to site (outline a detailed route, restrictions, and requirements for marking/signage, based on a discussion with the Clarkson PM).

2. All project materials, emails, correspondence, and submittals shall indicate the **project title**, **location**, and **number**.

3. The contractor shall inspect the job site and be aware of the conditions under which it must accomplish the work. The university will not consider or be responsible for claims as a result of failure to inspect the job site. The contractor will waive any claim based on conditions that would have been discovered from a site inspection.

01 14 00 Work Restrictions

1. The project site is a higher learning facility that requires special consideration to scheduled events throughout the duration of construction. The contractor shall schedule and coordinate his work with Clarkson's Representative to meet the following minimum requirements:

    a. No work shall be performed adjacent to student housing during student move-in dates in August and January. (Specific dates will be determined by Clarkson)

    b. No work shall be performed adjacent to student housing during student move-out in May. (Specific dates will be determined by Clarkson)

    c. Work adjacent to student housing and classrooms shall not be performed during final examinations in December and May. (Specific dates will be determined by Clarkson)

    d. The Contractor shall maintain uninterrupted water supply and utilities to all areas and facilities throughout construction. Scheduled outages shall be minimized, coordinated, and approved by Clarkson with no less than three weeks notice.

    e. Staging area will be determined after award, unless otherwise noted, and will be in keeping with Clarkson's desires.

01 20 00 Price and Payment Procedures

01 21 00 Allowances and Unit Prices

1. This section must include the types of allowances (lump sum, unit price, etc.) that will be in the contract and how they will be utilized.

2. Any and all cost savings from an allowance item shall be credited to the University in the form of a deductive change order. Likewise, any cost overrun from an allowance item shall be paid by the owner in the form of an additive change order. The Contractor must provide a complete, written

account and explanation, in sufficient detail for the owner, of any allowance cost overrun as a condition of approval of an additive change order.

01 25 00 Substitution Procedures

1. The Contractor shall be responsible for reviewing all substitution requests to ensure that they are complete, and if not, return them to the Sub-contractor/Trade Contractor for proper submission. The Contractor shall be responsible to review all substitution requests with the A/E and the University. The Contractor shall be responsible for tracking and monitoring all substitution requests until all such requests are processed by the A/E and the University. The Contractor shall ensure that all substitution requests are submitted in a timely manner and that other portions of the project affected by the substitutions are brought forward.

01 26 00 Contract Modification Procedures

1. Change orders will be processed in accordance with the provisions of the General Conditions and these procedures.

2. The Contractor is to provide sufficient back-up justification for the proposed change order or directed change or claim. Such supporting documentation shall include supplier estimates, delivery estimates, storage estimates, labor and equipment estimates, and so forth.

3. Each change order that is proposed, or directed, or each claim, shall be clear to indicate the value in terms of dollars and cents as well as any claim for time. Failure of the Contractor to make the appropriate claim for time and/or monetary compensation at once formally submitting a change request to Clarkson is a forfeiture of future claims for compensation or time related to that change.

01 29 00 Contract Payment Procedures

1. Schedule of Values: Prior to the execution of the work, the contractor shall present for approval a schedule of values to the Clarkson Project Manager.

2. It is noted that retainage will be deducted, in the Design Manual and the General Conditions from each monthly payment. Release of this retainage, in part or in full, will only be considered upon substantial completion or completion of the guarantee period as determined by the Project Manager.

01 31 00 Project Management and Coordination

1. For all project documentation purposes the contractor, A/E, and any other participant in the project shall use forms as directed by Clarkson. All parties are to obtain guidance from the Clarkson Project Manager as to the appropriate form or format to be used.

2. The Contractor shall participate in the following meetings as required by the Contract Documents or Clarkson to ensure successful completion of the project: Preconstruction Conference, Weekly and/or Bi-Weekly coordination/progress meetings, Subcontractor meetings and any meetings as required.

3. Progress meetings are to have an agenda issued and minutes prepared by the A/E of record. Meeting minutes prepared by the A/E shall be processed and distributed to meeting participants within seven (7) days of the meeting.

4. Requests for Information: The Contractor shall be responsible for developing and implementing a RFI form for use on the Work. The Contractor shall be responsible for reviewing all RFIs prior to

submission to the Consultant/ University. The Contractor is responsible for facilitating information requests to keep response times to a minimum. The Contractor will maintain copies of the final answers to information requests as part of the Project records.

5. Field Meetings: Periodic job meetings will be scheduled by the Consultant and/or University during the course of construction. The Contractor, and, upon request, its principal subcontractors and manufacturer's representatives, shall attend such meetings and be prepared to furnish answers to questions on progress, workmanship, or any other subject on which Clarkson or its representatives might reasonably require information.

01 32 00 Construction Schedule and Progress Documentation

1. Construction Schedule: Without taking exception to any provision of the General Conditions of the Construction Contract, the Contractor shall generate and maintain the schedule for the work.

    a. The Contractor is wholly responsible for the accuracy, correctness, and feasibility of the schedule presented to the University.

    b. The Contractor shall provide a hard copy, and digital copy of all schedules.

    c. It is the expectation of the University that any schedule presented by the Contractor presents a reasonable plan for performing the work. Additionally in presenting the schedule, or updates thereof, to the University, the Contractor warrants that this plan is presented such that the activity durations are reasonable, the logic ties are accurate between the various activities, and the aggregate remaining duration estimate is reasonable. As such the University makes no agreement nor does it take responsibility for any of the preceding.

    d. In general, activity durations should be formulated such that activities last no longer than the update period specified. The Contractor may opt to break apart portions of the work in phases, locations or other easily identifiable and discrete items in order to attain this requirement.

    e. The Contractor shall use a 7 day per week (or calendar day), 8 hour per day (or regular work day) calendar in the development of the schedule.

    f. Regardless of the method used, those activities that are on the critical path must be clearly identifiable both graphically and in a tabular format.

2. The Contractor will anticipate, plan for, and put sufficient time in his construction schedule to account for the likelihood of adverse weather conditions affecting construction times.

3. The University, Contractor and/or A/E Firm may dictate certain milestones that need to be tracked during the course of the project.

4. Progress Reports: During the administration of the contract, the Contractor and/or Consultant shall prepare monthly reports for the University to document Project actions and to keep the University's managers apprised of progress. The reports shall cover all relevant topics, including schedule, budget, submittals, RFI’s, RFP’s, change orders, quality control, meetings, safety and other topics conducive to the success of the Project.

5. In addition to the construction schedule, the Contractor will establish a “look ahead” schedule with general daily activities outlined for a minimum of three (3) weeks advanced notice to be reviewed at the weekly coordination meetings. The Contractor will provide Clarkson with a copy of the “three week look ahead” at least two (2) business days prior to the beginning of the schedule.

01 33 00 Submittals and Submittal Procedures

1. The A/E shall prepare a submittal log, as a part of the project manual, with a consolidated listing of all submittals included therein.

01 33 00

1. Shop Drawings and Samples - (Refer to Clarkson Construction Standards, Chapter 2 Design Procedures)

01 35 00 Special Procedures

1. The Contractor shall ensure they coordinate closely with Clarkson staff in regards to any kind of abatement work that may be a part of the project. The contractor must take care during construction, to not create conditions for such things as mold growth, legionnaire's disease, or sick building syndrome.

2. Clarkson has a zero tolerance policy with regards to fraternizing with students. Catcalls, whistles, cursing, leering, or other inappropriate behaviors are not acceptable. Personnel observed or reported to be participating in these activities will be removed from the project.

3. During construction the Contractor is responsible for adequate signage and way-finding for any and all campus routes that are disrupted by construction activities. The contractor shall propose pedestrian and other routes prior to installation of fencing or other barricades for approval to the University. All routes provided must perform in a similar manner to those that are disrupted (e.g. a vehicular path disruption shall provide the same traffic conditions as the non-disrupted state inclusive of MOT, or accessible pathways must have an alternate and equally accessible pathway provided). The contractor shall consult the accessible path routes information available on the Clarkson website in developing such plans.

4. Disruptions to parking and transportation systems must be fully coordinated with Clarkson with a minimum of three (3) weeks notice.

5. Use of heavy duty vehicles and compliance with Diesel Emissions Reduction Act of 2006: The Contractor certifies and warrants that all heavy duty vehicles, as defined in New York State Environmental Law (ECL) section 19-0323, to be used under this Contract, will comply with the specifications and provisions of ECL section 19-0323 and any regulations promulgated pursuant thereto, which requires the use of BART (Best Available Retrofit Technology) and ULSD (Ultra Low Sulfur Fuel).

01 40 00 Quality Requirements

01 41 13 Code Compliance

1. The Contractor will obtain a building permit as required by local and state building codes.

2. All work involving installation and modification to fire alarm systems shall be performed by individuals or firms currently licensed by the NYS Department of State, Division of Licensing Services. The contractor shall provide copies of the individual's or firm's current license and identification cards for all unlicensed employees performing work for the licensed individual or firm for this project. The Contractor shall post a copy of the license at a location approved by the University.

01 45 00 Quality Control

1. The Contractor shall have the overall responsibility for scheduling, coordinating, and inspecting all the Construction Trade Contractors' workmanship, materials, and equipment to ensure conformity with requirements of the Construction Documents (including the contract drawings and specifications, subsequent contract change orders, and approved submittals).

2. The Contractor shall make quality determinations based on the records and inspections to protect the University against defects, deficiencies, omissions, and delays. Throughout construction, the Contractor will maintain an up-to-date list of defects, deficiencies, delays, and omissions as well as corrective actions taken.

3. Special Tests and Inspections: The University will engage a qualified testing agency to conduct special tests and inspections required by in accordance with the requirements of the NYS Code, IBC and the NYS Code Special Inspections requirements. Other inspections are the responsibility of the contractor.

01 50 00 Temporary Facilities and Controls

01 51 00 Temporary Utilities

1. Install temporary service or connect to existing service. Arrange with utility company, University, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Provide temporary meters and pay all utility charges during construction. The contractor is responsible for closing any and all utility accounts it may open and transfer then to Clarkson, if they are to be maintained for permanent service. The contractor shall pay all utility charges until such time as Clarkson acknowledges in writing that it has fully transferred all utility charges into its account with the various individual utility providers.

2. Sanitary Facilities: The Contractor will provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

3. Heating and Cooling: The Contractor shall provide and pay for all temporary heating and cooling, coverings and enclosures necessary to properly protect all work and materials against damage by dampness and cold, dry or cure the work, and facilitate the completion thereof. The fuel, equipment, materials, operating personnel and the methods used therefor shall be at all times satisfactory to the University and adequate for the purpose intended. Completely remove from the project any coatings or residues created by the temporary heating system when they may be detrimental to the proposed finishes. The maintenance of proper heating, cooling, ventilation and adequate drying out of the work is the responsibility of the Contractor and any work damaged by dampness, insufficient or abnormal heating or cooling shall be replaced to the satisfaction of the University by and at the sole cost and expense of the Contractor.

4. Electric Power Service: Electrical energy, as/if it exists within the work area, will be available at no cost to the Contractor from existing outlets or panels from locations approved by Clarkson. This power may be used for small power tools (not exceeding 1/2 HP), etc., and the Contractor shall not exceed the capacity of the existing circuits being used. The Contractor shall be responsible for providing all necessary connections, cables, etc. and removal of the same at completion of construction with approval from Clarkson. The Contractor shall in no way modify the existing circuits at the panel boards to increase capacities of the circuits. If the required power load exceeds the capacities of the available power sources, the Contractor shall be responsible and pay for furnishing and installing all necessary temporary power poles, cables, fused disconnect switches, transformers and electric meters necessary to provide a temporary power system for the project, and remove the same at completion. Install all temporary wiring and equipment and make all connections in conformity with the National

Electrical Code. Make all replacements required by temporary use of the permanent wiring system. Provide ground fault protection..

5. Lighting: The Contractor shall provide and maintain all temporary lighting. The equipment, materials, operating personnel and the methods used shall be at all times satisfactory to the University and adequate for the purpose intended.

6. Water: Water used during construction will be the responsibility of the Contractor. The Contractor will be allowed use of onsite hydrants as designated by Clarkson. Prior to use of the hydrants the Contractor shall contact the appropriate Public Works Department to coordinate the installation of a portable water meter. Cost of water usage shall be borne by the Contractor.

7. The Contractor shall make all connections, as required, furnish and install all pipes and fittings, and remove the same at completion of work. The Contractor must provide for waste water discharge and shall take due care to prevent damage to existing structures or site and the waste of water. All pipes and fittings must be maintained to the satisfaction of Clarkson's Representative at all times.

01 52 00 Construction Facilities

1. For all capital projects the Contractor will provide, at a minimum, a Common-Use Field Office: Of sufficient size to accommodate needs of University, A/E, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as required.

2. For non-capital projects a common use field office shall be provided as directed by the Clarkson Project Manager. The A/E shall specify the size and accommodations to be provided in the contract documents.

3. Janitorial Services: Provide janitorial services on daily basis for temporary offices, first-aid stations, toilets, wash facilities, lunchrooms and similar areas.

4. Storage and Fabrication Sheds: Temporary offices, shops, and sheds are to be located within limits of the construction area or outside of 30 feet (9 m) of building lines with approval from Clarkson.

5. Traffic Controls: Comply with requirements of authorities having jurisdiction. Contractor will provide Movement of Traffic (MOT) and applicable traffic control measures as required. Protect existing site improvements to remain including curbs, pavement, and utilities. Maintain access for fire-fighting equipment and access to fire hydrants. Coordinate fire access with University Environmental Health and Safety Office

6. Dewatering Facilities and Drains: Maintain Project site, excavations, and construction generally free of ground water. Dispose of rainwater in accordance with the approved land disturbance and Erosion and Sediment Control Permit. Remove snow and ice as required to minimize accumulations.

7. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. See elsewhere in the design manual regarding recycling, waste management, and waste diversion.

8. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

9. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

10. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to University.

01 52 14 Staging Area and Storage of Materials

1. The Contractor shall store materials and equipment within the Contract Limit Lines as designated on the drawings or as approved by Clarkson's Representative.

2. All materials shall be stored in a neat and orderly manner, and shall be protected against the weather by a weatherproof temporary storage facility or trailer. Security for stored materials shall be the responsibility of the Contractor. Storage of materials is not permitted on the roof of any building.

3. If petroleum products are brought on campus in stationary containers of 55 gallons or larger, the Contractor shall provide a certification to Clarkson, stamped by a professional engineer currently licensed in New York State, that product storage, spill prevention, training, testing, inspections, handling and dispensing methods are incompliance with all applicable federal and state rules and regulations, including EPA rule 40 C.F.R. Part 112. This certification shall be provided to Clarkson two weeks ahead of any product or container(s) delivery and Clarkson shall be notified promptly of the removal of any container(s)

01 55 00 Temporary Parking and Access

1. The Contractor and its employees shall be subject to all the rules and regulations of the University, including parking regulations. Parking violations are subject to fines and are the sole responsibility of the Contractor or its employees. Parking within contract limit lines as shown on the drawings will be at no cost for the Contractor and its employees. However, if there is not enough space for all its employee parking and /or its employees choose on their own to use campus parking spaces, additional Contractor employee parking will be permitted and arranged within Campus parking lots on a limited basis, as approved by Clarkson and subject to applicable campus traffic regulations.

2. At no time is the Contractor, its subcontractors or employees allowed to park on sidewalks, lawns, or any other area not designated for vehicle traffic except within the predetermined Contract Limit Lines.

01 56 00 Safety and Protective Facilities

1. The Contractor shall provide the necessary safeguards to prevent accidents, to avoid all necessary hazards and protect the public, the Staff, students, the work and property at all times, including Saturdays, Sundays, holidays and other times when no work is being done.

2. The Contractor shall erect, maintain and remove appropriate barriers or other devices, including mechanical ventilation systems, as required by the conditions of the work for the protection of users of the project area, the protection of the work being done, or the containment of dust and debris. All such barriers or devices shall be provided in conformance with all applicable codes, laws and regulations, including OSHA and National Fire Prevention Association 241, for safeguarding of structures during construction.

3. Protection of Existing Structures and Utilities: The Contractor, during the course of its work, shall not damage any buildings, structures and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains and electric power and lighting and telephone cables lawns, curbs, plants and other improvements. Any damage resulting from the Contractor's operations shall be repaired or replaced at its expense.

01 57 00 Temporary and Environmental Controls

1. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion at all costs.

2. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

3. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for University. Perform control operations lawfully, using environmentally safe materials.

4. Site Enclosure Fence: Before construction operations begin, furnish and install a site enclosure fence, as approved by Clarkson, completely surrounding construction area in a manner that will prevent people and animals from easily entering site except by entrance gates.

5. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Coordinate placement and maintenance with a Clarkson University Facilities representitive.

6. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

7. Temporary Fire Protection: If the existing building is to be partially occupied during the course of the project, all existing exits and fire protection systems shall be continuously maintained in the occupied phases, or other measures must be taken which in the opinion of the University will provide equal safety. Those portions occupied by Clarkson must be available for their use 24 hours a day, seven days a week during the contract period unless otherwise scheduled in these documents. Comply with all applicable State and Federal codes and regulations. The cost of all labor, fire watches, variances, materials, installations, maintenance and removal of such temporary fire protection systems or modifications to the existing systems are the responsibility of the Contractor.

8. Comply with NFPA 241. Provide all temporary equipment, labor and material required for compliance with the applicable provisions of Chapter 14, Fire Safety during Construction and Demolition, of the Fire Code of New York State.

9. Prohibit smoking in construction areas and anywhere within thirty (30) feet of buildings.

10. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction. All such activities require daily issuance of a hot works permit provided by Clarkson University. Permits are available at Clarkson Facilities' webpage.

11. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

12. Erosion and Sediment Control: The Contractor shall take action daily to maintain erosion and sediment controls. The Consultant and/or Contractor and applicable subcontractors shall submit a Storm Water Pollution Prevention Plan (SWPPP), were applicable for approval and acquire any necessary applications or permits.

13. The Contractor shall provide a maintenance schedule for soil erosion and sediment control facilities and describe maintenance activities to be performed for review by Clarkson. Specific to the project and approach to construction activities, the Contractor shall prepare and submit to Clarkson for approval schedules for all excavation, grading, fill and operations connected with the project in or outside the project limits.

14. Temporary sediment trapping devices should be removed within thirty (30) calendar days following establishment of permanent stabilization in all contributory drainage areas.

15. Siltation deposits in storm sewers, surface waters streams or wetlands resulting from the discharge water if water from the project site shall be removed to restore profiles and conditions to that existing prior to the commencement of the work. The Contractor shall keep access routes and parking areas used for the work clean of debris and other obstructions resulting for the work. The Contractor shall keep traveled ways free of foreign objects such as spilled earth, rock, timber, and other items that may fall from transporting vehicles. Materials spilled by or dropped from the undercarriage of any carrying vehicle used in the Contractor's hauling operations along or across any public traveled way shall be removed immediately. Contractor shall devote particular attention to all drainage facilities, keeping them fully operational at all times.

16. The Contractor shall be required to continue to address sedimentation and erosion control issues related to the project through final acceptance.

17. Stormwater Control: Comply with requirements of the University annual permit requirements. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

18. Indoor Air Quality Controls: Replacement of any clogged, plugged, or damaged air filters due to construction activities is the sole responsibility of the contractor at the end of any project.

19. Project stake-out: The Contractor shall provide utility stake out for any utilities that are to be emplaced by local utility providers as a consequence of the work described in the contract documents. The Contractor shall coordinate with the local utility provider and provide such stake-out in the manner that is preferred or required by that utility (e.g. whether the utility wants offsets or not).

01 58 00 Project Identification

1. The Contractor shall leave space on the site for the University to install a project sign or signs as it determines necessary.

01 60 00 Product Requirements

01 61 00 Common Product Requirements

1. Material Safety Data Sheet: The contractor shall maintain on site MSDS (Material Safety Data Sheet) for all chemicals, solvents, and materials specified or proposed to be used on this project.

2. U.S. Steel: All structural steel, reinforcing steel, or other major steel items to be incorporated in the work shall, if this Contract is in excess of $100,000, be produced or made in whole or substantial part in the United States, its territories or possessions.

3. Non Asbestos Products: All materials used or installed for this work shall contain no asbestos. Upon project completion, the contractor shall provide a written and signed and dated document stating that the project site and all materials used were free of asbestos.

01 70 00 Execution and Closeout Requirements

01 71 33 Protection of Adjacent Construction

1. Existing construction, finishes, equipment, wiring, etc., that is to remain and which is damaged or defaced by reason of work done under this contract shall be restored by the Contractor to a condition satisfactory to Clarkson, or replaced with new, at no additional cost to the University.

2. Existing surfaces, materials, and work shall be prepared as necessary to receive the new installations. Such preparatory work shall be as required by the conditions, and in each case shall be subject to approval by Clarkson.

3. Newly exposed work or surfaces which are presently concealed shall be made to match existing corresponding or adjoining new surfaces as directed, and the materials and methods to be employed shall be subject to approval by the University.

4. All new, altered, or restored work in the building shall match existing corresponding work in the material, construction finish, etc., unless otherwise specified or required by the drawings. Coordination with Other Contracts: There may be other contracts let for work to be done in adjacent areas and, as such, this Contractor and such other contractors shall coordinate their work to conform with progressive operation of all the work covered by such contracts, and afford each other reasonable opportunities for the introduction and storage of their supplies, materials, equipment, and the execution of their work.

01 73 00 Execution

1. All work is to be conducted in such a manner as to cause a minimum degree of interference with Clarkson’s operation and academic schedule.

2. Safe and direct entrance to and exiting from the existing buildings shall be maintained at all times during regular hours while construction is in progress. A Clarkson approved “Safety Egress Plan” will be required where entrances or exits may be blocked during the course of construction.

3. Fuel powered equipment shall not be operated near building entrances, windows, air intakes, or any other area that may allow exhaust emissions to enter the building without prior approval from Clarkson and an “Emissions Mitigation Strategy” in place.

4. Unless otherwise permitted by Clarkson, the removal and/or demolition of given work items shall not occur until the Contractor has all the required replacement materials on-site.

5. The Contractor and its employees shall comply with the University’s regulations governing conduct, access to the premises, and operation of equipment.

6. The building shall not be left "open" overnight or during any period of inclement weather. Temporary weather tight closures shall be provided for by the Contractor to protect the structure and its contents.

7. Exterior excavations will be enclosed at all times with a fence, or similar barricade, with a minimum clearance of ten (10) feet from the opening.

8. Interior excavation or holes in the floor or roof will be barricaded and covered with a labeled cover sufficient to support unexpected loads (i.e. people or equipment).

9. If required by the nature of the work and campus regulations, the Contractor shall obtain from Clarkson “Confined Space Permits” or “Hot Work Permits” to execute the work of its contract.

10. The Contractor shall do all cutting, fitting, and patching of its work that may be required to make its several parts come together properly and fitted to receive or be received by work of other Contractors as shown upon or reasonably implied from the Drawings and Specifications for the completed project.

11. Any cost caused by defective or ill-timed work shall be borne by the party responsible therefor. Except as otherwise expressly provided in the Contract Documents, the Contractor shall not cut or alter the work of any other Contractor or existing work without the consent of the University.

12. The Contractor shall be responsible for submitting to the University, for their approval, a proposed schedule of all utility shutdowns and cutovers of all types which will be required to complete the Project; said schedule should contain a minimum of three (3) week’s advance notice prior to the time of the proposed shutdown and cutover. Clarkson University operates 12 months of the year, and shutdowns and cutovers, depending upon their type, generally must be scheduled on weekends, at night, or during holiday periods. The contract consideration is deemed to include all necessary overtime and all premium time, if any, that is required by the Contractor to complete the shutdowns or cutovers.

13. In the event the Contractor shall disrupt any existing services, the Contractor shall immediately make temporary connection to place such service back into operation and maintain the temporary connection until the Contractor makes the permanent connection. All work must be acceptable to the University.

01 74 00 Construction Waste Management and Cleaning

1. The Contractor will remove and legally dispose of all debris and other materials resulting from the alterations to University property. A Clarkson representative will determine if any material or equipment will be salvaged and remain the property of the University.

2. Periodic Cleaning: The Contractor shall at all times during the progress of the work keep the Site free from accumulation of waste matter or rubbish and shall confine its apparatus, materials and operations of its workers to limits prescribed by law or by the Contract Limit Lines, except as the latter may be extended with the approval of Clarkson. Cleaning of the structure(s), once enclosed, must be performed daily and removal of waste matter or rubbish must be performed at least once a week.

3. Final Clean Up: Upon completion of the work covered by the Contract, the Contractor shall leave the completed project ready for use without the need of further cleaning of any kind and with all work in new condition and perfect order. In addition, upon completion of all work, the Contractor shall remove from the vicinity of the work and from the property owned or occupied by the University all plants, buildings, rubbish, unused materials, concrete forms and other materials belonging to it or used under its direction during construction or impairing the use or appearance of the property and shall restore such areas affected by the work to their original condition, and, in the event of its failure to do so, the same shall be removed by Clarkson at the expense of the Contractor, and it and its surety shall be liable therefor.

01 77 00 Closeout Procedures

1. Closeout of a project is a deliberate process that Clarkson considers a critical element. Closeout starts at the point that the contractor indicates that they are prepared for commissioning activities to start and concludes once final completion is certified.

2. Attic Stock: Clarkson generally does not desire attic/bench stock from projects (see also chapter 2 of this design manual on A/E determinations for Attic stock). The A/E shall discuss with Clarkson its needs for attic stock

3. Other Closeout Documentation and Requirements: Closeout occurs when all training is complete, as builts are provided, and O&M manuals and turn over documents are received and there is a release of liens.

01 78 00 Closeout Information and Record Documents

1. The Contractor shall compile and provide a warranty manual to Clarkson in a format as directed by Clarkson. Operating Instructions and Manuals

2. The Contractor will provide a complete maintenance schedule for all equipment.

3. The Contractor shall furnish three (3) complete sets of operating instructions and manuals which shall include definite and specific instructions on all mechanical and electrical systems involved in the Project. Said instructions and manuals should set forth: (a) the manner of operation; (b) the necessary precautions and care to be followed: (c) periodic prevention maintenance requirements; and (d) a complete set of spare parts lists, catalogs, service manuals and manufacturing data on said systems. Said instructions and manuals are to be made available by the Contractor for review and comment by the University a minimum of six (6) weeks prior to the scheduled completion of the Project.

4. See also Chapter 2 of this Manual.

01 79 00 Demonstrations and Training

1. Contractor will provide Clarkson Facilities personnel training for all equipment and control systems.

01 80 00 Sustainability Documentation/Certification Requirements

1. RESERVED

01 90 00 Commissioning Requirements

1. Contractor is responsible for providing full balancing reports upon project completion and shall respond to concerns regarding equipment for the guarantee period after project acceptance.

Division 02 – Existing Conditions

02 41 00 Demolition

1. When a building/facility is to be demolished without new construction in its place, all foundation walls shall be removed to a point 36 inches below grade. All basement slabs below the 36-inch level need not be demolished, but must be broken into approximate 48-inch square areas or smaller, allowing drainage through slabs. Require the Contractor to hire the services of a NYS licensed surveyor to document the location of all foundations left in place below 36 inches, as well as abandoned utilities and utilities relocated as required by the demolition work. Specify that the survey shall become part of the Contractor's record drawing requirements at completion of the work.
2. Specify that all demolition debris shall be removed from Clarkson University property and disposed of by lawful means. Backfill basement cavities and depressions with clean fill, compacted to minimum density of 95 percent for cohesive material and 95 percent relative density for cohesionless material. Specify that the area shall be covered with topsoil and seeded.
3. Obtain Clarkson University approval prior to demolition of basement floors or before making connections into existing waste systems.
4. Specify that all utilities are to be cut and capped. Locations of capped utilities shall be included on the record survey provided by the Contractor.
5. Specify that the Contractor shall recycle non-hazardous materials that are removed.

Division 03 - Concrete

03 30 00 Cast-In-Place Concrete

1. Testing: Specify that the Contractor is to retain and pay for the services of a Clarkson University approved laboratory to perform concrete testing and inspections. For floors, use ASTM E1155 “Standard Test Methods for Determining Floor Flatness and Levelness Using the F Number System.”
2. Specify air-entrained concrete where concrete is exposed to the weather. With the exception of air-entrained agents, no antifreeze or other admixtures are permitted. Concrete additives containing more than 0.1 percent chloride ions are not permitted.
3. Specify that the Contractor protect newly placed concrete exposed to the public to insure that concrete is not defaced prior to complete setting up. This includes concrete floors intended to be left exposed to the public. Replacement of defaced concrete and concrete floors that are stained or otherwise damaged is included in the Contract Sum.
4. Specify clear sealer at all concrete floors which will be exposed within the finished building and which are not scheduled to receive an applied finish.
5. Specify a hardener where floor surfaces are subject to heavy loads, impact loads, or rolling loads.
6. Specify the finish of exposed concrete floors to meet a slip resistance requirement acceptable to the authorities having jurisdiction.
7. If using color in concrete floors, specify integral color additive. Surface-applied color may be used only with written approval from Clarkson University.
8. Architectural (exposed) concrete shall be included in mock-up requirements as specified in Division 01. Specify the specific requirements and criteria for review of architectural concrete in Division 03.
9. Sandblasted finishes for interior or exterior structural concrete are not permitted unless specifically approved by the Clarkson University.
10. Rubbed finishes for interior concrete to be painted is not permitted. Interior concrete may instead be specified with veneer plaster.
11. Detail concrete structural frames exposed to the exterior with insulation and finish systems minimizing thermal loss and gain.
12. Additional requirements for exterior concrete paving are included in Division 32.

03 40 00 Precast Concrete

1. Provide protection from rust stains and damage during construction of exposed pre-cast concrete.
2. Design precast concrete so that no portion of it touches grade or is below-grade.

Division 04 - Masonry

04 01 20 Masonry Restoration and Cleaning

1. Specify cleaning of brick or stone masonry using procedures and cleaning methods recommended by the original brick and stone manufacturers, except that no acid-based cleansers may be used.
2. Sandblasting of masonry is prohibited except where approved by Clarkson.
3. Obtain approval from the Clarkson University for mortar joint profiles and mortar colors.
4. Specify waterproof covering of masonry work during nonworking hours and for masonry work during inclement weather.
5. Experience Clause: A 5-year experience record of the subcontractor performing the restoration work is required.

04 20 00 Unit Masonry Assemblies

1. Specify submittals of brick masonry that show the full range of colors and textures that will be provided in the finished work.
2. Specify lightweight concrete block where CMU is used.
3. CMU less than 8 inches thick is not permitted unless approved in writing by the University.
4. Specify that mortar additives must be certified by the manufacturer to contain no more than 0.1 percent chloride ions.
5. Specify flexible through-wall flashing at cavity walls, minimum 20 mils thick.
6. Lead-coated flashing is not permitted.
7. Specify plastic weep holes at cavity walls, spaced not more than 24 inches on center at interruptions in the cavity caused by through-wall flashing, openings, and ledgers. Do not specify aluminum weep hole vents or weep holes with sash cord.
8. Specify that masonry coursing is to be coordinated with window and door heads and sills to minimize fractions of courses and cutting of full masonry units.
9. Include masonry in mock-up requirements as specified in Division 01. Specify the specific requirements and criteria for review of masonry in Division 04.

04 72 00 Cast Stone Masonry

1. Specify that samples of materials indicating each shape and color specified are required for approval before proceeding with the work. Submit samples of anchors and relieving angles.
2. Testing Laboratory: Require that the Contractor submit name and credentials of proposed testing laboratory for approval.
3. Inspection: Require that the Testing Laboratory inspect all material, equipment, fabrication, curing and storing of cast stone work at the plant. Mark and record each unit for identification with the day of casting.
4. Tests: Test representative pieces of cast stone randomly selected from those delivered to the jobsite. Costs for tests and replacement pieces of cast stone taken for testing are included in the Contract. A minimum of one unit per 50 units may be selected from delivered cast stone for testing. Samples shall be tested to destruction in accordance with ASTM C 116 and test reports shall be submitted to the A/E and University.

Division 05 - Metals

05 12 00 Structural Steel

1. For erection of structural steel, require that the Contractor provide an affidavit at the completion of the job, that the structural steel frame is plumb and level within the normal tolerances specified by code, or the more stringent tolerances if specified.
2. Require that the Contractor provide a certified survey indicating the exact location of the centers of the columns at their topmost level, exactly as installed. Require that this information be incorporated in the record drawings.

05 30 00 Metal Decking

1. Specify galvanized metal decking conforming to ASTM A 525, G 60 for metal decks, floor slabs, and roof decks. Prime-painted decks are not permitted. Require adhesion testing of sprayed on fireproofing on metal decking.

05 50 00 Metal Fabrications

1. Ventilation shafts penetrating the roof shall be equipped with welded anti-personnel grates to prevent unauthorized access to the building.
2. Specify all exterior miscellaneous steel to be galvanized and prime painted, ready for field finishing.
3. Specify structural support steel for equipment and for miscellaneous uses not specified elsewhere.
4. Specify manufactured removable collapsible steel bollard Maxiforce MCSP SS1-S with lockable base.

05 52 00 Metal Railings

1. Exterior Railings associated with Building: Specify powder-coated galvanized steel handrails. Specify railings to be non-removable and installed using non-shrink grout.
2. Exterior Railings elsewhere: Specify field-painted galvanized steel handrails. Specify railings to be non-removable and installed using non-shrink grout.

Division 06 – Wood, Plastics, and Composites

06 05 00 Common Work Results for Wood, Plastics, and Composites

1. Specify that all lumber be properly seasoned or kiln-dried.
2. Include carpentry elements in the mock-up requirements for exterior wood and plastic framed structures and exterior wood finish work with the mock-up requirements specified in Division 01. Specify specific carpentry requirements for the mock-up in Division 06

06 05 73 Wood Treatment

1. Where fire-retardant treatment or preservation treatment for wood is used, specify that treatment be accomplished by means of pressurization. Preservation treatment is required for all wood in damp areas or in contact with earth, concrete, masonry, plaster, or roofing. Do not provide treated wood in contact with steel.

06 10 00 Structural Carpentry

1. Specify that lumber must be inspected, marked according to grade and certified by the appropriate bureau governing that product.

06 13 00 Heavy Timber Construction

1. Require that the Contractor provide a complete design analysis of structural components along with shop drawings. Data shall bear the seal and signature of a NYS registered professional Architect or Engineer, attesting that design of trusses and other structural components meets requirements of the specifications and complies with requirements of all codes and ordinances applicable to the particular project.

06 20 00 Finish Carpentry

1. Conform to Architectural Woodwork Institute specifications for custom grade quality work as a minimum.

06 40 00 Interior Architectural Woodwork

1. Specify solid wood cabinet doors and drawer fronts for residential work.
2. Specify veneer plywood cabinetwork elsewhere except for laboratory casework, which is specified in Division 12. Plastic laminate may only be used after obtaining written approval of Clarkson University.
3. Specify that materials may not be delivered to the site until the building is completely closed in, weatherproofed, and climate-controlled. These controls shall be maintained until Substantial Completion.
4. Specify that the fabricator of cabinets shall also be the installer, and that the fabricator shall provide the cabinet hardware.

Division 07 – Thermal and Moisture Protection

07 10 00 Dampproofing and Waterproofing

1. Provide waterproofing membranes at floors and walls of below-grade spaces.
2. Specify dampproofing at exterior of below-grade walls that are not enclosing below-grade space.
3. Protect vertical waterproofing and dampproofing against damage during backfill with minimum 1-inch thick extruded polystyrene sheet with drainage grooves. Provide drainage at the bottom of below-grade walls, slabs, and foundation, sloped away from the building. See Division 33 for underslab drainage.

07 19 00 Water Repellents

1. Generally, do not specify water repellents for exterior brick or masonry walls. Where required on existing buildings, use saline based water repellents.

07 21 00 Thermal Insulation

1. When using fiberglass batt insulation in areas needing access for inspection and maintenance, specify foil-faced or paper-faced batts to facilitate removal.

07 24 00 Exterior Insulation and Finish Systems (EIFS)

1. EIFS may only be specified with the written approval of the University. Where used, specify only Class PM, Type A, heavy fiberglass mesh-reinforced high-abuse-resistant systems as defined by the Exterior Insulation Manufacturers Association (EIMA). Specify mechanical fastening of extruded polystyrene insulation and reinforcing mesh, and rigid acrylic modified cement plaster finish.
2. Locate control joints and detail the flashing and sealing at penetrations to ensure a properly designed and watertight installation. Provide weepholes at bottom of each panel. Specify the color of sealants to be used.

07 27 00 Air Barriers

1. Assure that a continuous moisture and air barrier is provided, including walls, slabs-on-grade, and roofs, with compatible joints between materials.

07 31 00 Steep Slope Roofing

2. Specify minimum 2 layers of #30 asphalt-impregnated building paper underlayment at roof shingles. Specify factory-coated aluminum valleys extending a minimum of 10-inches up each slope. Specify self-adhering sheet membrane waterproofing at eaves extending an additional 24-inches up the roof beyond the face of the exterior wall below.
3. Slate shingles shall be a minimum of 1/4-inch thick, weighing not less than 900 pounds per square and installed with no fewer than 2 nails per shingle.

07 40 00 Roofing and Siding Panels

1. Provide roof parapets on buildings greater than one story in height for safety purposes.
2. For metal panel exterior walls, specify construction of a mock-up panel. See Division 04 Masonry for details on extent of mock-up panel.

07 50 00 Membrane (Low Slope) Roofing

3. Only 4-ply SBS-modified bitumen roofing or single-ply EPDM roofs are acceptable for low-slope roofing, except at vegetated roofs. Provide cold- or hot-fluid-applied roof membranes at vegetated roofs, and use modular planting trays where possible. Fully adhered systems are preferred. Ballasted systems must be approved in advance by the University. Mechanically fastened systems are not acceptable. Specify ballast (if approved) using clean, river-washed gravel meeting ASTM-C-136.
4. Specify a flood test for new roof installations prior to final acceptance. Test must be witnessed by the University's representative.
5. Require a full materials and labor warranty of roof systems for a minimum of 2 years.

07 62 00 Sheet Metal Flashing and Trim

1. Specify thin wall (0.05-inch) copper flashing between parapet walls and capstone.
2. Specify gutters and downspouts formed of minimum (0.05-inch) copper.
3. Downspouts shall drain directly into underground storm drainage system.
4. Do not specify lead or lead-coated flashing.

07 72 00 Roof Accessories

1. Specify walkway pads no less than 24-inches wide to and around all roof-mounted equipment and appurtenances requiring maintenance.
2. Specify snow guards on all roofs with a slope of 6 in 12 or greater over entrances and adjacent to walkways. Specify that snow guards are to be screwed **and** adhered to roof.
3. Smoke relief vents shall be accessible for maintenance using a maximum height 10-foot portable ladder.

07 81 00 Applied Fireproofing

1. Specify fireproofing materials and application methods that are compatible with factory-applied steel finishes.

07 90 00 Joint Protection

1. Specify 2-part polysulfide, 2-part polyurethane or silicone-synthetic rubber type sealants wherever possible and appropriate. Specify pourable urethane base sealants for construction joints in traffic-bearing locations such as concrete walks, patios, and exterior stairs. Specify sealant for each individual application, and specify installation of sealants in accordance with manufacturers' recommendations.

07 95 00 Expansion Control

1. Specify manufactured interior and exterior covers for expansion joints. Specify interior joint covers that incorporate the finish material in public areas such that they are not apparent.

Division 08 - Openings

08 10 00 Doors and Frames

1. Doors to rooms storing high value items such as computers, scientific equipment, etc. shall have solid doors without vision panels and without adjacent sidelights.
2. The A/E must submit the door manufacturer list early in the design process for review and approval by Clarkson University.
3. Knock down frames are not acceptable.

08 11 00 Metal Doors and Frames

1. Specify exterior door faces with minimum 0.0635-inch (16 gauge) galvanized steel, and flush edges, including door tops. Specify exterior door frames with minimum 0.0785-inch (14 gauge) galvanized steel and with fully-welded drainage channel at head of each door.
2. Specify interior door faces with minimum 0.0478-inch (18 gauge) steel. Specify interior door frames with minimum 0.0598-inch (16 gauge) steel.
3. Knock-down frames are not permitted unless specifically approved in writing by Clarkson University.

08 14 00 Wood Doors

1. Do not specify exterior wood doors unless approval is obtained from Clarkson University.
2. Specify interior wood doors with solid core, using mineral core where a fire rating is required, or high density particle board core or wood stave core on non-rated doors.
3. Specify clear or stained finished wood doors with factory finishing and pre-machining for hardware. Specify door edges with solid wood matching wood face veneer.

08 33 00 Coiling Doors and Grilles

1. Specify steel slats for exterior coiling doors, unless insulated, in which case aluminum slats are acceptable.
2. Specify only fusible links for automatic closing rolling steel fire doors. Specifying both detectors and fusible links together is not permitted.
3. Fire shutters are not permitted; provide water curtains instead.

08 40 00 Entrances, Storefronts, and Curtain Walls

1. Specify wide-stile aluminum doors with minimum 5-inch stiles, 5-inch top rail and 10-inch bottom rail.
2. Specify that all hardware, with the exception of cylinders, shall be furnished and installed by the aluminum door manufacturer. Specify cylinders for these doors with the rest of finish hardware and matching the building system.
3. Specify finish hardware with US26D finish, with the exception of sprayed aluminum finish on door closers.

08 42 00 Automatic Entrance Doors

1. Specify that hinges and exit devices are to be installed with through-bolts. Specify spanner heads at exposed screws and bolts.

2. Specify frame reinforcement for overhead surface-mounted door operators.
3. Specify 120VAC power supply directly to each door operator.
4. Specify self-contained solid state circuit controller for operating and switching the swing power operator. The electronic control shall provide low voltage power supply for all means of actuation. External or auxiliary low voltage power source are not permitted. Specify adjustable time delay of 1 to 60 seconds, for normal cycle, as well as the following built-in features:
    - Torque limiting for controlled forces on opening,
    - Acceleration control for smooth starts and recycle,
    - Special circuitry for reducing power to the motor when door is in "Hold-Open" mode, extending longevity and assuring reliability.
5. A swing door presence sensor shall be mounted to each side of the swing door approach and swing path and shall be complete in all respects consisting of the following:
    - Extruded Aluminum housing of 6063-T52 alloy sized to run full width of door, integral high impact, tinted acrylic lenses and injection molded end caps.
    - Solid state electronics interfaced to alternating rows of light emitting diodes and receivers contained within the extruded aluminum housing.
    - Long/short range switch and flexible cable.
    - Sensor shall be capable of operation within temperature ranges of -20F and 160F. Vision pulse shall detect presence not motion and shall not be restricted in application due to door design, construction, material or glass type. Ambient light and radio frequencies shall not interfere with the sensors performance.

08 50 00 Windows (Exterior & Interior)

1. Where divided lites are required, specify muntins installed in insulating glass units, between the panes of glass.
2. At residential windows specify insect screens in aluminum frames, flat black. At ground floor residential windows specify security mesh in steel sash, flat black.

08 60 00 Roof Windows and Skylights

1. Skylights are not permitted unless special permission has been obtained from Clarkson University. Such permission will not be granted without extremely strong reasons. If skylights are accepted by Clarkson University, specify continuous inspection of skylight flashing during installation.

08 71 00 Hardware

1. The following hardware for the types of buildings indicated shall be provided.

ITEM	MANUFACTURER	MODEL NO. ACADEMIC BUILDINGS	MODEL NO. HOUSING FACILITIES
Butt Hinges, Interior	Stanley	FBB-179 4-1/2 USP or approved equal	FBB-179 4-1/2 USP
Butt Hinges, Exterior	Stanley	FBB-199 4-1/2 US32D or Approved Equal	FBB-199 4-1/2 US32D

Continuous Hinges	Roton or Zero	Continuous (to suit application)	
Locksets & Latch Sets	Best	93K Series	
Key Cylinders	Best	7 pin	
Flush Bolts	Ives	457-B26D or Approved Equal	457-B26D
Exit Devices	Von Duprin	99x990NL x US26D 1103 x 17	99 Series 1100 Series
Removable Mullions	Yale	M100 Series	M100 Series
Door Closers	LCN	4040 x Sprayed Alum.	4040 Series
Door Stops / Holders	Glynn - Johnson	500 Series Non H. O.	500 Series Non H. O.
Wall Bumpers	Ives	407 - 1/2 x B26D or Approved Equal	407 - 1/2 x B26D
Push Plates	Rockwood	70 3-1/2 x 15 US26D	70 3-1/2 x 15 USD26D
Pull Plates	Rockwood	123 x 73 3-1/2 x 15	123 x 73 3-12 x 15
Mop Plates	Rockwood	18-8-inches	18-8-inches
Kick Plates	Rockwood or Approved Equal	18-12-inches	18-12-inches
Silencers	Glynn-Johnson or Approved Equal	No. 64	No. 64

2. Specify and schedule a hardware set for each door opening in the building. Specifying hardware by allowance is prohibited.
3. Obtain Clarkson University approval to use hardware not listed.
4. In addition to these hardware requirements, see those for automatic door openers.
5. Require written guarantee from hardware manufacturers as follows:

   Locksets: Five (5) years

   Exit Devices: Five (5) years

   Closers: Ten (10) years

   Electronic closers: Two (2) years.

   All other hardware: Two (2) years.
6. Hinges: Outswinging exterior doors shall have non-removable pin hinges (NRP). Exterior hinges to be brass, bronze or stainless steel material. Hinges shall be extra heavy weight for high frequency openings or doors over 36-inches in width. All hinge open widths shall be 4.5-inches minimum, but of

sufficient size to permit door to swing 180. Furnish hinges with three knuckles and concealed bearing. Plain bearing shall not be permitted.

7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
8. Exit Devices: Furnish all sets at wood doors with sex bolts unless otherwise specified in Wood Door Section/ Hardware blocking. Trim of exit devices to match trim of locksets. Provide rim devices at single doors. At pairs of doors with low visibility provide two rim devices with key removable mullion. At doors with high visibility, provide concealed vertical rod devices. Depending on location, at exterior openings provide two surface vertical rod devices or two rim devices with key removable mullions.
9. Specify exit-only devices at exterior doors which are not the main access point to the building. Indicate that these doors are to be connected to the fire alarm system. Indicate that such doors shall be clearly marked on the inside that opening the door will sound an alarm.
10. Concealed vertical rod exit devices are not permitted. Specify only those exit devices and manufacturers listed below.
11. At pairs of doors specify rim-type exit devices latching into removable mullion or into strike on second leaf. When no removable mullion is provided, specify a door coordinator.
12. Specify removable mullions at pairs of entry doors.
13. Surface Door Closers: Full rack and pinion type with removable non-ferrous cover. Provide sex bolts at all wood doors unless otherwise specified in Wood Door Section/Hardware blocking. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized and adjustable. All closers shall be R14 die cast aluminum alloy material.
14. Floor type or overhead concealed door closers are not permitted.
15. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors unless otherwise specified.. Furnish Type "A" screws to match finish.
16. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
17. Wall stops or floor stops are not permitted.
18. Screws: All exposed screws shall be Phillips head.
19. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
20. Clarkson University will install permanent cores and return the construction cores to the Hardware Distributor. All Construction cores and keys remain the property of the Hardware Distributor.
21. Require that the Contractor submit three copies of the detailed schedule indicating clearly how the University's final instructions on keying of locks has been fulfilled.
22. Typical Door Schedules are as follows:

    Non-Public Toilet:

    1-1/2 pr. Butts
    1 - Stanley FBB179 X US26D
    1 - Privacy Set Best 93K Series w/ privacy lock
    1 - Door Closer LCN 4041 X Alum.
    Silencers GJ-64

    Storage Room, Custodial Closets

    Note: Same set shall apply to Mechanical and Electrical Rooms. However, lever trim shall not be used (knurled knob trim required).
    1-1/2 pr. Butts Stanley FBB179 X US26D
    1 Lockset Best 93K Series
    Silencers GJ-64

Office Doors
1-1/2 pr. Butts Stanley FBB179 X US26D
1 Lockset Best 93K Series
1 Door Closer LCN 4041 X Alum. (optional)
Silencers GJ-64
Public Toilet
1-1/2 pr. Butts Stanley FBB179 X US26D
1 Pull Plate
1 Push Plate
I Kickplate
1 Mop Plate
I Closer LCN 4041
Silencers GJ-64
Classrooms, Laboratories
1-1/2PR. Butts Stanley FBB179 X US26D
1 - Lockset Best 93K Series
1 - Closer LCN 4041 (optional)
Silencers GJ-64

23. Elevator and Fire Alarm Panel Keys

    Specify locking hardware for elevators and fire alarm panels such that it can be operated with existing keys.

24. Furnish one (1) Key Cabinet similar to Lund 1205A , with capacity of one (1) hook per cylinder, plus an additional one hundred (100) percent expansion.

25. Hardware installation locations:

    Bottom Hinge: 10 inches from door bottom to bottom of hinge.

    Top Hinge: 5 inches from door top to top of hinge.

    Center Hinge: Center between top and bottom hinge.

    Extra Hinge: 6 inches from bottom of top hinge to top of extra hinge.

    Lockset/Latchset: 38 inches from finished floor to center of lever or knob.

    Push Bar: 44 inches from bottom of door to center of bar.

    Push Plate: 44 inches from bottom of door to center of plate.

    Pull Plate: 42 inches from bottom of door to center of pull.

    Exit Device: 39-13/16 inches from finished floor to center of pad.

    Deadlock Strike: 44 inches from floor, centered.

08 80 00 Glazing

1. Specify exterior glazing to be insulating glass units consisting of clear glass with low-e coating, unless otherwise approved by the University.

08 90 00 Louvers and Vents

1. Specify fixed-drainable blade aluminum louvers unless specifically approved by the University.
2. Specify bird screen at interior of all louvers.

Division 09 - Finishes

1. Interior finishes that are extravagant or costly, or that require a high degree of maintenance, are not permitted. Likewise, finishes that require extremely high levels of workmanship or extremely close tolerances during construction are not permitted.
2. Obtain Clarkson University approval of the colors of all finish materials
3. Specify the flame spread and smoke-developed requirements for each interior finish material. Require submittals to indicate the actual flame spread and smoke-developed ratings for each material.
4. Do not specify maintenance materials for finish materials.

09 30 00 Tiling

1. Quarry Tile Cleaning: Where quarry tile is specified, require the Contractor to clean the floor with Hillyard Seal 341 or approved equal. Select colors to minimize showing of dust and footprints.

09 51 00 Acoustical Ceilings

1. Specify and schedule suspended acoustical panel ceilings in lieu of gypsum board wherever possible.
2. Specify minimum 15/16-inch wide exposed runners for suspended ceiling systems.
3. Specify standard ceiling panels not requiring special order or premium price.
4. Do not specify concealed spline ceiling tile systems unless acoustical tiles are directly adhered to ceiling substrate, and only with Clarkson University approval.
5. Detail expansion and movement control joints. Specify joint assemblies and soffit covers to minimize visual impact.

09 60 00 Flooring

1. The following are suggested floor finishes for certain space types. Except for materials noted as prohibited, actual finishes are to be selected by the A/E based on design judgment and the specific building requirements:
    - Offices: Carpet.
    - Seminar and conference rooms: Carpet.
    - Library and reading rooms: Carpet.
    - Restrooms: Ceramic tile with dark colored grout. Dark grout and ceramic tile covered base should extend up walls at least 4 inches.
    - Classrooms: Vinyl composition tile (VCT).
    - Corridors: Terrazzo or VCT. Carpet may be scheduled for upper floors in buildings where spills are not anticipated.
    - Lounges: VCT unless no vending area nearby, in which case carpeting may be considered.
    - Stairs: Terrazzo or rubber tile. Provide contrasting color warning stripe on first tread and at landing, either integral with stair tread material, or inset into tread material.
    - Laboratories: Fluid-applied epoxy or seamless sheet vinyl. Do not specify vinyl tile.
    - Entrances and Vestibules: Pedigrid/pedimat for recessed and on-surface areas (recessed preferred).
    - Lobbies: Terrazzo, Ceramic Tile or VCT.

- Multi-Purpose Rooms: Wood flooring.
- Janitor's Closets: Ceramic tile with 4-inch base and dark colored grout,
- IT Closets: Static dissipative VCT,
- Food Preparation Areas: To be determined by Clarkson University.
- Dining Rooms: Specify carpet tiles in lieu of broadloom carpet.

2. Detail expansion and movement control joints. Specify joint assemblies and covers to minimize visual impact and to withstand high traffic.
3. Floor treatment for exit stairways, corridors, common areas, assembly rooms, resident hall rooms and apartments shall be constructed of not less than Class I materials as tested to ASTM E648. Testing must be performed by an approved agency and each lot of carpeting procured shall be accompanied with a certified test report identifying the carpet by manufacturer and style name, and shall be representative of the current construction of the carpet. The carpet must also pass the DOC FF-1 "pill test" (CPSC 16 CFR, part 1630).
4. Floor treatment for offices and other areas not specified above shall be classified not less than Class II in accordance with ASTM E648. Testing must be performed by an approved agency and each lot of carpeting procured shall be accompanied with a certified test report identifying the carpet by manufacturer and style name, and shall be representative of the current construction of the carpet. The carpet must also pass the DOC FF-1 "pill test" (CPSC 16 CFR, Part 1630).
5. Provide details where floor coverings meet building expansion joints to ensure smooth transitions that will not present trip hazards or maintenance problems. Floor coverings shall not cover expansion joints without a transition. Pay special attention to providing a smooth, functional and attractive transition detail.

09 65 00 Resilient Flooring

1. Avoid use of fissured, ribbed or otherwise textured vinyl composition or rubber tile, except in locations where high slip resistance is required.
2. Select color and finish to make imperfections less noticeable.
3. Floor Tile: Vinyl composition, 1/8" x 12" x 12", as manufactured by Kentile, Armstrong or equal, meeting or exceeding Federal Specification #SF-T-321 B, Type 4. Colors selected shall minimize the showing of dust and/or footprints.
4. Base: Vinyl cove base, 4" or 6", as manufactured by Roppee Rubber, Johnsonite Rubber Company, Flexco, or equal, meeting or exceeding Federal Specification #SF-W-40A, Type 1.
5. Specify the type of floor sealer and wax to be used by the contractor prior to building turnover.
6. Linoleum is not permitted.

09 68 00 Carpeting

1. Specify that the Contractor is to provide a Notarized Statement from Manufacturer to the effect that all carpeting and associate materials (including padding) shall be certified to have a minimum flame spread and smoke developed rating meeting the requirements of the VUSBC.
2. Specify impervious carpet backing, such as vinyl.
3. Specify carpet to be solution-dyed.

09 70 00 Wall Finishes

1. Detail expansion and movement control joints. Specify joint assemblies and wall covers to minimize visual impact.

09 90 00 Painting and Coating

1. Specify eggshell paint in lieu of flat paint.
2. Specify a single brand of paint – e.g. Sherwin Williams (paint shop uses a Sherwin Williams paint mixing machine)
3. Specify paint colors and sheens using Sherwin Williams numbers as the basis-of-design, even if other brands are specified as permissible.
4. Specify paint and coating products with zero VOCs, including exterior paints and coatings.
5. Special paint is required for video-conferencing spaces, as determined by Campus Planning and ITU.
6. Specify paint for each use:
    - Office walls: flat or eggshell
    - Corridor walls: eggshell
    - Toilet room walls and ceilings: semi-gloss
    - Kitchen walls and ceilings: semi-gloss
    - Doors and Door Frames: semi-gloss
    - Railings: gloss (currently) – will transition to DTM (Direct to Metal) paint
7. Maintenance Stock: One full can of each paint type and color per building, plus records.
8. See Division 22 for painting pipes for identification.

Division 10 - Specialties

10 11 00 Visual Display Boards

1. Specify chalkboards only when specifically requested by the University.
2. Typically specify dry marker boards in classrooms and conference rooms.
3. Specify tack boards in conjunction with chalk boards and marker boards.

10 14 00 Signage

1. Refer to the Clarkson University Environmental Graphics Standards (TBP).
2. Provide an interior signage schedule to Clarkson University for review.

10 21 13 Toilet Partitions

1. Specify toilet partitions as ceiling hung or wall hung. Provide adequate structure to support partitions without sagging or warping. Specify vandal-resistant attachments.

10 26 00 Wall Protection

1. Provide stainless steel corner protection in kitchens and in back-of-house areas where carts will be used.

10 28 00 Toilet and Bath Accessories

1. Provide baby changing stations in Men's and Women's toilet rooms on the entry level of most buildings.
2. Electric Hand Dryers: N/A.
3. The following toilet and bath accessories will be provided by Clarkson University, and are to be specified to be installed by the Contractor.

    Toilet Tissue Dispensers.

    Roll-Towel Dispensers.

    Soap Dispensers.

10 44 00 Fire Protection Specialties

1. Specify solid cabinet doors with a small window made of polycarbonate or other plastic glazing to verify the presence of fire extinguisher. Specify cabinet sizes to accommodate the extinguisher sizes specified. Break-glass faced fire extinguisher cabinets are not permitted.
2. Specify 5 pound ABC type extinguishers allowing for 75 feet travel distance for Class A light hazards.
3. Bottom of cabinet shall be mounted a minimum of 16” and no higher than 48” above floor.
4. Fire extinguishers cabinets shall be incorporated into all projects as required by code.
5. Fire extinguishers shall be incorporated into all projects as required by code.

Division 11 - Equipment

11 40 00 Food Service Equipment

1. Prepare specifications for food service equipment in close coordination with University food service personnel.
2. Specify that the Contractor is responsible for coordinating foodservice equipment with utility installation and with structural backing in walls and ceilings.

11 53 13 Fume Hoods

1. General

All new hoods shall meet testing criteria established by the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) in ANSI/ASHRAE 110-1995, "Method of Testing Performance of Laboratory Fume Hoods". All hoods, bench, distillation, or walk-in types, shall have proper aerodynamic design to minimize eddy currents and assure against air movement from the hood into the laboratory. This is accomplished by airfoil sides and an aerodynamically designed sill with a one-inch air gap between it and the hood floor. An "air by-pass" shall be present on all hoods to control the range of the face velocity as the hood sash is raised and lowered. The face velocity at any sash position should never exceed three times the "open face" velocity. It is necessary to keep the air velocities within this range to reduce eddy currents around the edges of the hood face.

2. Location
   A. All new fume hoods shall be an integral part of the laboratory design and all laboratory renovations shall also rectify improper hood locations.

   B. Fume hoods shall be located in a room so that air currents generated in the room will not interfere with the hood's ability to capture and eliminate vapors, mists, and airborne particles. Therefore, hoods shall be located as far away as possible from:

      - Doors
      - Supply air diffusers
      - Windows which can be opened
      - Heavy traffic areas
      - Other local exhaust ventilation devices

   C. Room air current velocities at the face of the hood should not exceed twenty linear feet per minute (LFM) from any source and should be as close to zero as practicable.

3. Hood Design and Construction

   A. General: In general, all fume hoods should be constructed and contain materials that will permit their planned use to be carried out safely; therefore, their intended use must be known. When possible Direct Drive exhaust fans should be used.

   B. Ducts

      1) Ducts should be constructed of materials compatible with the chemicals being used in the hood. Circular ductwork shall be used.

      2) Ducts are to be constructed of a non-reactive stainless steel, unplasticized PVC, or have an inorganic ceramic coating. Questions about duct composition should be referred to Clarkson University.

3) Fume hoods shall not be manifolded.

4) Ductwork shall take the straightest route to the roof, minimizing bends and horizontal runs. Increased distances and bends create resistance to air flow and require larger exhaust motors. When elbows are necessary, they shall have proper center-line radius (one-and-one-half times the diameter of the ducts) to minimize eddying and resistance to air flow. All elbows shall have removable wear plates when operations will involve heavy dust concentrations. Ductwork shall not enter the blower motor on an elbow. Exhaust blower motors shall be located on the roof so that a negative pressure will be maintained in the ductwork and prevent escape of toxic material through holes and cracks in the duct.

C. Filter Housing

1) HEPA or charcoal filters are not required for most routine uses of fume hoods. Install a filter or filter housing only if specified by Clarkson University. Where filters are required, the housing shall be located in the fan room or roof before the blower. The filter housing shall be located to allow for easy filter changing by the bag-in bag out technique. Exhaust fans shall be sized accordingly to handle the increased pressure drop across the filter.

D. Discharge

1) The discharge point must be at a proper height above the highest point of the roof or parapet (10-15 ft.) to reduce air streaming effects of the building. Air shall be discharged vertically with at least 3500 feet per minute stack discharge velocity. The discharge stack should be located in the prevailing downwind direction of air intake point.

2) The discharge stack shall be uncapped, straight, and cylindrical. The discharge duct shall overlap the fan ductwork 6" and have a 1" greater diameter, to provide for rain drip discharge. Deflecting weather caps are prohibited on discharge stacks, as they reduce the effective stack height, reduce air velocity, are not effective rain shields, and increase final cost.

E. Sides: Hood sidewalls shall be 3 1/2 - 6 1/2 inches wide, and shall be properly formed to present a smooth airfoil to the inflowing air. The hood interior lining shall be flush with the sides. These features shall, over the range of the hood's designed air face velocity, prevent significant eddy currents from circulating air from inside the hood through the plane of the face of the hood.

F. Sill: A radiused stainless steel sill is required. It shall be installed at the bottom of the hood opening and extend back under the sash. An open area of approximately one inch shall be present under the sill to direct air across the work surface at all sash positions.

G. Sash: The sash may be vertically or horizontally tracked. Horizontal sash hoods shall have a device to lock the sash in its tracks. Removal of the sash only is possible with special tools or keys. Glass used in the sash shall be at least 7/32" thick combination sheet. The sash shall be securely enclosed in a complete frame, welded and ground smooth at the corners. Stainless steel or a baked on epoxy coat is to be used for the sash frame. Vertical sashes shall be counter-balanced with sash weights, suspended from each side of the sash and shall be easily operated. The sash frame must be held in a stainless steel track and have plastic guides. Sashes shall be anti-guillotine.

H. Interior:

1) The interior lining of the hood must be resistant to the materials and chemicals to which it will be exposed. Stainless steel is acceptable; suitable compositions, including composition board, must be painted or coated with an impervious sealer such as epoxy paint. The selection of

resistant materials must be made through consultation with the Clarkson University Environmental Health and Safety Department.

2) Use of perchloric acid, hydrofluoric acid, and radioisotopes require special consideration as detailed in those sections.

I. Exterior: Cold rolled steel shall be used for the hood exterior. All parts shall be joined together with screws to allow for dismantling and access for service. After fabrication and before final assembly, all component parts shall be given an acid, alkali and solvent resistant finish on both exterior and interior surfaces.

J. Frame: The exterior and interior walls of the hood shall be rigidly supported by a full frame.

K. Working Surface: The hood working surface shall be molded epoxy or stainless steel. It shall be recessed not less than 1/4" deep and have a raised area on all sides. The raised area across the front of the hood shall be at least three inches wide.

L. Hood Fixtures and Services: All hood services shall be specified by the user. All electric service shall be located on the exterior of the hood. Plumbing services shall be brass, chrome-plated, or acid and organic vapor resistant plastic. All fixtures shall have color coded end caps. All controls for plumbing services shall be located on the hood exterior.

M. Lighting: Sufficient lighting shall be provided by either fluorescent, halogen, LED, or incandescent light fixtures at the top exterior of the hoods. The light fixture shall be easily accessible from the outside of the hood, shall be shielded from the hood interior by a laminated or tempered glass panel, and shall be vapor sealed.

N. Air By-Pass Mechanism: All hoods shall be equipped with an air by-pass mechanism located above the hood face opening. It shall provide an effective sight-tight barrier between the user and the hood interior. By-pass louvers shall be directed upward away from the front of the hood and provide an effective barrier and deflector for flying debris from inside the hood. The by-pass shall control the face velocity as the sash is lowered. The velocity of the air at any sash position shall never exceed three times the open face velocity. The air by-pass shall begin to operate when the sash is one-third to one-half closed.

O. Plenum and Slot Arrangement: A plenum shall be located in the rear of all fume hoods. It must have at least two but no more than three slots. The lower slot shall be furnished at the working surface level and be locked at 2 to 2 1/2 inches or have the baffle removed entirely. The upper slot shall be located in the upper section of the hood. The opening shall be set at 3/8 to 1/2 inch maximum. A middle slot, if furnished, shall be fixed and have an opening no greater than 2 inches.

4. Exhaust Fans and Ductwork: See Division 15

5. Control System

Where appropriate the fume hood control system shall be incorporated into the Building Management System. Otherwise it shall be equipped with a device to measure and monitor air flow. At a minimum, the system shall have a visual indicator of the hood face velocity. Additionally, adjustable low flow/caution alarm points with audible buzzer or alarm are recommended. The system chosen shall be approved by Clarkson.

6. Special Hoods

A. Perchloric Acid Hood

1) To safely contain perchloric acid, work requirements in addition to the standard design for fume hoods are specified under this section.

2) Materials of construction for the hood and ductwork shall be nonreactive, acid resistant and relatively impervious. Type 316 stainless steel, with welded joints, is preferred. Unplasticized polyvinyl chloride or inorganic ceramic coatings, such as porcelain, are acceptable.

3) All interior surfaces of the hood and ductwork shall be smooth and seamless, and constructed for easy cleaning. The work surface shall be smooth and watertight with a minimum of 1/2" dished front and sides and an integral trough at the rear to collect wash-down water. The hood shall be designed to allow easy visual inspection of all interior surfaces.

4) Ductwork and Exhaust Fans: Each perchloric acid hood shall have an individual exhaust system (i.e., individual duct to individual fan). The ductwork shall go straight from the hood to the roof with no horizontal runs or sharp turns. "Wash-down" facilities shall be built into the hood and ductwork. An air ejector system or an exhaust fan may be used. An air ejector exhaust system eliminates the possibility of acid reaction with fan components and allows for ease of cleaning. If a fan is used, the blades shall be made of acid resistant metal or a metal protected by an inorganic coating. The fan shall be lubricated with fluorocarbon type grease.

B. Hydrofluoric Acid Hoods

1) Hydrofluoric acid is a highly corrosive agent. Consequently, materials resistant to hydrofluoric acid attack shall be substituted for standard laboratory fume hood construction materials. For hydrofluoric acid, use the standard design specified for fume hoods, supplemented by the following specifications on construction and materials.

2) The hood and ductwork shall be constructed of nonreactive materials that are resistant to hydrofluoric acid attack and are relatively impervious. A Portland cement hood interior or other suitable material is recommended. The hood shall be constructed to allow easy visual inspection of all interior surfaces. A transparent plastic sash and PVC ductwork are required.

3) Ductwork and Exhaust Fans: Horizontal runs and bends in ductwork must be kept to a minimum. The motor and blower housing shall not have exposed metallic parts.

C. Radioisotope Hoods

In addition to meeting the standard design specifications for fume hoods, the interior of all radioisotope hoods shall be stainless steel or molded epoxy resin and must form a smooth integral unit. All interior screws shall be countersunk and joints sealed and smooth for ease of decontamination.

11 53 19 Sterilizers (Autoclaves)

1. Install a floor drain capable of handling discharge under all autoclaves.
2. Install a stainless steel drip pan under every autoclave with an opening for the floor drain. This opening is to be sealed around the edges to prevent liquids from getting between the pan and the floor.
3. Provide a fused electrical disconnect within 3' of autoclave.

11 53 33 Emergency Safety Appliances

Eyewash Units:

1. Install eyewash units at or near sinks within the hazardous operations space. Such spaces include wet laboratories, areas where dust is generated, darkrooms and other areas where liquid chemicals are used or handled. Handheld hose type units providing a soft spray of 3-7 gpm at a pressure of 30 pounds per square inch are recommended. These may be mounted bench or on the side of the bench or wall, and should be readily accessible and located in a high area or near the main door. Wall mounted units, pedestal-mounted units; eye/face wash units combination safety shower/eyewash units must provide a soft spray of 3-7 gpm at 30 pounds per square inch of pressure.

2. All eyewash units must flush both eyes simultaneously, the flow must remain on without the use of the operator's hands, the unit must remain activated until intentionally cut off and the nozzles must be protected from airborne contaminants.

3. A sign must be posted to identify the location of the eyewash unit and the area behind or around the eyewash unit must be painted with a bright color. Eyewash units for non-ADA compliant units should be installed between 2'-9" and 3'-9" from the floor. For ADA compliant stations, for dimension references CABO ANSI A117.1 standards for drinking fountains shall be followed. However, the appliance shall be eyewash units.

Safety Showers:

1. Install safety showers in a conspicuous location within the room or space they serve. Safety showers in corridors should be recessed into the corridor wall as much as possible to avoid pedestrian traffic interference and can serve several laboratories or rooms. Install safety showers in locations that are clearly marked and accessible at all times.

2. Install safety showers so that the center of the shower head is at least 25" from the nearest wall, bench or furnishing and at a safe distance away from electrical equipment or outlets. The base of the shower must be between 6'-10" and 8' above the floor. The shower head should be a deluge-type head, and should be made of plated brass or plastic. The safety shower unit be capable of providing a flow of 30-50 gallons of water per minute at 30 pounds per square inch of pressure. Provide a floor drain at the shower location capable of handling the same amount of water as the shower head and piped to the applicable drainage system.

3. Safety shower activating valves are to be operated by pulling a chain, a cord attached to die valve lever, an 8 inch minimum diameter ring or a triangle connected by a chain or cord to the lever. The lowest point of the ring, triangle or cord should be located no more than 48" from the floor for frontal approach and no more than 54" from the floor for a side approach, and should run within 1-2 inches of a wall or bench. Safety shower activating valves are to be quick-opening, self-closing globe valves. A shut off valve accessible via a 6 foot ladder is to be installed for each shower head.

4. A sign must be posted to identify the location of the safety shower, and the area behind or around the safety shower must be painted with a bright color. Exterior safety showers and water supply lines must be protected from freezing.

5. Installation and operation of safety showers and eyewash units must comply with ANSI Z358.1-1990.

Division 12 - Furnishings

12 20 00 Window Treatments

1. Specify manually-operated shades unless written approval is obtained from the University.

12 35 53 Laboratory Casework

1. Specify doors and drawer fronts of laboratory casework to be solid wood, clear of defects and discoloration. Specify that casework bodies are to be constructed of steel with powder-coat or baked enamel finish.
2. Specify that a full-scale mock-up of laboratory casework is required prior to fabrication of casework to be delivered to the site.
3. There is a NYS contract for lab casework.

12 48 13 Entrance Floor Mats and Frames

1. Specify recessed entrance walk off mats that can be easily picked up and moved for cleaning. Do not specify entrance grids with carpet inserts.

    Product: American Floor Mats, 3/4" Recessed Grille Mat, http://www.americanfloormats.com/34-recessed-grille-mats/

12 50 00 Furniture

1. Specify that the Contractor shall coordinate the installation of furniture and furnishings with the installation of utilities.

12 61 00 Fixed Audience Seating

1. Fixed seating shall be included in the contract documents.

12 92 00 Site Furnishings

1. Exterior/site furnishings shall be determined based on the project.
2. Bollards: See Division 03 for concrete bollards and Division 05 for metal bollards.

Division 13 – Special Construction

13 34 00 Fabricated Engineered Structures

1. Specifications for pre-engineered building shall include complete structural requirements including:

   Wind load both horizontal and uplift

   Snow load

   Floor loading

   Mechanical equipment loads

2. Require that the Contractor submit written certification prepared and signed by a Professional Engineer, registered to practice in NYS, verifying that building design meets specified loading requirements and codes of authorities having jurisdiction.

3. Trailer structures must meet applicable codes for industrial facilities.

13 40 00 Storage Tanks

1. All Installations, Modifications and Upgrades of Underground Storage Tank Systems shall be done in accordance with all government regulations.

2. Obtain University approval for using steel or fiberglass tanks in a project. Specify anchors, cathodic protection, and leak detection in accordance with tank manufacturer's written instructions. Obtain University approval for anchor system and tank beds.

Division 14 – Conveying Equipment

14 24 00 Hydraulic Elevators

1. Manufacturers providing equipment to Clarkson University shall permit maintenance by the University's conveying equipment service contractor. The following are Clarkson University approved elevator manufacturers:

   Thyssen/Krupp

   Schindler

   Kone

2. All key switches used in the hallway or inside the elevator should be on Clarkson's master key system. An exception is the emergency fire key which shall be Chicago Key Way H2389. Twelve copies of the key shall be provided to the Clarkson Physical Plant for distribution to the appropriate department(s).

14 42 00 Platform Lifts

1. Chairlifts shall require keys for operation.

DIVISION 21 - FIRE SUPPRESSION

21 00 00 Fire Suppression General Requirements

1. At a minimum, follow the requirements set forth in the most current governing plumbing codes and their referenced standards and regulations. These shall include but are not limited to;
    - NYS Building Code (IBC),
    - ASME A17.1, Safety Code for Elevators and Escalators,
    - 2008 International Electrical Code,
    - 2009 NYS Fire Prevention Code (IFC),
    - National Fire Protection Association (NFPA),
    - NFPA 13, Standard for the Installation of Sprinkler Systems,
    - NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies,
    - NFPA 14, Standard for the Installation of Standpipe and Hose Systems
    - NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection,
    - NFPA 25,Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,
    - NFPA 45, Standard for Fire Protection for Laboratories Using Chemicals,
    - NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems,
2. All fire protection system components shall be FM Approved, including but not limited to sprinkler heads, valves, pipe, fittings, hangers, pumps, controllers, tamper switches and related specialties.
3. Any requirements specified in this design manual that may exceed the minimum requirements of the governing code shall be adhered to unless prior approval is granted by Clarkson.
4. Coordinate fire sprinkler/standpipe service entrance with the corresponding site utility plans. Verify all sizes and depths are coordinated.
5. Coordinate fire department connection (FDC), fire pump test header and fire hydrant locations with the corresponding site plans.
6. This Section must be coordinated with the General Conditions.
7. All equipment shall be installed with sufficient walk-around room to insure proper maintenance of equipment.
8. Products and materials manufactured in the United States are preferred.
9. The A/E may specify a single manufacturer and model number to establish a basis of design, however, all specifications shall be open to equal manufacturers or vendors. Where a basis of design specification is indicated, provide at least three other qualified manufacturers or vendors.
10. Refer to Section 10 44 00 “Fire Protection Specialties” for information on fire extinguishers and fire extinguisher cabinets.
11. For all new construction, renovations, and alterations, the Contractor shall mark-up the contract documents to indicate any changes in construction and installation due to field conditions or other deviations from the plans and specifications. The A/E shall take the record drawings and produce the As-Builts with a CAD file.

22 05 29 Hangers and Supports for Fire Protection Piping and Equipment

1. Provide calculations for pipeline flexibility. Anchor as needed. Conform to ASME Code for allowable stresses.
2. Hanger installation shall be in accordance with FM LPDS 2-8N and NFPA 13 requirements.
3. Seismic requirements must be followed.

21 05 23 General Fire Suppression Valves

4. Control Valves:
    - In all buildings with fire alarm systems, all control valves, including post indicator and wall indicator valves, shall be electrically supervised by the fire alarm panel.
    - At all locations that control valves are concealed above ceilings or behind access doors, a sign shall be provided on the ceiling below the valve or the access door indicating the location of the control valve. See Signage Standards 3.7
    - In residential buildings, all control valves that are located in spaces accessible by the occupants of the building shall be provided with lockable tamper prevention devices and locks (that shall be specified by the University).
    - Control valves shall only be installed in corridors, stairwells, mechanical rooms, fire pump rooms and sprinkler valve rooms and shall be easily accessible. The control valves shall be accessible with the use of no more than a six foot stepladder. Provide 24" x 24" access door for valves located above inaccessible ceiling types.
    - Control valves shall not be installed in classrooms, offices, conference rooms or any dormitory living quarters.
    - Each control valve shall be supplied with a sign indicating the area of the building that is served by the valve.
5. Inspector Test Valves:
        - At all locations that inspector test valves (ITV) are concealed above ceilings or behind access doors, a sign shall be provided on the ceiling below the valve or on the access door indicating the location of the ITV. See Signage Standards 3.7
        - Inspector test valves shall only be installed in mechanical rooms, corridors, stairwells, fire pump rooms, sprinkler valve rooms and custodial closets and shall be easily accessible. The ITV's shall be accessible with the use of no more than a six foot stepladder.
        - Inspector test valves shall not be installed in classrooms, offices, conference rooms or in dormitory living quarters or in any area requiring entry through a classroom, office, conference room or any dormitory living quarters.
        - Inspector test valves discharge shall be piped to a drain capable of handling the discharge at full flow or to the exterior of the building.
6. Drain Valves:
7. Drain valves shall only be installed in corridors, stairwells, mechanical rooms, fire pump rooms and sprinkler valve rooms and shall be easily accessible. The drain valves shall be accessible with the use of no more than a six foot stepladder.
8. Drain valves shall not be installed in classrooms, offices, conference rooms or in dormitory living quarters, or in any area requiring entry through a classroom, office, conference room or any dormitory living.
9. Main drains discharge shall be piped to the exterior of the building.

10. Auxiliary drain valves discharge shall be piped to a drain capable of handling the discharge at full flow or to the exterior of the building.

21 05 53 Identification for Fire Suppression Piping and Equipment

1. Utilize standard tag or placard to mark all major equipment. Tag all valves and provide valve chart for each floor. Coordinate identification information with resident GIS Administrator.
2. Utilize standard NYS color coding for various building service piping and equipment. Mark each with name of service, direction of flow, and associated unit served where appropriate.
3. Equipment requiring electrical power shall be provided with a label indicating the electrical panel and/or motor controller feeding the equipment.
4. Plastic labels for equipment shall be multi-layer, multi-color phenolic with contact-type permanent adhesive compatible with attached substrate. Labels shall be 1/16" thick with black lettering over red background.
5. Equipment labels shall include the equipment's name and unique drawing designation or schedule tag number.
6. Provide pre-coiled, semi-rigid labels to cover full circumference of pipe. Pressure-sensitive type markers are not acceptable.
7. Valves shall be tagged with stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers. 1 ½" diameter disk with smooth edges.
8. Valve tag material shall be brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware. Brass wire-link or beaded chain or S-hook.
9. Unless specified otherwise, comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

21 11 00 Facility Fire Suppression Water Service Piping

10. Fire department connections to sprinkler and or standpipe systems shall not be flush mounted or wall mounted. Fire department connections shall be located a minimum of 25 feet from the building.
11. Fire department connections shall be labeled with a permanently fixed, weather resistant information placard describing the type of system served and the area of coverage.
12. Fire protection water service, below grade, 4 inch and larger:
    - Cement lined ductile iron, Class 52, AWWA C 151.
    - Mechanical joint, ductile iron fittings, AWWA C 110, ductile or gray iron standard pattern or AWWA C 153 ductile iron compact pattern.
    - AWWA C 111 rubber gaskets. ANSI Class 150 flanges.
13. Water service flexible joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts. 250 psig pressure rating. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213 and shall be factory holiday tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to ANSI/AWWA A21.11/C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene. Equal to EBAA Iron, Inc
14. Flanges shall be ANSI Class 150 flange adapter equal to Victaulic Style 641 for connections to flanged equipment. ANSI B16.1 dimensions.

15. Provide di-electric couplings or unions between dissimilar pipe materials.
16. Provide unions at connections to equipment.
17. Any improperly installed piping, joints or fittings or any piping that does not pass pressure testing requirements shall be removed and replaced.

21 12 00 Fire Suppression Standpipes

18. Where required by the IBC, standpipe systems shall be of the automatic wet type, Class III with 2 1/2" x 1 1/2" removable cap connection.
19. Hose cabinets may be used only for required supplemental hose valves outside of the main egress stairwells.
20. Fire department hose valves shall not be provided with hoses.
21. Standup Pipe Connections will be at 33 degrees.

21 13 13 Wet Pipe Sprinkler Systems

22. Automatic sprinkler system calculations shall include at a minimm 10 psi safety factor to accommodate for any future deterioration or fluctuations in the water supply system.
23. A two-color plastic engraved identification card shall be provided for each sprinkler system zone indicating the hydraulic design information and secured to the respective floor control valve, zone valve or sprinkler riser.
24. All sprinkler heads should be installed using the appropriate wrench as specified by the sprinkler manufacturer. This will help to insure that the heads are installed properly without damage.
25. All steel piping shall not be less than Schedule 40 wall thickness for any pipe size.
26. CPVC sprinkler pipe and fittings (e.g Blazemaster®) will only be used with Clarkson approval.
27. All sprinkler piping should be hydrostatically tested at 200 psi and should maintain that pressure without loss for 2 hours. Pressure loss should be determined by drop in gauge pressure or visual leakage.
28. Test Connections - Each water flow indicator shall be provided with an Inspector's Test Connection, consisting of a test pipe of not less than 1" diameter terminating in a smooth bore corrosion resistant orifice giving a flow equivalent to one sprinkler head of the type installed on the system. Test connection shall discharge to the building exterior. The 1" control valve for the Inspector's Test Connection shall be located not more that 7' above finished floor. An alternative arrangement for the Inspector's Test Connection is the "Testmaster", manufactured by the Victaulic Corporation or other Clarkson approved device.
29. Final acceptance will be upon completion of the Contractor's Material and Test Certificate (Form 85A) and field examination by an FM Global representative.
30. The A/E shall provide a full head layout on the plans as required by Town of Potsdam. Also, the A/E shall include the sprinkler main and branch piping layout for the most hydraulically remote/demanding area. Pipe sizes shall be shown. Provide hydraulic summary indicating design criteria, area covered, required flow rate, end head pressure, required pressure at the riser and pressure available at the riser for each area calculated.
31. Hydraulic calculations shall be based on approved flow tests which will be performed by a Clarkson appointed test facility. All hydraulic calculations shall be reviewed by Owner and Factory Mutual.
32. Hydraulic Design Submittal: In addition to the distribution of drawings specified in General Conditions, the University shall be provided with one set of shop drawings depicting the complete automatic sprinkler system. Shop drawings shall clearly identify the hydraulically remote area, and all

reference nodes shall be included from the supply to and including the remote area. In addition, one complete set of hydraulic calculations, including detail and summary sheets, shall also be submitted for retention by the University.

33. Automatic Sprinkler System Submittals shall include:
    - Piping layout and sizes,
    - Location and number of sprinklers (with sprinkler identification numbers (SIN) clearly indicated on the drawing),
    - Fire department inlet connection location and configuration,
    - Location of remote area used in hydraulic calculations,
    - Hydraulic Calculations,
    - Sprinkler head types,
    - Sprinkler pipe and fittings,
    - Sprinkler control valves,
    - Any peripheral equipment - including tamper alarms, waterflow alarms, etc.
    - Occupancy Details - In order to review submitted plans to ensure adequate protection, accurate occupancy details must be provided. This would include a general description of the area being protected and, in the case of dedicated storage areas details of the materials being stored, storage height, storage arrangement, etc. should be provided.
    - Indicate the extent fire detection sprinkler system and the fire detection sprinkler system area covered.

21 13 16 Dry Pipe Sprinkler Systems

34. Specify only galvanized pipe and fittings for dry pipe and preaction sprinkler systems.

35. Coordinate the requirements for preaction or preaction type interlocks for sprinklers in elevator machine rooms and at the tops of elevator hoist ways with Clarkson, and the appropriate jurisdiction following NFPA 13 and NY State Fire Protection and building Code at a minimum.

21 22 00 Clean Agent Fire Extinguishing Systems

36. Design and install clean agent fire extinguishing systems in accordance with NFPA 2001.

37. Coordinate fire alarm, HVAC controls and dampers, and interface with preaction systems (if used in conjunction) with the clean agent system monitoring and activation sequences.

38. Clean agent systems shall be used only as a first response extinguishing system to preserve vital or costly equipment in the hazard zone. They shall not be used as a substitution to a required automatic wet sprinkler system (or pre-action system) designed and installed in accordance with NFPA 13.

21 13 13 Electric Drive Centrifugal Fire Pumps

39. Buildings less than three stories (i.e. low rise) should only require a fire pump when insufficient municipal water pressure is present.

40. The installation of a fire pump is prohibited when street pressure alone with appropriately sized mains and branches will provide specified water density over the coverage area.

41. Fire pumps shall be installed on the discharge side of water service entry backflow preventor(s).

21 34 00 Pressure Maintenance Pumps

42. Fire pumps shall be provided with a properly sized pressure maintenance (jockey) pump. The jockey pump stop setpoint shall be equal to the fire pump churn pressure plus the minimum static supply pressure.

43. The jockey pump start set point shall be at least 10 psi less than the jockey pump stop setpoint.

44. The fire pump start setpoint shall be 5 psi less than the jockey pump start point.

21 39 00 Controllers for Fire Pump Drivers

45. Refer to NFPA 70 (National Electrical Code) NFPA 20 (Standard for Centrifugal Fire Pumps)
46. Electric fire pumps shall be fed from emergency power through an automatic transfer switch where applicble.

Division 23 - Heating Ventilating and Air Conditioning

23 00 00 Heating, Ventilating, and Air Conditioning (HVAC)

23 00 10 Clarkson University Preferred HVAC Equipment and Brands

Clarkson's preferred equipment manufacturer or brand. This list supersedes any brands listed elsewhere in this document and can only be substituted.

1. Pumps; B&G will be the primary brand
2. Air Handlers; Trane
3. VAVs; Siemens ZCUs or Trane
4. Motors;
5. VFDs; Danfoss/Trane or AC Tech
6. DEM 2000 for tracking electrical use
7. Onicon ultrasonic flow meters for both chilled water and hot water for heating and cooling
8. Onicon ultrasonic flow meter for domestic cold water
9. Onicon gas meter (if applicable) for natural gas consumption
10. Valves; Crane, Jenkins, Powell, Vogt.
11. Balancing Valves 2″ and Smaller: Manual Balancing Valves; B&G or a Clarkson approved equivalent. Automatic Balancing Valves; Macon Balancing Valves models AB & WB preferred or Clarkson approved equivalent.
12. Balancing Valves 2-1/2″ and Larger: B&G triple duty valve or Clarkson approved equivalent.
13. Non-modulating control valves (baseboard or cabinet heater valve) will be a ball type valve, manufactured by Siemens, Belimo, or a Clarkson approved equivalent.
14. Modulating valves will be consistent with the Building Management System either Siemens or Trane/Belimo.
15. Boilers less than 500 MBTU; Weil-McClain
16. Boilers greater than 500 MBTU; Cleaver-Brooks

23 05 00 Common Work Results for HVAC

23 05 02 Demolition

- Remove all utilities, piping, ductwork, wiring, cabling, pneumatic tubing back to the active portion of the distribution system. Portions of distribution systems no longer required for service shall be removed back to the active portion of the distribution system and capped off.
- All hangers, supports, and controls devices connected to demolished material shall also be removed.
- No in-active systems or system components are allowed to be abandoned in place.

23 05 10 Sleeves and Penetrations

- Pipe penetrations through exterior walls - use schedule 40 galvanized pipe sleeve with leak plate and premanufactured “linkseal” with stainless steel hardware. Do not use sheet metal sleeves through outside walls. Sleeves shall be pipe conforming to ASTM A 120.
- Pipe penetrations through interior masonry walls - use schedule 40 steel pipe sleeve.
- Pipe penetrations through Floors - use schedule 40 steel pipe sleeve. Provide galvanized schedule 40 pipe or cast iron pipe, extended 2 inches above the floor and seal water tight between floor and sleeve.
- Pipe penetrations through interior (dry-wall) partition walls - use schedule 40 steel pipe sleeve for diameters 6 inch and below; use galvanized steel sheet sleeves for diameters greater than 6 inch.
- Duct penetrations through non-fire rated interior walls - cover opening between the wall and duct or duct insulation with sheet metal flanges of the same material and thickness as duct. Overlap openings on all four sides by at least 1-1/2 inches.
- Protect and fire stop all penetrations in accordance with the applicable codes.
- Coordinate fire stopping requirements with Section 078000.

23 05 13 Common Motor Requirements for HVAC

23 05 16 Expansion Compensation

1. Welded piping systems:
    - Expansion compensators and expansion joints on concealed piping are not allowed. Provide expansion loops and z-bends on concealed piping.
    - Provide expansion loops and z-bends on HW piping systems. Bellows type expansion joints are allowed on HW piping systems, where approved by Clarkson.
2. Threaded and soldered piping systems (Piping 2 inches diameter and below):
    - Provide expansion loops, z-bends and swing joints.
    - Bellows type expansion joints are allowed on HW piping systems, where approved by Clarkson.
3. Grooved piping systems (2 1/2 diameter and greater), only to be used in machine rooms:
    - Expansion and contraction of grooved IPS steel piping systems shall be provided with loops or bends consisting of (8) Victaulic Style 75 or 77 flexible couplings, (4) grooved end 90 degree elbows, and grooved end pipe spools provided in water systems to 230°F in accordance with Victaulic recommendations for expansion compensation.
    - Provide packless, gasketed, slip-type expansion joint with grooved end telescoping body, for installation with Style 07 rigid couplings, providing up to 3" axial end movement with pressure rating up to 350 psi. Victaulic Style 150 Mover® where pipe bends or expansion loops cannot be applied.

23 05 19 Meters and Gages

1. Specify pressure/temperature test stations, combination (PIT) plug on supply and return piping of all water coil connections not otherwise provide with pressure and temperature gages. The basis of design shall be Peterson Equipment Company (Pete’s Plug).
2. Water and steam pressure gages shall be liquid filled.

3. Provide water totalizing meter with contact head for make-up water lines on hot water boilers, closed loop hydronic systems, evaporative cooling systems and steam generating systems.
4. Refer to Section 23 09 00 “Instrumentation and Control for HVAC” for flow meters and BTU meters.
5. Use bimetallic temperature indicators in 5" diameter case. Orient gage so that special flexible joint is not needed.
6. Use materials compatible with service for pressure indicators, temperature indicators and flow meters. Use diaphragm where needed.
7. Use solar powered meters and gages.

23 05 23 General-Duty Valves for HVAC Piping

1. Butterfly valves are not to be used as general duty valves.

- Gate Valves: Shall be solid wedge with stainless steel wedge or wedge faces, stainless steel seat rings. Stainless steel bonnet bushings and beveled collar on valve stem for back seating. Provide braided, teflon impregnated backing rings in a large, deep stuffing box suitable for high temperature water service. Insert at bottom of stuffing box, to serve as base for packing. Packing glands shall be non corrosive and shall have bolted gland flange with minimum of 2 eye bolts. Valves with their bypasses, need to be installed for proper operating access.

    1) Gate Valves 3″ and Smaller: **To be used only with permission from Clarkson.** Provide with a minimum of 4 packing rings.

    2) Gate Valves 3-1/2″ to 5-1/2”: **To be used only with permission from Clarkson.** Provide with a minimum of 6 packing rings.

    3) Gate valves 6” and Larger: Provide with a minimum of 6 packing rings. Provide forged steel, globe valves bypass, minimum 3/4". Provide with tapered roller or ball bearing yokes and button type grease gun fittings and adapters to allow charging a reservoir with valve lubricant.

    4) Gate Valves 8″ and Larger: Provide a minimum of 6 packing rings. Provide forged steel, globe valve bypass, minimum 3/4". Provide with tapered roller or ball bearing yokes, bevel gear operators, clockwise rotation to close, laminated lubricating fittings and approved grease seals.

- Globe and Angle Valves: Shall be of the cast plug disc with bevel seat, separately screwed or pressed in disc and seat rings, long disc locknut, port opening full pipe diameter. Provide stainless steel seat ring and disc: stainless steel bonnet bushing and beveled collar for backseating. Provide braided, teflon impregnated packing rings in a larger, deep stuffing box to service as base for packing. Packing glands shall be non-corrosive and shall have bolted gland flange with minimum of 2 eye bolts. Valves with their bypasses shall be installed for proper operating access.

    1) Globe & Angel Valves 3″ and Smaller: Shall have mini um of 4 packing rings.

    2) Globe & Angle Valves 3-1/2″ and Larger: Shall have a minimum of 6 packing rings.

    3) Globe & Angle Valves 6″ and Larger: Shall have minimum of 6 packing rings. Valves shall have forged steel, glove valve bypass; button-type grease gun fittings and adapters to allow charging a reservoir with valve lubricant tapered roll or ball bearing yokes.

    4) Globe & Angle Valves 8″ and Larger: Shall have minimum of 6 packing rings. Valves shall have forged steel, globe valve bypass; button-type grease gun fittings

and adapters to allow charging a reservoir with valve lubricant; and tampered roller or ball bearings yokes. Shall be equipped with impactor or hammer-blow hand wheel.

- Check Valves: Shall be horizontal swing check, 300 lb. cast steel, with 13% Cr. stainless steel disc, disc face and barrel type seat rings. Provide full port opening. Disc and seat shall be removable without removing valve from line.
- Gage and Instrument Valves: Shut-off valves for pressure gages and instrument isolating valves shall be of the "barstock" construction, with stainless steel body and stainless steel plug type disc integral with stem. Ends shall be I.P.S. screwed. Rating shall be 600 psig at 750°F. Valves shall be 1/2" size, Crane Co. or approved equal.
- Blowdown Valves: Blowdown valves for cascades, expansion drums, hot water generators shall be unit-tandem type valves, consisting of none hardseat and one seatless valve in one common steel body to conform to the ASTM Boiler Code. Valves shall be rated at 400 psig and suitable for pressures to 665 psig. Valves shall be welding ends and alloy steel trim.
- Needle Valves: For high temperature water convectors shall be of "barstock" construction with stainless steel body and stainless steel plug type disc integral with stem. Ends shall be I.P.S. screwed. Rating shall be 600 psig at 750°F. Crane Co. or approved equal.
- Drain and Vent Valves: Drain and vent valves shall be ASA 600-pound class 1 forged steel globe or angle valves, as specified above. Drain valves need to be sized and shown on the Drawings. Unless otherwise required, vent valves shall be 1/2" size.
- Control Valves: All control valves will be installed with either flange type connections or NPT fittings and unions for maintenance (no solder).

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2. Valves for Hot Water
   - Ball Valves (preferred): Use for isolation and shut-off duty, size 2-inch and below, Class 150 (150 psig SWP) screwed connection, two-piece, bronze body, PTFE seat, stainless steel ball, lever operated with insulation extension.
   - Gate Valves (not to be used unless specifically approved by Clarkson): Use for isolation and shut-off.
     1) Size 3-inch and below: Class 150 (150 psig SWP), screwed connection, bronze body, bronze seat, bronze disk, inside screw rising stem operator.
     2) Size 3-1/2 inch and greater: Class 125, flanged connection, cast iron body, bronze seat, cast iron disc, OS&Y operator.
   - Globe Valves (not to be used unless specifically approved by Clarkson): Use for by-pass and throttling duty.
     1) Size 3-inch and below: Class 150 (150 psig SWP), bronze body with union-ring bonnet integral seat, PTFE disc, inside screw rising stem operator.
     2) Size 3-1/2 inch and above: Class 125 (200 psig CWP), cast iron with bolted bonnet, flanged ends, cast iron seat, cast iron disc, OS&Y operator.

   Control Valves: All control valves will be installed with either flange type connections or NPT fittings and unions for maintenance (no solder).
3. Valves for Dual Temperature Water

- Ball Valves (preferred): Use for isolation and shut-off duty, size 2-inch and below, Class 150 (150 psig SWP) screwed connection, two-piece, bronze body, PTFE seat, stainless steel ball, lever operated with insulation extension.
- Gate Valves (not to be used unless specifically approved by Clarkson): Use for isolation and shut-off.
    1) Size 3-inch and below: Class 150 (150 psig SWP), screwed connection, bronze body, bronze seat, bronze disk, inside screw rising stem operator.
    2) Size 3-1/2 inch and greater: Class 125, flanged connection, cast iron body, bronze seat, cast iron disc, OS&Y operator.
- Globe Valves (not to be used unless specifically approved by Clarkson): Use for by-pass and throttling duty.
    1) Size 3-inch and below: Class 150 (150 psig SWP), bronze body with union-ring bonnet integral seat, PTFE disc, inside screw rising stem operator.
    2) Size 3-1/2 inch and above: Class 125 (200 psig CWP), cast iron with bolted bonnet, flanged ends, cast iron seat, cast iron disc, OS&Y operator.
- Control Valves: All control valves will be installed with either flange type connections or NPT fittings and unions for maintenance (no solder).

4. Valves for Chilled Water
    - Ball Valves (preferred): Use for isolation and shut-off duty, size 2-inch and below, Class 150 (150 psig SWP) screwed connection, two-piece, bronze body, PTFE seat, stainless steel ball, lever operated with insulation extension.
    - Gate Valves (not to be used unless specifically approved by Clarkson): Use for isolation and shut-off.
        1) Size 3-inch and below: Class 150 (150 psig SWP), screwed connection, bronze body, bronze seat, bronze disk, inside screw rising stem operator.
        2) Size 3-1/2 inch and greater: Class 125, flanged connection, cast iron body, bronze seat, cast iron disc, OS&Y operator.
    - Globe Valves (not to be used unless specifically approved by Clarkson): Use for by-pass and throttling duty.
        1) Size3-inch and below: Class 150 (150 psig SWP), bronze body with union-ring bonnet integral seat, PTFE disc, inside screw rising stem operator.
        2) Size 3-1/2 inch and above: Class 125 (200 psig CWP), cast iron with bolted bonnet, flanged ends, cast iron seat, cast iron disc, OS&Y operator.
    - Control Valves: All control valves will be installed with either flange type connections or NPT fittings and unions for maintenance (no solder).

5. Valves for Low Pressure Steam, Low Pressure Steam Condensate Return and Pumped Condensate:
    - Ball Valves (preferred): Use for isolation and shut-off duty, size 2-inch and below, Class 150 (150 psig SWP) screwed connection, two-piece, bronze body, PTFE seat, stainless steel ball, lever operated with insulation extension.
    - Gate Valves (not to be used unless specifically approved by Clarkson): Use for isolation and shut-off.

1) Size 3-inch and below: Class 150 (150 psig SWP), screwed connection, bronze body, bronze seat, bronze disk, inside screw rising stem operator.

2) Size 3-1/2 inch and greater: Class 125, flanged connection, cast iron body, bronze seat, cast iron disc, OS&Y operator.

- Globe Valves (not to be used unless specifically approved by Clarkson): Use for by-pass and throttling duty.

1) Size 3-inch and below: Class 150 (150 psig SWP), bronze body with union-ring bonnet integral seat, PTFE disc, inside screw rising stem operator.

2) Size 3-1/2 inch and above: Class 125 (200 psig CWP), cast iron with bolted bonnet, flanged ends, cast iron seat, cast iron disc, OS&Y operator

- Control Valves: All control valves will be installed with either flange type connections or NPT fittings and unions for maintenance (no solder).

6. Valves for Condenser Water:

- Ball Valves (preferred): Use for isolation and shut-off duty, size 2-inch and below, Class 150 (150 psig SWP) screwed connection, two-piece, bronze body, PTFE seat, stainless steel ball, lever operated with insulation extension.
- Gate Valves (not to be used unless specifically approved by Clarkson): Use for isolation and shut-off.

1) Size 3-inch and below: Class 150 (150 psig SWP), screwed connection, bronze body, bronze seat, bronze disk, inside screw rising stem operator.

2) Size 3-1/2 inch and greater: Class 125, flanged connection, cast iron body, bronze seat, cast iron disc, OS&Y operator.

- Globe Valves (not to be used unless specifically approved by Clarkson): Use for by-pass and throttling duty.

1) Size 3-inch and below: Class 150 (150 psig SWP), bronze body with union-ring bonnet integral seat, PTFE disc, inside screw rising stem operator.

2) Size 3-1/2 inch and above: Class 125 (200 psig CWP), cast iron with bolted bonnet, flanged ends, cast iron seat, cast iron disc, OS&Y operator.

- Control Valves: All control valves will be installed with either flange type connections or NPT fittings and unions for maintenance (no solder).

7. Balancing Valves:

- With the exception of Triple Duty Valves, manual balancing valves will not be used as shut off valves.
- 2″ and Smaller: Manual Balancing Valves will be ball type circuit setter with threaded end connections and provisions for connecting a portable differential pressure meter. Automatic Balancing Valves will have threaded end connections and provisions for connecting a portable differential pressure meter.
- 2-1/2″ and Larger Balancing Valves will be triple duty valves with threaded or flanged connection.
- Install a Series 78U union port fitting and Series 78Y strainer/ball valve combination to complete terminal hookup at coil outlet.

23 05 29 Hangars and Supports for HVAC, Piping, and Equipment

1. All piping with insulation shall be supplied with properly fitted sheet metal saddles and high density insulation inserts at all pipe support locations.
2. Victaulic Style will only be used with permission from Clarkson. Style 107, 07, and W07 rigid couplings may be used on IPS steel piping systems, which meet the support and hanging requirements of ASME B31.1 and B31.9. An adequate number of Victaulic Style 75, 77, or W77 flexible couplings shall also be used to compensate for thermal expansion/contraction of the pipe.
3. Compensation should be made to account for additional loads on hangers where accessibility issues may occur, i.e. walking across pipes to access equipment.

23 05 53 Identification for HVAC Piping and Equipment

1. Mark location of air handlers, fan coil units, air terminal units, etc., above ceilings with identifying "buttons" to facilitate maintenance through ceiling.
2. Tag roof top exhaust fans and associated fume hood to facilitate maintenance and identification.
3. Utilize standard tag or placard to mark all major equipment. Tag all valves and provide valve chart for each floor.
4. Utilize standard NYS color coding for various building service piping and ductwork. Mark each with name of service, direction of flow, and associated unit served where appropriate.
5. All systems handling hazardous materials must have appropriate marking and visual or audible alarms to protect building occupants and maintenance personnel. Mark exhaust fans on roof which handle hazardous fumes with appropriate color code.
6. Mark air handling units with large letters and numbers.
7. Provide strap-on markers for pipe. Pressure-sensitive type markers are not acceptable.
8. Conform with ANSI 13.1
9. Mark all equipment with location of supply power (panel and breaker numbers) and control panel, when applicable.

23 05 93 Testing, Adjusting, and Balancing (TAB)

1. Specify a third party TAB Contractor. The TAB Contractor shall not be subcontracted by the Mechanical Contractor.
2. Agency Qualifications: The independent testing, adjusting, and balancing agency shall be certified by the National Environmental Balancing Bureau (NEBB) or the Associated Air Balance Council (AABC) in the testing and balancing disciplines required for the project, and have at least one Professional Engineer registered in the State of New York, certified by NEBB or AABC as a Test and Balance Engineer.
3. In accordance with the submittal specifications and 01810, submit a synopsis of the testing, adjusting, and balancing procedures and proposed agenda.
4. In accordance with the submittal specifications, submit sample forms, if other than those standard forms prepared by the AABC or NEBB are proposed.
5. Submit a detailed testing, adjusting and balancing plan for each system and equipment type that is required to be balanced. Testing, adjusting and balancing work in the field will not be permitted without an approved testing, adjusting and balancing plan for each system and equipment type.
6. All domestic hot water recirculating zones provided with balancing valves shall be tested, adjusted and balanced by the TAB contractor. The TAB contractor shall review the plumbing drawings prior to bidding.

7. Pre-balancing Conference: Prior to beginning the testing, adjusting, and balancing field work, schedule and conduct a conference with Clarkson, Siemens, the Mechanical Engineer, and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1. Draft Reports: In accordance with the submittal specifications, prepare and submit draft reports on the approved forms upon completion of testing, adjusting, and balancing procedures. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports.

2. Final Report: In accordance with the submittal specifications, prepare and submit a final report. Bind approved report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents.

3. Report Contents:

    - General Information and Summary: Inside cover sheet to identify the testing, adjusting, and balancing agency, Contractor, Owner, Architect, Mechanical Engineer, and Project Engineer. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal, name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include a listing of the instrumentation used for the procedures along with the proof of calibration within six months prior to starting the project.

    - The remainder of the report shall contain the appropriate approved forms for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

4. Renovations:

    - All renovations will require a new analysis and rebalancing of the HVAC system.

23 06 00	**Schedules for HVAC**
23 06 20	**Schedules for HVAC Piping and Pumps** TBD
23 06 20.13	**Hydronic Pump Schedule** TBD
23 06 30	**Schedules for HVAC Air Distribution** TBD
23 06 30.13	**HVAC Fan Schedule** TBD
23 06 30.16	**Air Terminal Unit Schedule** TBD
23 06 30.19	**Air Outlet and Inlet Schedule** TBD
23 06 30.23	**HVAC Air Cleaning Device Schedule** TBD
23 06 50	**Schedules for Central Heating Equipment** TBD
23 06 50.13	**Heating Boiler Schedule** TBD
23 06 60	**Schedules for Central Cooling Equipment** TBD
23 06 60.13	**Refrigerant Condenser Schedule** TBD
23 06 60.16	**Packaged Water Chiller Schedule** TBD
23 06 70	**Schedules for Central HVAC Equipment** TBD
23 06 70.13	**Indoor, Central-Station Air-Handling Unit Schedule** TBD

23 06 70.16 Packaged Outdoor HVAC Equipment Schedule TBD

23 06 80 Schedules for Decentralized HVAC Equipment TBD

23 06 80.13 Decentralized Unitary HVAC Equipment Schedule TBD

23 06 80.16 Convection Heating and Cooling Unit Schedule TBD

23 06 80.19 Radiant Heating Unit Schedule TBD

23 07 00 HVAC Insulation

5. All insulation shall conform to the latest Energy Code requirements.
6. Staples are not acceptable for insulation installation.
7. All "raw" ends of insulation shall be sealed.
8. For Hot Water and Steam/Condensate piping insulation, provide the following:
    - For interior piping: canvas jacket, coated with Fosters 81-42w or equal and painted.
    - For tunnel piping: wrap with an approved non-flammable moisture barrier and cover with an aluminum jacket.
    - Calcium silicate insulation, 4″ minimum thickness for operating temperatures greater than 400°F.
    - Removable insulation jackets shall be provided on all valves and expansion joints.
9. All indoor exposed chilled water and hot water piping located in the following areas shall be provided with a field installed protective canvas jacket.
    - Existing central heating and cooling plant at the main Hill campus.
    - Mechanical rooms which also contain Steam piping systems.
10. All indoor exposed chilled water and hot water piping located in all other areas (except areas identified in paragraph 5 above): 20 mil (minimum) PVC protected jacket shall be provided.
11. For condensation control on interior Chilled Water piping use the minimum thicknesses: Pipe sizes 1-1/2" and smaller use 1-1/2" insulation, pipe sizes greater than 1-1/2" use 2" insulation.
12. Condensate drains shall have 1" of insulation.
13. Internal insulation or lining of ductwork is prohibited unless approved by Clarkson.
14. Insulation specification shall describe what systems and services are to be insulated. Refer to the insulation schedule below.

INSULATION SCHEDULE					
Insulation Description	**Service**	**Maximum Thermal Conductivity**	**Minimum Density (lb./c.ft.)**	**Pipe Size**	**Thickness**
Closed Cell Foam	Chilled Water	0.23	3	1½″ and smaller 2″ to 5″	1” 1”
Fiberglass Pipe Insulation	Hot Water	0.23	3	2″ and smaller 2½″ and larger	1½″ 2″
Fiberglass Pipe	Chilled Water	0.23	3	1½″ and smaller	1½”

INSULATION SCHEDULE					
Insulation Description	**Service**	**Maximum Thermal Conductivity**	**Minimum Density (lb./c.ft.)**	**Pipe Size**	**Thickness**
Insulation				2″ to 5″ 6″and larger	1½″ 2″
Fiberglass Pipe Insulation	Low Pressure Steam (15 psig and below)	0.23	3	1″ and smaller 1½″ to 2½″ 3″ to 6″ 8″ and larger	1½″ 2″ 3″ 3½″
Fiberglass Pipe Insulation	Medium Pressure Steam (15 to 70 psig)	0.23	3	1″ and smaller 1½″ to 3″ 4″ and larger	2″ 3″ 4″
Fiberglass Pipe Insulation	Steam Condensate Return and Pumped Condensate	0.23	3	2″ and smaller 2″ and larger	1½″ 2″
Fiberglass Pipe Insulation	Hot Water Air Separators	0.23	3	All sizes	1″
Fiberglass Pipe Insulation	Steam Vent and Relief Valve Piping	0.23	3	All sizes	1″
Fiberglass Pipe Insulation	Coil Condensate Drain and City Water	0.23	3	All sizes	1″
Fiberglass Pipe Insulation	Refrigerant Suction and Hot Gas	0.23	3	All sizes	1″
Fiberglass Pipe Insulation	Indoor Free Cooling and Outdoor Condenser Water Piping	0.23	3	5″ and smaller 6″ and larger	1½″ 2″
Fiberglass Pipe Insulation	Hot Water Valves	0.23	3	2½″ and larger	2″
Fiberglass Pipe Insulation	Valves for Steam and Steam Condensate Return	0.23	3	2½″ and larger	3″
Calcium Silicate Pipe Insulation and Ceramic Cloth	Engine Exhaust	0.42		All sizes	4″
Foamed Plastic Pipe Insulation	Coil Condensate Drain and City Water	0.26	6	All sizes	½″
Flexible Unicellular Pipe Insulation	Refrigerant Suction and Hot Gas	0.26	6	All sizes	½″
Calcium Silicate Equipment Insulation	Boiler Breeching, Induced Draft Fans, Converter Shell, Condensate Receivers, Flash Tanks, Deaerator Heaters, Hot Water Generator Shell, Boiler Feed Water Heaters, Boiler Feed Water Pumps, and Fuel Oil	0.42		All sizes	4″

INSULATION SCHEDULE					
Insulation Description	**Service**	**Maximum Thermal Conductivity**	**Minimum Density (lb./c.ft.)**	**Pipe Size**	**Thickness**
	Heaters				
Calcium Silicate Equipment Insulation	Boilers	0.42		All sizes	4″
Calcium Silicate Equipment Insulation	Condensate Storage Tanks	0.42		All sizes	2½″
Flexible Unicellular Equipment Insulation	Chilled Water Pumps, Plate and Frame Heat Exchangers, Air Handling Unit Coil Headers, Centrifugal Refrigeration Machines, and Chilled Water Valves	0.26	6	All sizes	2″
Flexible Unicellular Equipment Insulation	Flexible Duct Connections	0.26	6	All sizes	2″
Rigid Fiberglass Board Insulation	Supply Air, Outdoor Air and Mixed Air Ductwork and Plenums Located in Mechanical Equipment Rooms	0.23	6	All sizes	1½”
Rigid Fiberglass Board Insulation	Supply Air, Return Air, Exhaust Air and Mixed Air Ductwork and Plenums Located Outdoors	0.23	6	All sizes	2″
Rigid Fiberglass Board Insulation	Terminal Air Boxes, Duct Mounted Coils, and Air-to-Air Heat Exchangers	0.23	6	All sizes	Mfgr’s Standard Thickness
Fiberglass Duct Blanket Insulation	Supply Air, Outdoor Air and Mixed Air Ductwork and Plenums	0.31	1.5	All sizes	2″

15. In addition to the thickness of insulation of pipes listed above, the Professional shall consider the use of thicker insulation if required by AHRAE 90.1, latest edition. The insulation shall meet the requirements of International Mechanical Code, latest edition.

16. All supply air, mixed air, and return air ductwork shall be insulated with Ductwrap or rigid fiberglass board (as indicated above). Minimum thickness is 1½" with FSK (Reinforced Foil, aka FRK) laminate facing. It must have a minimum of ¾ densities and a minimum an out of package R-value of 5.1.
17. All supply air ductwork in the ceiling used as return air plenum shall be insulated with 1″ thick 1-1/2 lbs./c ft. fiber glass insulation.
18. Duct liners are NOT permitted in the laboratories and the animal use areas.
19. Wherever duct liners are used, the installation shall meet the installation requirements of the manufacturer and SMACNA guidelines.
20. All steam, condensate return, chilled water, hot water, condensate drain, make-up water and ductwork shall be insulated as listed under Insulation Materials.

23 09 00 Instrumentation and Control for HVAC

1. All new buildings shall have a Siemens Building Technologies DDC energy management and control system (EMCS) installed. The new EMCS system will tie into the existing campus EMS system Database. The System Database shall host on the existing Apogee server, and must be able to use Microsoft Internet Explorer or Mozilla Firefox Browsers to remotely view system graphics, monitor, control, and configure the HVAC system and its properties. The energy management and control system shall monitor and control HVAC operations and conditions, alarm abnormal conditions and index control modes and provide AHU optimized start/stop operations, peak demand limiting, demand control ventilation, provide reporting and trend logs. The specific system requirements shall be reviewed with the Clarkson Building Automation and Energy Management shops during the design phase. All Retail Space will have at a minimum the ability to communicate to the existing campus EMS system as well as the following utility meters:

2. In general, the system shall include field level panels receiving information on the status of various sensors in the building and comparing this information with standard instructions relayed from a central processor. The local unit then makes changes required according to programming already present in its memory or overridden by the central processor. All control devices will be electric/electronic. Control shall generally be DDC, with the exception of general space and equipment room heating and ventilation which may be electric when deemed necessary by Clarkson.
3. The plans and specifications for the EMCS and mechanical system must include a detailed points list showing all monitor and control points and identify all required software and hardware, and must also include a sequence of operations for major equipment and systems. The point list shall also show all alarm conditions. Lab controls, if applicable shall be VAV fume hood type, Siemens lab controls; Phoenix air valves are not acceptable. If chillers are part of the project, consultant shall design the plant using Siemens Demand Flow Program for chiller sizing, plant equipment selection, and chiller system sequences.
4. The EMCS must be capable of alarming to, and allowing interface and programming by any compatible personal computer via Clarkson's LAN. EMCS shall be expandable and be compatible with the electronic equipment controls. EMCS must have a security password/code for system entry and programming. A network RJ45 jack shall be provided for network communications over Clarkson's LAN. Alarms must utilize the existing Reno software. Consultant shall specify and identify all EMCS panels for connection to Clarkson LAN to be connected by the telecom contractor. New laptops or PC workstations are not to be provided in building as part of the project.
5. The EMCS must be capable to perform the following functions: Initiate selected control sequences for AHUs, chillers, boilers pumps, exhaust fans, cooling towers, rooftop mounted units, VFDs, fan coil units, start/stop, occupied/unoccupied modes, optimized equipment start/stop operation, monitor total building electric usage with DEM, chilled water/hot water, domestic water, and dual temp consumption Onicon Ultrasonic 4200 flow meters, demand control ventilation and provide peak demand limiting routines as determined by Owner. Monitor and alarm selected conditions for

temperature, Pressure, Flow, mixed air temperature, supply air temperature, return air temperature, CO2, outside air temperature, static pressure, temperatures of dedicated IT rooms or closets, On/Off, Start/Stop Status; Safety Control Status (Fire, Freeze, and Smoke alarms). Co2 sensors should only be specified where actually required by sequence. Clarkson does not want inputs for filter status, and valve/damper position unless critical. Clarkson wants to minimize use of air flow stations and consultant must design adequate straight runs as recommended by manufacturer for accurate reading and TAB set-up.

6. The EMCS control panels shall be located inside the building preferably in the mechanical rooms or one level below the roof if roof mounted equipment is provided. They shall be capable of standalone operation in the event of network communications failure.
7. The EMCS shall include complete graphics that will include all application devices associated with the installed control system including floor-level graphics with links to equipment for each building system. Floor plans will include room numbers, VAV locations and room sensor locations. The graphic start page for each new facility will include links to .pdf files of as-built mechanical plans and as-built control drawings. Samples and templates will be provided by Clarkson. The Architect must provide background CAD files for creation of floor plans.
8. Provide electric utility metering for each new building and provide setup in Apogee Insight, UCM, and Infocenter. The flow meters shall be tied into the EMCS system and be setup in Apogee Insight, UCM, and Infocenter. If the building is being retrofitted or upgraded, the consultant shall research and show the existing metering and LANs on the plans and identify for maintained connection and use.
9. Provide CO2 sensors on all air-handling units with economizer control for demand ventilation control, and provide economizer control on AHUs for free cooling. Provide current switches for pump and fan status. VAV terminals shall have room and supply air temperature sensors.
10. Siemens shall provide all VFDs under this section. The VFDs shall be DanFoss or AC Tech. The VFDs will communicate remotely with the EMCS system via P1 communications and added to the EMCS with the proper unbundled points for control.
11. Integration to other HVAC equipment shall be provided as follows using BACNET MSTP, MODBUS RS485 or other Clarkson approved method. Provide integration for CRAC's when there are multiple units and chillers. Integration of split AC systems, heat pumps, and emergency generators is required on a case by case basis. Specify Siemens controls and EMCS connection for fan coil units, heat recovery units, and roof top air handling units; manufacturer controls are not allowed

23 09 23 Direct Digital Controls

Test Plan

1. Prepare a written test plan indicating in a step-by-step, logical fashion, the procedures by which the automatic control system will be tested, adjusted, and checked.
2. Not less than 6 weeks prior to testing, provide copies of the proposed test plan for approval in accordance with the specifications for submittals. Meet and discuss the test plan, and make agreed changes to the written plan. Resubmit the revised test plan in accordance with the specifications for submittals.
3. The Test Plan shall include, as a minimum, for each system and subsystem of the automatic control work, the following:
    - System name.
    - List of devices with brief description of functional purpose of each.
    - A description of the expected signal values transmitted by the sensor.
    - A description of the expected signal values transmitted by the controller to the control device or actuator.

- A description of the expected signal values of the control device over its operating range.
- A description of the instrumentation required to test the system.
- A detailed description of the test.
- A log sheet or sheets on which expected and field read values will be recorded and final field read values indicating that the system is operating in accordance with contract requirements.
- A functional performance test of sequences.
- A functional performance test of sequences.

Testing and Adjusting During and After Installation

1. The testing and adjusting includes the submission of a test plan which shall describe in detail the method by which each component, subsystem, and system will be tested, adjusted, and retested after installation in accordance with the specified sequences of operation and other characteristics of the control system.
2. A report on test results, including set points and operating ranges of all components shall be submitted in accordance with submittal specifications. The set points and operating ranges of all components shall be recorded to be submitted as part of the commissioning tests results.
3. The testing specified in this paragraph shall not replace the testing specified in "Commissioning Tests."
4. The entire test shall be witnessed by the University and the A/E.
5. Upon satisfactory test, a copy of the final test results shall be bound in the Operating and Maintenance Manual.

Commissioning Tests

1. In addition to the "Testing and Adjusting During and After Installation", the contractor shall perform commissioning tests to verify that the entire automatic control systems are designed, installed, and adjusted to perform as required in the contract. This phase is an extension, not a substitute, of the phase "Testing and Adjusting During and After Installation."
2. Demonstrate all calibration and tests performed under "Testing and Adjusting During and After Installation."
3. Point to Point checkout of every control sequence.
4. Verification of Electronic Digital Controllers
    - Verify the operation of the microcomputer operating system of the field panels. Demonstrate proper automatic restart of equipment after power restoration.
    - Verify each required software application routine. They shall include, but not be limited to:
        1) All control sequences specified for each local loop
        2) Time of day scheduling
        3) Chilled/Hot water reset
        4) Outdoor air reset
        5) Occupied/Unoccupied cycle
        6) Demand Control Ventilation
        7) Start/stop time optimization

8) Event initiated programs

9) Trending

10) Peak demand limiting

- Verify the operation through the use of a laptop connected to the Siemens Field Panel.
- Verify self-diagnostics of the field panel. Each field panel shall be verified by the use of a laptop connected to the Siemens Field Panel.
- Verify the operation of the clock routine in the field panel.
- Demonstrate changing of default values of sensors by the use of a laptop connected to the Siemens Field Panel.
- Demonstrate proper system operation while set points and data are being modified.
- Verify operation of all terminal equipment controllers.
- Verify all graphics for accuracy and that they meet Clarkson approved standards. Graphics will include all application devices associated with the installed control system including floor-level graphics with links to equipment for each building system. Floor plans will include room numbers, VAV locations and room sensor locations. The graphic start page for each new facility will include links to pdf files of as-built mechanical plans and as-built control drawings.

5. Mechanical system demonstration
    - Demonstration shall include the operation of the entire mechanical system under the control of the contractor and shall include the start-up, operation, and shutdown of the system in accordance with the sequence of operation.
    - The operation of each device shall be performed in accordance with the written instructions contained in the operation and maintenance manual, a copy of which shall be available 10 working days prior to the test. No deviation from the procedures in the operating manual will be permitted.
    - Should the system fail to perform in accordance with the requirements of the operation and maintenance manual, the system shall be repaired, recalibrated, retested as necessary, and a second demonstration performed at no additional expense. The contractor shall reimburse the expenses of the commissioning team for each test after the first.
6. All commissioning tests, verifications, and demonstrations shall be witnessed by Clarkson Personnel.
7. For any test, verification, or demonstration that fails to meet the specification requirements, the component of the automatic control system causing the control system failure, be it hardware, firmware, or software, shall be repaired, replace, or readjusted. The failed test, verification, or demonstration shall be repeated.
8. Upon satisfactory tests of the automatic control systems, copies of the final test results shall be bound in the Operating and Maintenance Manual.

Final Operational Test and Acceptance

1. The final operational test and acceptance shall constitute an operational test over a 30 day period that the system performs the functions and intent of the contract requirements. During the 30 day test period, Clarkson's Building Automation and EMS personnel shall operate the system in accordance with the manufacturer's requirements and shall log all deviations, failures, and other deficiencies which constitute contract nonperformance. The requirement for minor adjustments and/or system modifications shall be submitted in writing stating the scope of said modifications and the need therefore, prior to implementing such changes.

2. Final testing of seasonal equipment shall be done within the appropriate season (heating equipment in heating season and cooling equipment in cooling season) unless otherwise approved by Clarkson.
3. During the 30 day test duration, the system shall demonstrate its continuous functional and operational capabilities without breakdown or shutdown defined as "UPTIME." During the testing period, the UPTIME of all field panels, terminal microprocessors, host computer and peripherals, network, etc. shall not be less than 95%. The tests shall be extended on a day-by-day basis until the UPTIME over 30 consecutive days meets the stated level, at which time the system will be accepted by Clarkson.
4. Consultant to specify training for the EMCS. Training shall be appropriate for building complexity. 8 hours for complex building systems and 4 hours for all others

23 09 33 Electric and Electronic Control Systems for HVAC

1. All control transformers for thermostats, baseboards, or other individualized equipment will be located in nearby machine rooms unless expressly permitted by Clarkson University.
2. As-Builts of any and all control systems, including thermostat networks, will be provided with closeout documents.

23 10 00 Facility Fuel Systems

1. All fuel oil handling equipment and systems such as fill stations, transfer pumps, polishing systems, day tanks, etc. shall be checked out and started up by a factory authorized technician. Training and demonstration to Clarkson's operating staff shall also be provided by a factory authorized representative. Training and demonstration shall not be performed concurrent with the start-up.

23 11 00 Facility Fuel Piping

1. Fuel Oil Piping Schedule
    - Above ground fuel oil supply, fuel oil return, fuel oil vent, 2″ and smaller: Carbon steel, threaded joints and cast iron fittings, standard weight.
    - Above ground fuel oil supply, fuel oil return fuel oil vent, 2-1/2″ and larger: Carbon steel, butt welded joints and fittings, standard weight.
    - Below ground fuel oil supply, fuel oil return, fuel oil vent 2″ and smaller: Double containment piping system; Carrier Pipe same as above grade piping described above with socket welded joints and fittings; Secondary Containment Pipe shall be FRP with bell and spigot adhesive bonded joints, Ameron Dualoy 3000/L or approved equal.
    - Below ground fuel oil supply, fuel oil return, fuel oil vent and fuel oil fill 2-1/2 and larger: Double Containment Piping System; carrier pipe same as above grade piping described above with butt welded joints, Ameron Dualoy 3000/L or approved equal.
    - 100% of all below ground carrier pipe welds shall be UT tested.
    - Galvanized piping is prohibited.

23 21 13 Hydronic Piping

1. All hydronic piping shall be in accordance with this section.
2. Pipe sizes 2-1/2-inch and smaller, above ground:
    - Type L hard drawn copper, ASTM 88 with wrought copper fittings, ASME B16.22. soldered joints; mechanical joints are not acceptable.

- Schedule 40 steel, ASTM A53, Grade B, ERW with malleable iron fittings, ASME B16.3. Screwed joints; mechanical joints are not acceptable.

3. Pipe sizes 3 inch and greater, above ground:

    - Schedule 40, ASTM A53 or A106, Grade B, seamless. Wrought Steel fittings; ASME B16.9, ASME B16.28 or ASTM A420. All joints will be welded; mechanical joints (Victaulic, etc.) will only be allowed in mechanical equipment rooms with prior written approval from Clarkson.

4. Welding Requirements

    - Heating Water within Buildings - ASME 31.9 Building Services Piping. 20% UT testing. Welder qualifications and welder continuity logs shall be a required submittal.

    - Chilled Water Piping Below Grade (Carrier Pipe) - ASME B31.1 Power Piping. 100% UT testing. Welder qualifications and welder continuity logs shall be a required submittal.

    - Chilled Water Piping within Buildings - ASME 31.9 Building Services Piping. 20% UT testing. Welder qualifications and welder continuity logs shall be a required submittal.

    - Condenser Water Piping within Buildings - Welder qualifications and welder continuity logs shall be a required submittal.

5. Underground distribution piping shall be a manufactured pre-insulated piping system consisting of carrier pipe, insulation, and outer jacket. Manufacturers shall be approved by Clarkson. Exceptions can be made with Clarkson approval however all buried pipe must be protected with insulation and sleeves.

6. Inspection and Testing. Weld inspection to include 100% visual inspection on gap alignment and root pass; and, ultrasonic inspection (UT) of at least 15% of the field welds by each certified welder on the job. Any failure in UT testing to result additional testing of 15% of that welder's work. There is to be 100% hydro testing at 200 psig to be witnessed by and coordinated with Clarkson personnel and the Project Inspector.

7. Cleaning:

    - Flushing: Perform initial piping system flush to remove core system debris prior to chemical treatment. Typically, this would involve filling the system with water, leaving no air voids, and then flushing the system out at fire hose volumes. In this process, all vents and drains need to be well rinsed until no visible debris or discoloration is visible. The initial rinse water shall be tested and compared to the raw water source to provide a base line for procedure performance. Flushing to be witnessed by and coordinated with Clarkson Facilities personel and the Project Inspector.

    - Chemical Cleaning: Chemical cleaning must remove unwanted debris while installing an initial coating of corrosion inhibitor film. The objective is to reduce internal pipe corrosion by at least 95% during the first year of operation. The chemical treatment must remove oils, grease, mill debris, weld slag and other forms of new piping contaminants. The core ingredients of the chemicals used must be biodegradable. Chemicals used must form an initial film of corrosion inhibitor to yield high levels of internal pipe protection. Chemicals used must include an EPA approved micro biocide that provides a broad spectrum kill of unwanted microorganisms that result in corrosion.

    - Recirculation: Provide taps with isolation valves and cross connections as required to isolate and chemically clean each piping system section. Provide circulation pump(s) as required. Circulate the chemical solution for a minimum of 72 hours. During this process, monitor and maintain system pressure at appropriate levels. After 72 hours, flush the system until debris and products are no longer present. The rinse water shall be tested and be verified to be free of treatment products.

    - Inhibitors: After flushing the chemical cleaning solution, inject an initial charge of inhibitors to maintain the system until it is brought into service. If at any time prior to placing the piping

system into service, the system is drained and refilled, then an additional charge of corrosion inhibitors must be injected into the piping system section. Once all treatment is completed, pipe must remain full of water.

- Report. All chemical cleaning to be witnessed by and coordinated with Clarkson Central Heating and Cooling Plant personnel and the Project Inspector. Provide a written report of cleaning results.

23 22 00 Steam and Condensate Piping

1. Steam piping, above ground:
    - Sizes 2 inch and Smaller: Schedule 40 steel, ASTM A53, Grade B, ERW. Malleable iron fittings, ASME 16.3 Screwed joints, mechanical joints are not acceptable.
    - Sizes 2-1/2 inch and greater: Schedule 40 steel type E, ASTM A53 or A106, Grade B. Standard weight wrought steel fittings ASME B16.9 or B16.28. Butt welded joints and fittings; mechanical joints are not acceptable.
2. Condensate piping, above ground:
    - Sizes 2-inch and smaller: Schedule 80 type S, ASTM A53, Grade B. Fittings shall be 300 psig malleable iron, ASME B16.3 Screwed joints and fittings; mechanical joints are not acceptable.
    - Sizes 2-1/2 inch and greater: Schedule 80 type E, ASTM A53 or A106, Grade B. Fittings shall be extra heavy duty wrought steel, ASME B16.9 ASME B16.28 or ASTM A420. Butt welded joints and fittings; mechanical joints are not acceptable.
3. Underground steam and condensate piping:
    - Shall be a manufactured pre-insulated piping system consisting of carrier pipe, insulation and outer jacket. The piping system shall be fully dryable, drainable and air testable. Acceptable manufacturers will be approved by Clarkson..
    - Steam piping 2 inch and smaller: Schedule 40 steel, ASTM A53, Grade B, ERW, steel fittings, socket welded joints.
    - Steam piping 2 1/2 inch and greater: Same as indoor steam piping 2 1/2 inch and greater.
    - Condensate piping 2 inch and smaller: Schedule 80 type S, ASTM A53, Grade B, steel fittings, socket welded joints.
    - Condensate piping 2 1/2 inch and greater: Same as indoor condensate piping 2 1/2 inch and greater.
4. Welding:
    - Steam working pressures 15psig and below - ASME 31.9 “Building Services Piping.” 100% UT testing. Welder qualifications and welder continuity logs shall be a required submittal.
    - Steam working pressures greater than 15 psig - ASME 31.1 “Power Piping.” 100% UT testing. Welder qualifications and welder continuity logs shall be a required submittal.

23 36 00 Air Terminal Units

1. Construction

- Terminal Casing shall be minimum 22-gauge galvanized steel, internally lined with 1/2″ dual density insulation that complies with UL181 and NFPA 90A. Insulation shall be non-eroding and non water absorbing. Use of fiberglass insulation is allowed only in double wall construction where the insulation is completely protected from the air stream by an inner metal liner.
- The casing shall have access panels which allow for full service and maintenance to fans, motors, controls.
- All units that require a motor shall use ECM motors.
- Fans shall be forward curved steel constructed with permanent lubricated bearings.
- The primary damper shall be heavy gauge steel with self-lubricating bearings.

2. Noise Criteria
   - Sound ratings for the terminal units shall not exceed NC 35.
   - Sound attenuation shall be provided in consultation with the university.
3. Controls
   - Terminal units shall be provided with factory mounted controls unless approved by the University.
   - The controls manufacturer shall be sole sourced based on the Clarkson Instrumentation and Controls Standards (see 23 09 00)

23 50 00 Central Heating Equipment

23 52 00 Heating Boilers

1. **Sectional cast iron boilers are not allowed.**
2. Modular type condensing boilers rated at 90 % + efficiency are preferred for all locations.
3. Scotch marine boilers may be considered for installations larger than 50 horse power. They should be multi-pass and have an efficiency of greater than 90% at the design point. Comply with Factory Mutual requirements. Buy a packaged boiler whenever possible. Consult Clarkson for use of dual-fuel burners for type of burner to use, turn-down desired and type of control to use.
4. All boilers shall be checked out and started up by a factory authorized technician. Factory start-up services shall include the following as a minimum:
   - Pre-functional installation check-out.
   - Operation and testing of all operating and safety controls.
   - Combustion efficiency testing and reporting (multi-point testing). The engineer shall specify detailed testing requirements.
5. Training and demonstration to Clarkson's operating staff shall also be provided by a factory authorized representative. Training and demonstration shall not be performed concurrent with the start-up.

23 55 00 Fuel-Fired Heaters

1. Do not use without permission of Clarkson. If so, use stainless steel heat exchangers that are gas-fired units (not oil fired), using spark ignition only.

23 57 00 Heat Exchangers for HVAC

2. Selection and specifications for liquid-to-liquid, steam-to-liquid, air-to-air, etc. shall be reviewed by the University.
3. HW heat exchangers shall be shell and tube type.
    - In water-to-water exchangers, the water flow shall be upward.
    - In water-to-steam generators, the controls shall be similar to those used for fired steam generators, excluding low water cutoff.
    - Provide separate over-temperature control on leaving secondary hot water.
    - Provide required level controls, secondary water relief and/or safety valves piped to floor drain on water or steam generators.
    - Provide increase tube pitch on steam generators.
4. Provide units with a fouling factor of 0.0005 for water or as approved by Clarkson. For glycol exchangers, consult with Clarkson. 30% glycol solution should provide adequate freeze protection; consult with Clarkson if it is felt that a greater percentage is required. Propylene glycol may be required for certain food handling operations.

23 60 00 Central Cooling Equipment

1. Warranty: 5 year parts and labor on all components including the compressor, fan motors, structural components, etc.
2. All equipment shall be checked out and started up by a factory authorized technician. Factory start-up services shall include the following as a minimum:
    - Pre-functional installation check-out.
    - Operation and testing of all operating and safety controls.
    - Verification of refrigerant charge and lubrication levels.
    - Verification of proper evacuation and dehydration of all built up systems, custom systems and split systems.
3. Training and demonstration to Clarkson's operating staff shall also be provided by a factory authorized representative. Training and demonstration shall not be performed concurrent with the start-up.

23 63 00 Refrigerant Condensers

1. Use only on very small projects, with Clarkson permission. Water-cooled units may be considered for special applications such as back-up refrigeration. Air-cooled units must be justified by life-cycle cost analysis.
2. Limit air cooled condensers to very small systems or for equipment such as constant temperature rooms unless life-cycle cost indicate otherwise.
3. Where air cooled condensers are used, they shall be designed for low ambient temperature operation.
4. Warranty: 5 year parts and labor on all components including the compressor, fan motors, structural components, etc.

23 64 00 Packaged Water Chillers

23 64 16 Centrifugal Chillers – Water Cooled

1. Clarkson requires as efficient a unit as possible. Units shall be provided with variable frequency drives. Refrigerant type to be approved by Clarkson. Centrifugal chillers shall not be located outside of the building. A/E shall design all refrigerant relief piping, including all sizes and termination to safe point outside the building.
2. If the unit is pre-purchased, the A/E shall obtain pre-purchase specifications from Clarkson.
3. Provided condenser shell with marine style water boxes for pipe connection end. Provide hinged or davited water boxes on machines greater than 400 tons.
4. Type of refrigerant used must meet Clarkson University's environmental standards and must be guaranteed to be commercially available for the life of the equipment.
5. Trane or Carrier are the approved manufacturers.

23 64 19 Reciprocating Water Chillers

1. Use only on small projects, for remote locations and for special applications such as back-up cooling. Modular type units are preferred. Heat recovery units will require an economic evaluation including life-cycle analysis. Refrigerant type to be approved by Clarkson.

23 64 26 Rotary Screw Water Chillers

2. Clarkson requires as efficient a unit as possible. Units shall be provided with variable frequency drives. Refrigerant type to be approved by Clarkson. Centrifugal chillers shall not be located outside of the building. A/E shall design all refrigerant relief piping, including all sizes and termination to safe point outside the building.
3. If the unit is pre-purchased, the A/E shall obtain pre-purchase specifications from Clarkson.
4. Provided condenser shell with marine style water boxes for pipe connection end. Provide hinged or davited water boxes on machines greater than 400 tons.
5. Type of refrigerant used must meet Clarkson University's environmental standards and must be guaranteed to be commercially available for the life of the equipment.

23 65 00 Packaged Cooling Towers

1. Fan shall be shaft driven.
2. Provide handrail, ladder and cage for access.
3. Provide all needed screens and protective devices. Discharge hoods and sound control measures shall be provided to attain noise levels acceptable to local conditions and ordinances.
4. For multiple cell cooling tower arrangements, provide automatic control valves on each inlet and outlet. Provide equalizer pipe between all cells to maintain equal basin levels under all possible operating conditions.
5. Float type Water level control is preferable. EP, BD and chemical pump should have H-O-A- selection switch.
6. Provide drains near cooling towers to handle overflow. The drains on cooling towers must drain to sanitary sewer as required by code for water treatment reasons.

7. Provide electric basin heaters unless Clarkson confirms that the cooling tower will be drained down in the winter and does not require basin heat.
8. All cold water basins shall be stainless steel construction.
9. Warranty: 5 year parts and labor on all components including the fan motors, structural components, etc.
10. All equipment shall be checked out and started up by a factory authorized technician. Factory start-up services shall include the following as a minimum:
    - Pre-functional installation check-out.
    - Vibration testing.
    - Operation and testing of all operating and safety controls.
    - Drive and fan blade adjustments.
    - Lubricating system level verification.
11. Training and demonstration to Clarkson's operating staff shall also be provided by a factory authorized representative. Training and demonstration shall not be performed concurrent with the start-up.

23 70 00 Central HVAC Equipment

23 74 00 Air Handling Units

1. All units shall be modular type unless custom, semi-custom or field erected units are approved by Clarkson. All air handling units shall be double wall construction.
2. Air handling units over 6,000 CFM capacity shall include the following as a minimum:
    - Double wall access doors, hinged with latches and durable gaskets. Gaskets shall be mechanically secured; they shall not be secured only by adhesives. Access door in positive pressure plenums must swing inward. Access doors in negative pressure plenums must swing outward. All access doors shall be provided with vision panel and the section served shall include a marine light with external switch.
    - All fans shall be non-overloading (backward inclined or airfloil type).
    - Provide all fans with factory mounted inlet airflow measuring devices.
    - Provide field mounted outdoor airflow measuring device and return air flow measuring device (where return fan is not integral to unit).
3. Cooling coil fin density shall not exceed 12 fins per inch.
4. Heating coil fin density shall not exceed 10 fins per inch.
5. Cooling coil section interior liner, supports, framing system and fasteners shall be type 304 or type 316 stainless steel.
6. All individual coils shall be supported by a framing system. Stacked coils shall not be supported by the coil below.
7. Humidifier section interior liner, supports and fasteners shall be type 316 stainless steel.
8. All fans shall be internally isolated.
9. All custom, semi-custom and field erected units:
    - Shall be factory fabricated, assembled and leak. Units shall be broken down in the factory for shipments/rigging. All components requiring field assembly shall be match marked in the factory.

- Shall be leak tested in the field after installation is completed.
- The installation shall be supervised by a factory authorized representative who shall inspect the installation prior to leak testing and start-up.
- The unit shall be started up by a factory authorized representative.
- The engineer shall be responsible for specifying test pressures and allowable leakage rates.
- The factory representative shall be responsible for producing leak test procedures and submitting to Clarkson for approval. The contractor shall be responsible for leak testing under the supervision of the factory representative. A leak test report shall be submitted to Clarkson, and shall be certified by the contractor and the factory representative.

10. All outdoor units shall be provided with the following as a minimum:
    - Units with width greater than eight feet shall have slope roof for proper rain water drainage.
    - Units with width exceeding 12 feet shall be provided with rain gutters and downspouts.
    - All exterior access doors shall have drip covers.

23 74 00 Packaged Outdoor HVAC Equipment

Rooftop Heating and Cooling Units

1. These may be used only with Clarkson approval.
2. When rooftop equipment is suggested for the project, the access to the roof shall be as a minimum a stair tower meeting applicable codes extended full-size to the roof. In addition, an available elevator may be required to extend to the roof.
3. As an alternative, the equipment may be located on an approved ground slab.
4. Coils shall be fully drainable from valve with hose connection.
5. Heating and cooling should be from external sources of hot water (or glycol mixture) or chilled water; do not use gas fired exchangers or air cooled refrigerant (DX) systems without Clarkson approval.
6. Relief Fan configurations are not acceptable. Return Fans shall be utilized in all applications except where approved in writing by Clarkson.

23 79 00 Central HVAC Misc

23 79 10

Condensation Drains for Centralized HVAC Systems

1. All condensation drains for HVAC cooling system components (evaporators, etc.) beyond those supplied with the unit will be schedule M or L Copper, Schedule 40 or greater PVC or other acceptable rigid sanitary piping. CPVC, PEX, or any other non-rigid piping which doesn't allow for easy draining are not acceptable.
2. Condensation drain pipe will have sufficiently spaced hangers to prevent any sagging which could prevent the drain pipe, with the exception of the trap, from completely emptying.
3. Condensation drains will be insulated with closed cell or fiberglass insulation when required to prevent exterior condensation "pipe sweating".

23 81 00 Decentralized HVAC Equipment

23 81 13 Packaged Terminal Air Conditioners

1. Use 18 gauge front panels on baseboards.
2. Fan coil units shall have permanent split capacitor motors.
3. Window air conditioning units are not acceptable unless approved by Clarkson. Portable Air Conditioners, while not desirable, are more acceptable alternative. If no other options exist, they shall be equipped with a programmable timer which can be shut off when the space is not occupied. The timer can be part of the unit, or at the panel as appropriate.

23 81 46 Heat Pumps

1. Clarkson encourages investigating water-source heat pumps for feasibility. Use only after detailed life cycle cost analysis and approval of Clarkson.

23 83 00 Radiant Heating Units

Radiant Heaters

1. Consider only for areas with high ceiling and low ventilation areas.

2. Do not use in office areas.

23 84 00 Humidity Control Equipment

Humidifiers

1 Electronic steam generators to be used only when building steam is not available.

2 Water softening equipment shall be provided when electronic steam generators are used.

Dehumidifiers

Small packaged dehumidifiers shall be arranged so condensate is piped to sanitary system.

23 89 00 De-Central HVAC Misc

23 89 05 HVAC Control Power

1. All control transformers for thermostats, baseboards, or other individualized equipment will be located in nearby machine rooms unless expressly permitted by Clarkson University.
2. As-built for any and all control systems will be provided with closeout documents.

23 89 10 Condensation Drains for Decentralized HVAC Systems

1. All condensation drains for HVAC cooling system components (evaporators, etc.) beyond those supplied with the unit will be schedule M or L Copper, Schedule 40 or greater PVC or other acceptable rigid sanitary piping. CPVC, PEX, or any other non-rigid piping which doesn't allow for easy draining are not acceptable.
2. Condensation drain pipe will have sufficiently spaced hangers to prevent any sagging which could prevent the drain pipe, with the exception of the trap, from completely emptying.

3. Condensation drains will be insulated with closed cell or fiberglass insulation when required to prevent exterior condensation “pipe sweating”.

Division 25 – Integrated Automation

25 00 00 Integrated Automation

1. The following building system and equipment controls shall be integrated through the HVAC Energy Management and Control System (EMCS)
    - HVAC DDC Control System
    - Building Lighting Controls and Day Lighting Controls
    - Data Center Monitoring
    - Power Monitoring
    - Plumbing Equipment Monitoring
    - Fuel oil handling systems and equipment, where applicable.
    - Building Performance Measurement and Verification.
    - Laboratory Fume Hoods
2. The following building system controls shall not be integrated with the EMCS:
    - Security
    - Audio/visual
    - Laboratory Equipment Monitoring, with the exception of laboratory fume hoods
    - Elevator Controls
    - Fire Alarm, with the exception of Siemens Fire Safety Systems
3. Siemens Building Technologies will be Clarkson's primary Building Management System. All other BMS providers will integrate their systems through BACnet to Siemens.
4. All building equipment shall be provided with integral microprocessor based controllers when available through the manufactures. The integral equipment controllers will function with the Siemens Building Technologies DDC system or be capable of communications with the EMCS through industry standard communication protocol such as BACnet (ASHRAE Standard 135.1), Lontalk (LonWorks), or Modbus (Modicon/Schneider Electric) where applicable.
5. The EMCS shall utilize the HVAC DDC control system network and operator interface for monitoring and adjustment of all integrated systems. The level of integration with integral equipment controllers shall be discussed with Clarkson and evaluated during the design. Refer to 230900 - "Instrumentation and Control for HVAC" and 230923 - "Direct Digital Controls."
6. Measurement and verification of building system performance, efficiency and energy usage shall be incorporated into the EMCS.
7. All equipment utilizing programmable controllers shall be provided with a licensed copy of the controller software and software manual for use by Clarkson.
8. In addition to use of the Siemens Building Technologies DDC system to monitor power, all power monitoring shall also be provided using separate, field mounted power monitoring hardware. Use of integral factory mounted power monitoring hardware in electrical panels and motor control centers is not acceptable.

Division 26 00 00 - Electrical

26 00 00 General Requirements

- Refer to Part 3.3.2 of this manual for General Electrical Design Criteria.
- The following specifications and standards, as applicable to the materials and methods specified, shall be considered part of these specifications:

AEIC	American Association of Edison Illuminating Companies
ANSI	American National Standards Institute
ASHRAEIIES	90.1 Code- 2004
ASTM	American Society for Testing and Materials
BAS	Building Automation System
ETL	Electric Testing Laboratories
NYSBC	Building Code of NY State
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories Inc.
OSHA	Occupational Safety and Health Standards
EIA/TIA 586	and Supplements
EIS/TIA 569	and Supplements
TIA/TSB-40	Levels (Categories) of electrical performance.

State Telecommunications Services: STS-1000

26 00 10 Clarkson University Preferred Electrical Equipment and Brands

The Electrical Trades Preferred Manufacturers List identifies manufacturers and suppliers who are known to provide good quality products, meet specification and schedule requirements, provide technical support, and provide service after the sales. This list is intended to regulate product quality, standardize electrical designs, and simplify maintenance activities. It is not intended to limit competition. It is not all inclusive. It is a list of manufacturers whose products are well known to the University due to their frequent and successful use.

This List shall be used by A/E's when selecting manufacturers for specification in electrical designs. A/E'S shall specify only the listed manufacturers that meet their project's requirements, and should specify a minimum of three manufacturers whenever possible. A/E's may specify manufacturers not on this list to satisfy project requirements, but only after obtaining university approval in advance.

This List shall NOT be used by Contractors to justify making substitutions for products specified in the construction documents. Contractors shall provide the products specified in the construction documents unless the university approves their proposed substitutions at the time of bid in accordance with the project's standard general conditions.

Conduits, Raceways and Accessories

- **EMT, liquid-tight flexible metallic conduit, and/or non-liquid-tight flexible metallic conduit/raceway; plus associated accessories, fittings, junction and pull boxes,**
  - Products of all manufacturers are acceptable as long as they are electro- galvanized steel, have a smooth interior, and are NRTL labeled for the application.
- **Rigid (galvanized metal), and IMC (intermediate metal) conduits/raceway, plus associated accessories, fittings, junction and pull boxes, and related products**

  - Products of all manufacturers are acceptable, as long as they are hot-dipped galvanized steel inside and out, have a smooth interior, and are NRTL labeled for the application. Boxes shall be cast, not formed. IMC may only be used when tools specifically designed for IMC are used.
- **PVC conduit/raceway (Type DB, Schedule 40, and Schedule 80, plus associated accessories, fittings, junction and pull boxes, and related products**
  - Products of all manufacturers are acceptable as long as they are sunlight resistant, and NRTL labeled for the application. Products from manufacturers making both the conduit and the fittings are preferred whenever possible.
- **Fiberglass Reinforced Epoxy (FRE) conduit/raceways, accessories, fittings, and related products**
  - FRE Champion
- **Electrical Enclosures**
  - Carlon (For use with PVC raceways) Hammond Hoffman Park Metal Rittal
- **Fire Stop Compounds**
  - A. D. Fire Protection Systems Flame Safe Hilti Nelson STI SpecSeal 3M Company
- **Structural Support Materials**
  - Aickinstrut (Fiberglass) B-Line Champion (Fiberglass) Hilti Powerstrut Unistrut
- **Surface and Underfloor Wireways**
  - Carlon Hubbell Legrand Evolution Floor Boxes Legrand (Wiremold) Mono-Systems Panduit
- **Underground Hand Holes, Junction Boxes and Pull Boxes**
  - CDR Systems Carson-Brooks Quazite
- **Cables (Medium Voltage)** General Cable Kerite Okonite Prysmian
- **Cable Splices for Medium Voltage Cable**
  - Raychem
- **Cable Terminations for Medium Voltage Cable**
  - Raychem
- **Cables and Wire (600 Volts)**
  - Aetna Wire and Cable Alan Wire American Insulated Wire Cerro Wire Encore General Cable Republic Wire Rockbestos-Surprenant Service Wire Southwire United Copper Industries
- **MC Cables (600 Volts)**
  - AFC Encore Kaf-Tech Rockbestos-Surprenant Service Wire Southwire United Copper Industries
- **2-Hour Fire Rated Cables (600 Volts)**
  - Lifeline by Drake USA VITALink by Rockbestos-Surprenant
- **Control Cables and Wire**
  - Belden
- **Cable Trays - Center Spline and Wall Mount Types (Use only where ladder and wire basket trays can not be used, and only with ITCS (Campus projects) or MCIT (UMHHC projects) approval)**
  - B-Line Legrand/Wiremold Mono-Systems Thomas & Betts
- **Cable Trays - Ladder Type**
  - B-Line Chalfant Cope Globetray (GS Metals) Husky Legrand Cablofil Mono-Systems Thomas & Betts
- **Cable Trays – Wire Basket Type (Use only with ITCS (Campus projects) or MCIT (UMHHC projects) approval)**

- B-Line Chalfant Legrand Cablofil EZTray Mono-Systems

- **Dimmer Switcher**
  - Leviton (Incandescent type only) Lutron (Incandescent and fluorescent types)
- **Occupancy Sensors (Infrared, Combination Infrared/Microphonic Dual Technology and Combination Infrared/Ultrasonic Dual Technology)**
  - Watt Stopper
- **Pin & Sleeve Connectors Crouse-Hinds**
  - Hubbell Killark Leviton Pass & Seymour
- **Power Poles**
  - Hubbell Mono- Systems Steelcase Wiremold
- **120-volt, 20-ampere Receptacles (GFCI, Hospital Grade, TVSS & Child Resistant)**
  - Pass & Seymour
- **120-volt, 20-ampere Receptacles and Plugs**
  - Pass & Seymour
- **Special Power Receptacles and Plugs**
  - Pass & Seymour
- **USB Charging Port Receptacles**
  - Hubbell
- **120/277 Volt, 20-Ampere Light Switches**
  - Pass & Seymour
- **Cord Reels**
  - Hubbell
- **Natural Gas Fired Engine-Generator Sets (Only those which require inlet gas pressures of**
  - **14 inches of water column or less)**
  - Caterpillar Generac Industrial Power (up through 300 kW) Kohler
- **Automatic and Manual Transfer Switches (Open and Closed Transition Types)**
  - ASCO
- **Automatic Transfer Switches (Soft-Loading Type)**
  - ASCO
- **Resistive Load Banks**
  - Avtron Sephco Simplex
- **Batteries**
  - C & D Technologies Chloride Plante Enersys Johnson Controls
- **Battery Chargers**
  - LaMarche SCI Enersys C & D Technologies Hi-Tran
- **Uninterruptible Power Supply Systems (Battery type)**
  - A.P.C. Best (Individual small load units only) Controlled Power Liebert MGE Mitsubishi (Totally solid- state) Toshiba
- **Rotary UPS Systems**
  - Designed Power Solutions International (DPSI)
- **Non-Current Limiting Fuses (Primary)**
  - S & C Type SM-5SS (With high interrupting capacity adapter)
  - Eaton/Cutler-Hammer Type RBA-400 (With high interrupting capacity adapter)
- **Current Limiting Fuses (Primary)**
  - Ferraz-Shawmut, Type CL-14 Eaton/Cutler-Hammer Type CLE General Electric Type EJO
- **KWHR/Demand Meters**

- E-MON D-MON (no other manufacturers shall be accepted)

- **15 kV Fused and Unfused Primary Switches (5kV rated switches may only be used for 5 kV (4,160 volt) class motors)**
  - Eaton/Cutler-Hammer Powercon Square D
- **15kV Metal Clad Switchgear and/or Circuit Breakers (5kv rated circuit breakers may only be used for 5 kV (4,160 volt) class motors)**
  - Eaton/Cutler-Hammer General Electric Square D
- **Circuit Breakers for 600-volt Class Secondary Switchgears and Switchboards**
  - General Electric
- **Transformers**
  - General Electric
- **Substation Assemblers (Using components from Preferred Manufacturers only)**
- General Electric
- **Bus Ducts**
  - General Electric
- **Fuses (600 Volts and Below)**
  - Bussmann
- **Surge Protective Devices**
  - Current Technology Eaton/Cutler-Hammer-Tycor
  - Intermatic (For protection of individual loads and receptacle panels only) L.E.A. Dynatech
  - Leviton (For protection of individual loads and receptacle panels only) Liebert Square D
- **Switchboards, Panelboards and Circuit Breakers**)
  - General Electric
- **Time Switches**
  - Intermatic
- **Transformers (Liquid Filled and Dry Pad-Mounted Type)**
  - General Electric
- **Transformers (Distribution Dry Type)**
  - General Electric
- **Ground Connections**
  - Burndy Hyground (Proper dies must be used) Thomas & Betts Blackburn (Above grade only)
- **Capacitors for Power Factor Correction**
  - Aerovox Eaton/Cutler-Hammer General Electric Myron Zucker Siemens Square D
- **Motor Controls (MCC's, Starters, Contactors, Disc. Switches and Control Devices)**
  - General Electric
- **Motor Starters (Electronic Soft Starter Type)**
  - Sprecher & Schuh
- **Ballasts (Electronic Compact Fluorescent)**
  - Advance Smart Mate Aculite Lightolier Prescolite
- **Ballasts (Electronic Rapid Start T-8 Fluorescent)**
  - Advance Optanium Bodine (For emergency lighting only) Osram/Sylvania Quicktronic Professional Universal AccuStart
- **Ballasts (Electronic Dimming T-8 Fluorescent)**
  - Advance Mark X (5% dimming type) Lightolier (1% dimming type) Osram/Sylvania

(10% dimming type)

- **Emergency Power Ballasts (Electronic Rapid Start T-8 Fluorescent)**
  - Bodine (For emergency lighting only) Lithonia
- **Ballasts (H.I.D.)**
  - Advance Universal
- **Dimming Systems**
  - AMX Crestron Electronic, Inc. E.T.C. Lithonia Strand (Stage lighting only) Leviton (Small single room systems only) Lutron
- **Emergency Lights Chloride Dual-Lite Emergi-Lite**
  - Exide Lightguard Lightalarms Lithonia Sure-Lites
- **Exit Signs (LED)**
  - Chloride Dual-Lite Emergi-Lite Exide Lightguard Lightalarms Lithonia LSI Industries Morlite (High abuse areas) (Philips) Prescolite Sure-Lites
- **Lamps**
  - General Electric Philips
- **Lighting Fixtures (LED and Fluorescent)**
  - Alkco (Philips) Kirlin Bartco Lightolier (Philips) Columbia Linear Lighting Day-Brite (Philips) Lithonia (Acuity) Fail-Safe (Cooper) LSI Industries Finelite Cooper (Metalux) Focal Point Peerless (Acuity) Guth (Philips) Prudential Harris Quality (Philips) Holophane (Acuity) Visa Hubbell Williams Keene Zumtobel Kenall
- **Lighting Fixtures (H.I.D.)**
  - Best Hubbell Crouse-Hinds (Cooper) Kenall
  - Day-Brite (Philips) Lightolier (Philips) Fail-safe (Cooper) Lithonia (Acuity) General Electric LSI Industries Guth (Philips) Lumark (Cooper) Harris McGill Holophane Quality (Philips) SPI
- **Lighting Fixtures (Compact Fluorescent and Incandescent)**
  - Globe Lightolier (Philips) Gotham (Acuity) Lithonia (Acuity) Halo LSI Industries Harris Omega (Philips)
  - Kenall Prescolite (Hubbell) Kirlin Quality (Philips) Swivelier
- **Lighting Fixtures (Outdoor Parking Lot and Roadway with poles by fixture supplier)**
  - Gardco Holophane Lithonia Hi-Tek LSI Industries McGraw-Edison Sterner Wide-Lite (Philips)
- **Lighting Fixtures (Outdoor Pedestrian Area with poles by fixture supplier)**
  - Lumec
- **Photoelectric Lighting Controls**
  - Crouse-Hinds Holophane Hubbell Intermatic Tork
- **Fire Alarm Systems**
  - Notifier

26 05 19 Low-Voltage (600V and below) Electrical Power Conductors and Cables

- All conductors shall be copper. All power conductors shall be awg #12 or larger. Minimum control wire shall be AWG #14 and minimum signal wire size no smaller than AWG #22.
- Wire for low voltage circuits shall be single conductor stranded copper Type THHN/THWN insulation. Type XHHW may be used for sizes #2AWG and larger.

- All conductors shall be color-coded where visible and numbered and tagged to each junction box, pull box, panel and device with suitable fireproof tags or adhesive identification bands. Color-coding of conductors for power and branch circuits shall be as follows:

For 120/208 Volt System	For 277/480 volt System
Phase "A": Black	Phase "A": Brown
Phase "B": Red	Phase "B": Orange
Phase "C": Blue	Phase "C": Yellow
Neutral: White	Neutral: Grey
Ground: Green	Ground: Green

- Feeder sizes and protections shall not be such a large percentage of the main that coordination of devices cannot be achieved.
- Use two wire circuits with individual neutral conductors for all branch receptacle circuits in administrative, office, computer laboratory and classrooms, and general laboratory areas.
- Refer to Part 3.1.5.5.6 for Branch Wiring Criteria.

26 05 13 Medium Voltage (600 ~ 15000V) Cables

- Provide testing of the feeder cables per NETA-ATS and furnish Clarkson with a copy of the completed test report prior to equipment startup.
- All cable in manholes shall be wrapped in two "opposing layers" of fireproofing tape secured in place with glass-cloth binder type. Slack cable shall be provided in manholes by routing the cables by the longest path possible through the manholes.
- All cables in manholes shall be properly supported on cable supports a minimum of every 36". Provide new cable supports in existing manholes as required for proper support of both the new and existing cables.
- High voltage cables shall be terminated in accordance with the cable manufacturer's recommendations using terminators specifically recommended by the type of cable specified.
- Terminations and splices shall be performed by a certified experienced cable splicer. Taped "T" splices are not permitted; they will be made using elastimold, or approved equal, disconnectable fittings.
- Cables shall be identified in manholes as to source and destination.
- Testing: DC proof testing on high voltage and medium voltage cabling systems including primary / secondary, MCC, motors, etc. Test results to be included in O & M Manual.

26 05 26 Grounding and Bonding for Electrical Systems

- Provide testing of the ground systems per NETA-ATS 7.13 and furnish Clarkson with a copy of the completed test report prior to equipment startup.
- 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.

- Grounding conductor in raceways shall be a minimum 600 volt green insulated copper conductor sized per NEC code. The neutral bar of the panel shall not be used for equipment grounds.
- Where concentric knock outs are used on panels or cabinets the paint needs to be removed to ensure metal to metal contact or a bonding bushing is to be used. This includes switchboards, panelboards, 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.
- Convenience outlets shall have a wired ground for continuity of ground path from the device grounding pole.
- Provide an 8' deep copper-clad driven ground rod at outdoor lighting poles for equipment grounding, and provide an equipment ground wire in PVC underground conduits to the poles per NEC.
- A system ground shall be provided for each separately derived system including service entrance, each voltage level, and generators per NEC.
- An isolated ground shall be provided where required for designated sensitive electronic equipment in any facility. An isolated ground bus must be provided in the source panel and connected back to the service ground point by an identified insulated ground conductor per NEC.
- Grounding shall be per UL 467. Bare grounding conductors shall be stranded copper grounding. Bus shall be predrilled rectangular copper with stand-off insulators.

26 05 33 Raceway and Boxes for Electrical Systems

- MC type cable is acceptable for electrical and fire alarm concealed applications such as walls and ceiling. Installation and support of the MC type cable shall comply with current NEC.
- Minimum conduit size shall be ¾". All empty conduits shall have a 65-lb. test polymer (or equivalent) pull string tied off at both ends.
- Galvanized rigid steel conduit can be used for the following:
    - Buried raceways in concrete slabs (except for main services which shall be PVC conduit concrete encased ductbank) or in the ground. Where directly buried, two coats of asphaltic compound shall be applied.
    - Interior high voltage runs.
    - Exposed exterior raceways.
    - Any raceway in hazardous areas.
        1) Termination of ductbank runs through concrete and into equipment or indoor areas.
- EMT can be used for the following:
    - Interior branch circuits that are exposed.
    - Interior exposed feeders.
    - Interior exposed motor circuit wiring.
    - Interior exposed control, Fire alarm, signal and sound wiring.
    - Use compression fittings only. Set screw type fittings are unacceptable. All fittings shall be steel.

- Rigid Plastic Conduit, Schedule 40 PVC, can be used for the following:
    - Underground primary or secondary service ductbank encased in red 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.
    - Underground telephone service ductbank encased in concrete.
    - Lightning protection down leads, and individual ground conductors.
    - Interior branch circuits that are exposed in wet or caustic environments.
    - Interior exposed feeders in wet or caustic environments.
- Underground ductbank runs shall be installed minimum of 30" below grade to top of bank, wherever possible. If 30" is not possible, concrete encased ducts may 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. See also 02580.
- Liquid-Tight Flexible galvanized steel conduit with continuous copper bonding conductor shall be used for connection, not exceeding 5' in length, to all motors, heating and ventilating controls, and at other locations where vibration, movement, moisture, or oil-vapor atmosphere are encountered.
- Plastic jacketed rigid steel galvanized conduit shall be used in corrosive atmospheres.
- Aluminum conduit shall not be used except with permission from Clarkson.
- Conduit shall be 3/4" size minimum. Flexible steel conduit of 1/2" diameter may be used for connections to be recessed and chain hung lighting fixtures.
- Where empty conduits are required to be installed, provide a continuous #12 nylon draw line with identification tag securely attached to both ends. The tags must clearly identify location of other end of empty conduit.
- 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.
- 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 with matching bends.
- Surface metal raceways with snap-on covers shall be used for exposed runs in finished areas, for counter and workbench power and data outlets where required. Pull and junction boxes shall be of ferrous alloy. Cabinets shall be galvanized steel with hinged cover.

26 11 00 Substations

- Type and Location of Building Substations:
    - Outdoor compartmental type pad mounted, completely enclosed, liquid filled power transformer with load break primary disconnect, or two "on-off" load break disconnects for loop feed service where required by campus distribution, 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.

- Indoor unit substation shall consist of a load break primary disconnect, or two "on-off" load break disconnects for loop feed service where required by campus distribution system, primary fuses, primary lighting arresters; dry type ventilated power transformer; and main secondary power distribution switchboard. Unit substations shall be provided as a completely enclosed, integrated and coordinated line-up by the manufacturer. The two primary "on-off" load interrupter switches for loop feed shall be in individual vertical section connected together on the load side and key interlocked to prevent both incoming circuits from being connected to transformer at the same time. 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^{o} C. above a 40^{o} 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. 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.

26 22 19 Control and Signal Transformers

- All control transformers for thermostats, baseboards, or other individualized equipment will be located in nearby machine rooms unless expressly permitted by Clarkson University.
- As-builts for any and all control systems will be provided will with closeout documents.

26 24 16 Panelboards

- All panelboards and Motor Control Centers will be tested in accordance with NETA-ATS 7.1 and a copy of the test report will be furnished to Clarkson prior to equipment start-up.
- All panelboards shall be rated for the intended voltage and shall be in accordance with Underwriter's Laboratories, Inc., standards for panelboards and standards for cabinets. Panelboard boxes shall be so labeled.
- 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 painted, galvanized code gauge sheet steel having multiple knockouts with lapped and screwed or welded corner construction. 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 panelboards 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.

- 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. Doors and trims shall each be in one piece so designed that door will close without a rabbet.
- 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 lock and catch with keys. Doors over 48 inches high shall be provided with vault handle, built-in locks and three point catch fastening door at top, bottom and centers. All panels shall be keyed alike. Doors shall be provided for access to contactors, time clocks, relays, and similar devices as required.
- When unpainted, backbox interiors, inside trim, door and exterior shall be treated with a rust inhibiting phosphatized 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 of the door of each panelboard, indicating the room or area and the service controlled by each circuit.
- 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 per NEC requirements. Ground bar shall be bare uninsulated and suitable bolted to the cabinet for equipment grounding. Busing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Bracing shall be equivalent to, or compatible with, the rated interrupting capacity of the smallest overcurrent device in that panelboard. 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.
- 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.
- Multiple section panels shall have feed-thru lugs with full capacity taps to adjacent panel sections.
- 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. Panelboards shall be furnished with main overcurrent interrupting devices consisting of circuit breakers of size and capacity as required.
- 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.
-

26 29 13 Enclosed Controllers

- Motor starters (Individual), Magnetic Type:
    - 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 circuit breaker (MCP) disconnect 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 and 2 extra normally closed interlock contacts. Starters shall be mounted in NEMA 1 enclosure indoors and NEMA 4X outdoors. Minimum size shall be NEMA 1.
    - 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.
    - Starter shall have "Hand-Off-Auto" selector switches and indicating "run" light.
- 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 pilot light to indicate when motor is running, with thermal overload protection as required. Enclosure shall be NEMA 1 for indoors, NEMA 4X for outdoors, or NEMA 7-9 for hazardous areas.

26 24 19 Motor Control Centers

- Refer to Clarkson's preferred brand list.
- Motor control centers shall be NEMA Class 1.
- 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.
- Motor disconnect switch operating handles shall be interlocked with the door so that the door cannot be opened with the switch in 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.
- Engraved nameplates shall be provided for each unit of the motor control center as well as the assembly. Screw or pin attachment only, no label tape for switchgear.
- Remote Disconnect Switch: Provide a remote disconnect switch for any motor located out of sight 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 4X outdoors.
- Provide a motor disconnect switch within sight of motor.

26 27 26 Wiring Devices

- All wiring devices shall be industrial heavy duty specification grade, rated a minimum 20A, 125V.
- Local wall switches shall be heavy duty specification grade, toggle, quiet type, color as approved by the University, fully enclosed in composition cases, rated 20 amp. 120/277 volt AC.

- 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.
- Receptacles for use with specific equipment, special applications, etc. shall be suitable for the load to be served and of proper configuration for the mating plug.
- Switches and receptacles for wet hazardous areas shall be an approved type for the environment served. Receptacles near water basin or sink shall be GFCI IAW the code.
- Receptacles fed from emergency power upon failure of normal power shall have cover of steel with red baked enamel and word "EMERGENCY" marked in white letters on cover.
- Ground fault interrupter type receptacles shall be duplex 120V. AC 20 amps as required, Class A.
- Device plates, telephone outlet plates, and blank plates in finished areas shall be .04 gauge 302 stainless steel with brushed finish.
- 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.
- Provide a 20 amp duplex outlet in the corridor near each floor landing of each set of stairs.
- Provide at least one 20 amp duplex outlet in corridors and space such outlets at 25 feet on center in all corridors.
- Emergency Power Off (EPO) switches shall be double action to prevent accidental activation. They shall also be labeled as to which panel and breakers are tripped when activated if panel is not located in same room as EPO.
- Label all outlets with panel and circuit number. Match numbering at panel with directory at panel.

26 28 16 Enclosed Switches and Circuit Breakers:

- 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.
- Circuit breakers shall be of the indicating type providing "on", "off" and "tripped" position of the operating handle.
- 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.
- Locking tabs shall be provided on all circuit breakers serving emergency lighting, fire alarm system, security systems and other emergency or critical equipment.
- 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.
- Circuit breakers feeding 120 volt lighting circuits that are not controlled by local wall switches shall be approved type "SWD" circuit breakers.
- Circuit breakers for Heat Trace systems shall be a GFCI.

26 32 13 Engine Generator Assemblies

- The emergency system shall consist of a diesel packaged engine generator set when natural gas is unavailable.
- The generator shall be tested with a portable load bank by the Contractor.
- Generator shall meet the requirements of NEMA MG1 and NFPA 37.

- When used, diesel generators shall have in-skid fuel tank.
- Diesel fuel storage shall have adequate capacity in order to provide 24 hour run time at full load of the generator.
- Outdoor units shall be in sound attenuated enclosure. Indoor units must have acoustical treatments to meet the required project NC rating. Sound attenuation/acoustical and exhaust design must be approved by the University.
- Shall be provided with a full maintenance service. All generators shall have a minimum 2 year parts and labor warranty.
- For generator design criteria see Part 3.3.2

26 42 00 Cathodic Protection

Underground steel pipe systems shall be cathodically protected using Pikotec or approved equal.

26 50 00 Lighting

- Refer to Part 3 of this manual for interior and exterior lighting design criteria.
- Emergency light fixtures shall be provided with the emergency power.

- Ballasts
  - Fluorescent ballasts shall be electronic type.
- Lamps
  - LED lighting is preferred.
  - Incandescent lamps are not preferred and require specific Univeristy approval for use.
- Exterior Lighting:
  - Street and parking lot poles shall be per project design.
- Lighting Control:
  - Contractor shall provide the initial lighting control setup.
  - If any software/cabling are required, provide the University a copy of the software and a set of said cables.

26 52 00 Emergency Lighting

Emergency lighting shall be provided as required by code; including toilet areas, outdoors at all egress doors, mechanical / main electrical room and in laboratory areas.

Division 27 - Communications

27 00 00 General Communications Provisions (Communications)

- Installers must adhere to ANSI/TIA/EIA-568 guidelines.

  .

- Testing:
  - Cat6 is to be verified with a certifying tester. All runs must be under 90 meters, pass continuity tests and 1000BaseT testing. Installer will provide Clarkson University a document or spreadsheet of the continuity test results.
  - Telephone cabling will have 10% of pairs chosen at random to be tested for continuity.
  - Fiber is to be certified with an OTDR. Installer will provide Clarkson University with a PDF version of all OTDR results. Splices are not to exceed 0.03dB loss. Each fiber is allowed a loss of <0.5dB per km at 1310nm
- Warranty:
  - Communication jacks installed will be warranted by the contractor for a minimum of 5 years.
  - All cable, conduit, or other hard parts installed will be warranted by the contractor for a minimum of 10 years.

27 05 00 Common Work for Communications

- Ethernet Cabling:
  - Ethernet cabling must be solid copper Cat6.
  - All terminations must adhere to the 568B standard.
  - The overall (tested) length for any Cat6 cable is not to exceed 90 meters.
  - Cat6 is only to be bundled or supported by Velcro straps; Zip ties are not be used for either purpose.
  - Cat6 will be terminated to modular style patch panels, punched down to keystone jacks in MDF
  - and IDF closets
  - Wall jacks will utilize keystones, with a minimum 8” of slack left behind its faceplate.
  - Conduit will run from the electrical box to the top of wall, drop ceiling, or cable exit.

- Telephone Service Cabling:
  - All Telephone cabling must be run as 25-Pair, minimum Cat3 rating
  - 25-Pair cables must be terminated to 66-Blocks.
  - Terminations must follow ICEA Method 5, Telco Standard color coding.

- Fiber Cabling:
  - Intra-Building fiber will be single-mode tight-buffered with a Kevlar member and plenum rated unless run through an unfinished area (i.e. dirt floor basement) in which case inter-building fiber will be used. Inter-building Fiber will be single-mode loose-tube (dry or

gel) with a fiberglass member and rated for outdoor/indoor and riser use Fiber count: Minimum 12 strand cable between an aggregation and edge closet, minimum 24 strand cable between two aggregation closets.

- Fiber Termination: A rack mounted, 2RU or larger FDP is required and must be installed in a 41- RU two-post aluminum telco rack pre-tapped with #12-24 holes in standard EIA-310-D pattern. FDP will have provisions for splice trays. If 'splice-on' ends are being used instead of pigtails/trays, a minimum 24" coil of 900µm or 250µm fiber must be left in the enclosure for future troubleshooting / repair. A minimum 3 meter slack coil should be left at either endpoint.
- All FDP will be LGX capable, with singlemode SC UPC (blue) bulkheads/connectors

27 05 26 Grounding and Bonding for Telecommunications Systems

- TBD

27 05 28 Conduit and Backboxes for Communications Systems

- New conduit will be sized at minimum 50% larger than current need. Existing conduit will not be filled past 50%.
- All conduits will have some type of insulating bushing/anti-chafing device installed on/in both ends.
- All conduits are to be fire-stopped as required by code

27 05 43 Building and Underground Conduit

- A minimum 3 meter slack coil will be left where cable enters/exits an underground conduit.
- Pull boxes are to have conduits enter and exit on opposing sides only. If a bend/corner needs to be made, it will be made in the conduit after the pull box.
- All pull box ingress and egress are to be made through appropriately sized conduits.
- New conduit will be sized at minimum 50% larger than current need. Existing conduit will not be filled past 50%.
- All conduits will have some type of insulating bushing/anti-chafing device installed on/in both ends.
- All conduits are to be fire-stopped as required by code

27 05 53 Labeling

- Any jack, cable or conduit must present a label.
- Jacks are typically assigned an alphanumeric room designation, and additional identifying number; (ie. 302B-1, 302B-2). Intra-building cables will be labeled in the same manner as jacks.
- Inter-building cables and conduit will be labeled with identifying information about its opposing termination points. (ie. Peyton Rm 102 to Clarkson Hall Rm 001)

27 15 00 Communications Cabling

- Copper cable jacketing must be White, Gray, or Blue.
- Horizontal cable will be run in wire baskets or conduit. Cabling not leaving a given space is exempt and may utilize J-hooks.
- Vertical cable runs will be installed in conduit.
- Any cable installed in a drop ceiling or ventilation space must be plenum rated.
- All penetrations between rooms/firewalls must be fire-stopped.
- Installers will maintain ~3 meters of slack in network closets.
- Slack is to be either placed in a figure-8, or an extended loop pattern.

Division 28 - Electronic Safety and Security

28 31 11 Fire Alarm Systems

Fire alarm systems shall be installed in buildings when required by this section.

1. Purpose:
    - The primary purpose of a fire alarm system is to notify the appropriate people and initiate the proper response from those people who are notified.
    - The secondary purpose is to initiate fire safety functions, which are building and fire control functions that are intended to increase the level of safety for occupants or to control the spread of the harmful effects of fire.
    - The fire alarm system operation must be coordinated with the facility fire plan.

    Note: This does not preclude the fire plan from being modified to meet the fire alarm system operation.
2. General Requirements:
    - The fire alarm system shall be installed where required by NFPA 101 and shall be designed to meet the requirements contained in NFPA 72 (2007), National Fire Alarm Code, NYS Statewide Fire Prevention Code (2006) and this manual.
    - Do not combine fire alarm systems with other systems such as building automation, energy management, security, etc. Down time for any of these non-life safety systems will also take the fire alarm system out of service. This is not acceptable to Clarkson.
    - Where applicable Fire Alarm Systems shall be tied to back up or emergency generators to maintain charging during outages.
    - All fire alarm wiring shall be installed in raceway separate from all other systems.
    - Installation of Fire Alarm Systems, including all conduit, supports, wiring, peripheral devices etc.; shall be installed according to all applicable codes referenced in the VUSBC, signed Architectural Drawings, and project Specifications Manual. All Fire Alarm equipment shall meet the requirements of UL 864 Ninth Edition.
    - All wiring shall be installed in a protected raceway e.g.; conduit, Greenfield, Liquid Tight, MC cable with proper color band for fire alarm use. Under no condition shall free air wiring be installed.
    - Wiring for local building fire alarm systems shall be specified as defined in NFPA 72 as follows:
        1) Initiating Device Circuits (IDC): Class B.
        2) Signaling Line Circuits (SLC): Class B. Residential Signaling Line Circuits will be Class A.

3) Notification Appliance Circuits (NAC): Class B.

- System shall include an elevator pre-action system.
- There will be no performance spec system.
- System shall be approved by a Clarkson approved third party authorized inspector.
- Existing systems that are obsolete, shall be removed not abandoned in place.
- Amv does first F.A. inspection.

1) Communications between building fire alarm control units: Class X.

Note: Installation of the Fire Alarm System shall consume no more than 80% of the systems maximum capacity in all respects. In particular, all addressable circuits shall allow for the future installation of at least (15) additional devices, without requiring additional components in the FACP or new "home-run" wiring. All visual notification circuits shall allow for the future installation of at least (200) linear feet of additional circuit length, with (4) 15cd strobes at the end of the new circuit.

- The use of “wire nuts” shall be strictly prohibited. If it becomes necessary to create a junction point, all wiring shall be terminated under a terminal screw and printed labels showing each wire’s origin and destination shall be affixed to the wire and a clear protective covering over the label shall be used.
- The FACP shall be equipped with the means to disable ALL audio/visual devices, (including sounder bases if so equipped) elevator recall, AHU shutdown, door release, and solenoids for any pre-action or sprinkler dry pipe systems without having to go through menu options, e.g.; single push button for each event listed.
- Analog addressable systems are required where many smoke detectors are required to be installed. These systems do not require the frequent sensitivity testing for smoke detectors that the hard-wired systems require and the savings in testing will pay for the extra cost of the system.

1) It is the intention of the University to obtain competitive bids for maintenance and repair services and material for the fire alarm system provided. Any special tools, prints, technical data, layouts, hardware, software, etc. required throughout the life of the equipment and which cannot be obtained from multiple suppliers, must be provided by the manufacturer to the Owner at substantial completion of the project.

2) Clarkson only uses Notifier Systems, a viable alternative with RFI approval will only be used with Clarkson approval.

3) Any and all maintenance diagnostic tools, electrical schematic wiring diagrams and any access codes and passwords required to perform any maintenance function over the life of the equipment such as diagnostics, adjustments or reprogramming shall be provided to the Owner on the Date of Substantial Completion. Tools may be handheld or built into the control system and shall function for the life of the equipment without

the requirement to return them to the Manufacturer. Provide complete operations and maintenance manuals including diagnostics instructions for troubleshooting the system. The Owner shall not be required to sign licensing agreements related to the use of maintenance or repair tools.

4) The fire alarm control panel shall be listed under UL Category UOJZ for each of the following:

   a. Type: "P (PPU)" (proprietary fire alarm, protected premises control unit).

   b. Type Services: "A" (automatic fire alarm), "M" (manual fire alarm), "WF" (waterflow alarm), and "SS" (sprinkler supervisory).

   c. Type Signaling: "DAC" (digital alarm communicator).

Note: No other category or use types will be considered

- Upon Date of Substantial Completion, the installing contractor, consultant, and/or designated party responsible for the creation of such shall provide the Owner all of the following;

  1) Three (3) complete sets of binders containing OEM Manuals including the Maintenance, Operation and Programming Instructions

  2) Bill of Material of all installed equipment, part numbers, and the replacement cost of each item. Prices shall remain valid for two (2) years including the warranty period

  3) Cut sheets and wiring diagrams

  4) Electronic copy of the FACP program

  5) Written sequence of operation

  6) Complete battery calculation sheets

  7) Three (3) sets of reproducible as-built drawings

  8) CAD copies of as-built drawings

3. Typical Operations:

- Table 7.3(1) & (2) is provided to identify the typical operation required by the respective fire alarm systems. A table similar to this should be added to the contract documents to indicate the specific operation required of the system.

	Output								
Input	1. Sound general building alarm	2. Initiate alarm to GMU Police via Digital alarm communicator	3. Initiate supervisory signal to GMU Police	4. Close associated smoke barrier doors on the floor	5. Shutdown air handler served by detector	6. Recall elevator	7. Initiate elevator shut down and disconnect elevator	8. Open all locked egress doors.	9. Disconnect fuel source from cooking equipment.
Duct Smoke Detector			X		X				
Area Smoke Detector	X	X						X	
Door Release Smoke Detector	X	X		X				X	
Elevator Smoke Detector	X	X				X		X	
Manual Pull Station	X	X		X				X	
Elevator Machine Room Heat Detector	X	X					X	X	
Generator Room Heat Detector	X	X						X	
Sprinkler Waterflow/Pressure Switch	X	X		X				X	
Water Control Valve Tamper			X						
Fire Pump (Any alarm condition required by NFPA20)			X						
High/Low Pressure Dry-Pipe Sprinkler System			X						
Kitchen Hood Suppression System	X	X		X				X	X
Gas Extinguishing Systems	X	X		X				X	
Dry Pipe Valve Room Temperature Alarm			X						

TABLE 7.3(2) STUDENT HOUSING BUILDING'S GENERAL MATRIX

	Output												
	ANNUNCIATION			NOTIFICATION		CONTROL							
Input Device	1. Alarm Annunciation FACP, Remote Annun & Send Status to receiving station & Printer	2. Supervisory Annunciation FACP, Printer, Graphic Annunciator & Send Status to Receiving Station	3. Trouble Annunciation FACP, Printer, Graphic Annunciator & Send Status to Receiving Station	4. Sound General Evacuation Horns, Strobes & Audible bases throughout Building	5. Sound Audible Bases Throughout Associated Dwelling Unit (Also Activates Strobes in Dwelling Unit for ADA or HI Unit)	6. Activate Elev Recall to Primary Floor	7. Activate Elev Recall to Alternate Floor	8. Initiate Elevator Shunt Trip	9. Activate Exterior Electric Bell Device	10. Open Smoke Damper Associated with the Vent at Top of Elev Hoistway	11. Shutdown Applicable Air Handling Unit & Associated Dampers	12. Close Service Counter Door	13. Disconnect Power to Access Control Power Supply
Manual Pull Station	X			X									X
General Area/Corridor Smoke Sensor	X			X									X
First Dwelling Unit Smoke Sensor		X			X								
Second Dwelling Unit Smoke Sensor	X			X									X
Service Counter Door Smoke Sensor	X			X								X	X
Elev Lobby Smoke Sensor (all except first floor)	X			X		X				X			X

TABLE 7.3(2) STUDENT HOUSING BUILDING'S GENERAL MATRIX													
	Output												
	ANNUNCIATION			**NOTIFICATION**		**CONTROL**							
Input Device	1. Alarm Annunciation FACP, Remote Annun & Send Status to receiving station & Printer	2. Supervisory Annunciation FACP, Printer, Graphic Annunciator & Send Status to Receiving Station	3. Trouble Annunciation FACP, Printer, Graphic Annunciator & Send Status to Receiving Station	4. Sound General Evacuation Horns, Strobes & Audible bases throughout Building	5. Sound Audible Bases Throughout Associated Dwelling Unit (Also Activates Strobes in Dwelling Unit for ADA or HI Unit)	6. Activate Elev Recall to Primary Floor	7. Activate Elev Recall to Alternate Floor	8. Initiate Elevator Shunt Trip	9. Activate Exterior Electric Bell Device	10. Open Smoke Damper Associated with the Vent at Top of Elev Hoistway	11. Shutdown Applicable Air Handling Unit & Associated Dampers	12. Close Service Counter Door	13. Disconnect Power to Access Control Power Supply
First Floor Elev Lobby Smoke Sensor	X			X			X			X			X
Elev Machine Room Smoke Sensor	X			X		X				X			X
Elec Machine Room Heat Sensor	X			X		X				X			X
Duct Smoke Sensor for AHU		X						X			X		
Sprinkler Flow (Floor)	X			X					X				X
Sprinkler Flow (Top of Hoistway/Elev Closet)	X			X					X	X			X
Sprinkler Tamper Switch		X											

TABLE 7.3(2) STUDENT HOUSING BUILDING'S GENERAL MATRIX													
	Output												
	ANNUNCIATION			**NOTIFICATION**		**CONTROL**							
Input Device	1. Alarm Annunciation FACP, Remote Annun & Send Status to receiving station & Printer	2. Supervisory Annunciation FACP, Printer, Graphic Annunciator & Send Status to Receiving Station	3. Trouble Annunciation FACP, Printer, Graphic Annunciator & Send Status to Receiving Station	4. Sound General Evacuation Horns, Strobes & Audible bases throughout Building	5. Sound Audible Bases Throughout Associated Dwelling Unit (Also Activates Strobes in Dwelling Unit for ADA or HI Unit)	6. Activate Elev Recall to Primary Floor	7. Activate Elev Recall to Alternate Floor	8. Initiate Elevator Shunt Trip	9. Activate Exterior Electric Bell Device	10. Open Smoke Damper Associated with the Vent at Top of Elev Hoistway	11. Shutdown Applicable Air Handling Unit & Associated Dampers	12. Close Service Counter Door	13. Disconnect Power to Access Control Power Supply
High/Low Air PSI (Dry pipe System)		**X**											
Pressure Alarm Switch (Dry Pipe System)	**X**			**X**					**X**				**X**
Fire Pump Running		**X**											
Fire Pump Phase Reversal		**X**											
Fire pump Phase Loss		**X**											
Fire Pump on Emergency Power		**X**											

- Provide initiating devices in accordance with NFPA 101, NFPA 72.
- Notification Appliances: Placement and spacing of notification appliances shall be in accordance with NFPA 72.
- In accordance with NFPA 72 and 101, provide smoke alarms in domiciliary resident sleeping rooms, family/staff quarters, on-call staff sleeping rooms, hotel sleeping rooms, and other sleeping rooms. ABA and ADA require a minimum of 1 unit, and 1 out of each 25 rooms in each occupancy category, to be provided with visible appliances (strobe lights) activated by the smoke alarm. Facilities are encouraged to provide additional visible notification appliances (combination smoke detector/visible notification appliance) up to 100%, where possible. See NFPA 72 for light intensity and mounting instructions.

Note: If visible notification appliances are provided in only 1 in 25 rooms, the facility will have to ensure that hearing-impaired persons are assigned only to those rooms where accommodation (visible notification) is provided. Installing strobes in all rooms will allow a hearing-impaired person to occupy any room. In addition, for every room which contains a strobe light activated by a smoke alarm and where a building fire alarm system is present, the room must also contain a strobe light activated by the building fire alarm system.

- Smoke detectors are to be installed only where required by the National Fire Codes, this design manual, or where required by an equivalency. All smoke detectors shall be photoelectric type only. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning. **Exception: All student sleeping dormitories shall provide at minimum 30sec alarm verification.**

Note: Dormitory smoke detectors shall be supervisory on 1st smoke detector alarm, it will sound all sounder bases within the suite or apartment. If smoke detector does not clear within the verification period the general alarm shall sound throughout the building. If two smoke detectors get activated the general alarm shall activate immediately.

- Heat detectors are not required unless used in conjunction with elevator shutdown, where used as a substitute for smoke detectors in environments unsuitable for smoke detectors, or where used to protect emergency generators that are not equipped with automatic sprinklers.
- Indicate the capacity of all air-handling units. Duct smoke detectors are to be installed only where required by NFPA 101 or NFPA 90A. Where a duct smoke detector is located above a ceiling or in a difficult to reach location, provide a remote indicating lamp and a test key switch on nearby wall at 7ft AFF to facilitate testing.

- ALL Modules e.g., Monitor Modules, Control Modules, Relay Modules etc. shall be installed in their own individual junction box. **Exception: 1) Modules mounted on a DIN Rail or other supporting means and installed within the cabinet of the FCAP shall be acceptable. 2) Where space is limited for the installation of multiple modules, they may be installed on a DIN Rail or other supporting means within a lockable cabinet keyed to the same lock on the FACP. 3) Mini-modules used for addressing manual pull stations and installed in the same box as the pull station shall be acceptable.**

Note: All cover plates for modules shall have the means for module LED's to be seen without having to remove the cover plate. All modules shall have a typed label affixed to the cover plate showing loop number and device address. ALL initiating devices shall have typed labels affixed to the exterior of the device showing loop number and device address. Modules shall NOT be installed in Troughs or larger junction boxes.

- When an annunciator is required, it shall be located at the building entrances where the fire fighters will respond. The main control panel can act as an annunciator. Coordinate the location with the local fire department. Circuits from the fire alarm control panel to a remote annunciator shall be supervised.
- Elevators: Elevator fire protection shall comply with the requirements of NFPA 13, NFPA 70, NFPA 72, and ANSI/ASME A17.1 or A17.3 as applicable.

Note: Designers are reminded of the requirement in Chapter 7 of NFPA 101 for independent ventilation or air conditioning systems to maintain proper temperature during elevator fire fighters service operation for elevator machine rooms that contain solid-state equipment for elevators having a travel distance of more than 50 feet above the level of exit discharge or more than 30 feet below the level of exit discharge, and the requirement that when standby power is connected to the elevator, the machine room ventilation or air conditioning shall be connected to standby power.

Note: Elevators have been an ongoing fire protection problem, not only for Clarkson, but also for the entire industry. Many conflicting requirements seem to exist at any given time. Although other methods are permitted in the National Fire Alarm Code for power shut down when sprinkler protection is present, Clarkson uses the heat detector option as identified in the National Fire Alarm Code and as clarified below.

1) Provide smoke detection for Phase I recall for new elevators. Provide smoke detection for Phase I recall for existing elevators that have a travel distance of 25 feet or more above or below the level of fire department response (this is generally a building greater than three stories).

Note: The requirements for Phase I recall do not apply when the hoistway, or portion thereof, is not required to be fire-resistive construction, the travel does not exceed 6 ft 8 in, and the hoistway does not penetrate a floor.

a. Provide smoke detectors in the elevator lobbies, in elevator machine rooms, and elevator machine and control spaces to initiate Phase I recall. Provide smoke detectors at the top of the elevator hoistway to initiate Phase I recall only when sprinklers are installed at the top of the hoistway.

Note: Smoke detectors are only required above the elevator machine room equipment in larger rooms that contain other mechanical equipment. Some rooms have a lot of space that is not dedicated to elevator equipment; smoke detection would not be required for that space.

b. Provide three supervised control circuits from the fire alarm system to a point within three feet of the elevator controller for the purpose of providing an interface with the elevator system. When actuated, the three circuits will, respectively, 1) initiate recall to the alternate floor, 2) initiate recall to the designated floor, and 3) initiate flashing of the firefighter helmet symbol in the elevator car.

2) Where sprinklers are installed in elevator machine rooms or elevator hoistways, provide heat detection to remove power from the elevator prior to water discharge from these sprinklers. In non-combustible hoistways and where cars meet the flammability requirements of ASME A17.1, the sprinkler at the top of the hoistway should be omitted. Sprinklers can be omitted from elevator pits of enclosed, noncombustible shafts where there are no combustible hydraulic fluids contained in the shaft. Sprinklers, when installed in the pits, shall be sidewall type installed no more than 2 feet above the floor.

Note: Elevator cars which were built to the requirements of the ANSI code since 1985 have a flame spread no greater than 75 and a smoke developed rating no greater than 450 (Class B, per ASTM E 84 / NFPA 255). Where the elevator cars meet these requirements, NFPA 13 allows sprinklers to be omitted from the top of the hoistway as well as from the pit as indicated. When sprinklers are omitted from the top of the hoistway, NFPA 72 does not require, nor does it permit, a smoke detector to be installed at the top of the hoistway due to the difficulty experienced with performing testing and maintenance.

a. Elevator main line power shutdown (commonly known as “shunt trip”): Power to the elevator must be removed prior to or immediately upon release of water from a sprinkler in the elevator machine room (including machine space, control room, or control space) or hoistway. Operation of a heat detector used

to initiate shunt trip shall cause the shunt breaker to operate, thereby removing power from the elevator(s) within the common hoistway or controlled by equipment in a common machine room. Cars sharing the same hoistway or the same machine room shall have power removed independently from cars within other hoistways or those controlled from equipment in other machine rooms.

Note: The industry expects that the removal of elevator power (caused by operation of the heat detector) will not trap any occupants on the elevator because sequences under Phase I operation will have already moved the car(s) to the recall level and placed the doors in the open position. Smoke detection required for Phase I initiation is provided at all of the spaces where heat detection is provided for power shut down.

b. Provide 57° C (135° F) rate compensation heat detectors within two feet of each sprinkler in the elevator machine room and hoistway in accordance with NFPA 72. Do not provide a heat detector for the pit sprinkler. Higher temperature rated heat detectors may be used where local conditions warrant; however, the heat detectors must have a lower temperature rating than the sprinklers. The sprinklers in the elevator machine rooms and hoistways must be standard response type; quick response sprinklers are prohibited in these areas.

c. Provide a supervised control circuit from the fire alarm system to a supervised relay within three feet of the shunt breaker. This signal is the input to remove the mainline power to the elevator.

d. Provide a 110-vac power source to the shunt breaker independent of the elevator controller. This power circuit shall be supervised by the fire alarm system as a supervisory signal.

Note: The shunt breaker requires 110-vac to operate and the source must be independent of the elevator in accordance with ANSI A17.1. The intent of the code is to have to a reliable power source and not to rely on one that may be on fire. Without supervision of the 110-vac power circuit needed for the shunt breaker, the condition of the power necessary for the shunt breaker to operate during a fire is unknown. There have been instances where the breaker to the 110-vac power source for the shunt breaker has been turned off and the elevator power would not shunt upon operation of the heat detector.

3) Fire alarm system elevator interface summary: As described above, there will be five supervised control circuits from the fire alarm system that will interface with the elevator system. They are as follows (see following pictorial and the accompanying notes):

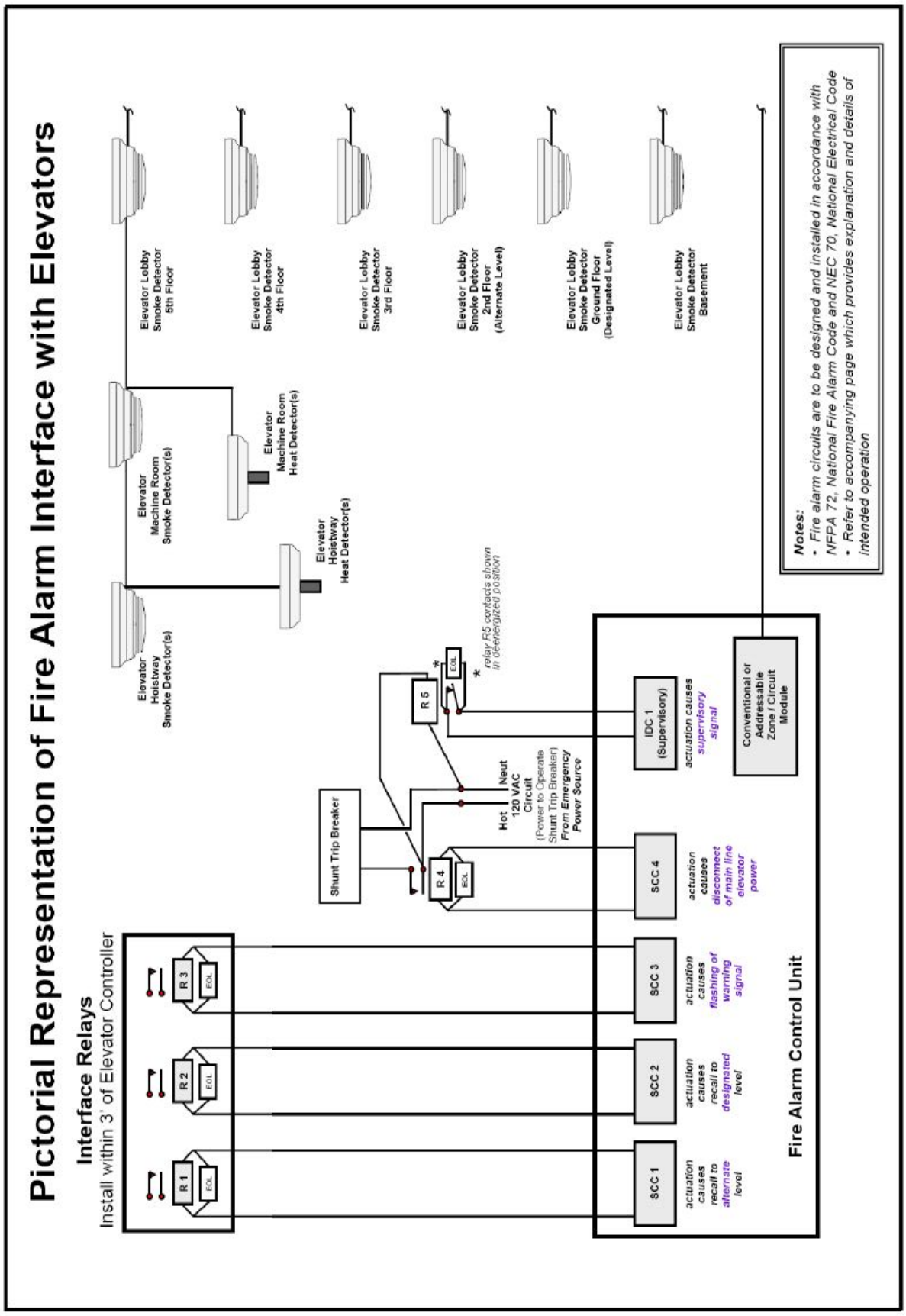
a. Input to elevator controller for Phase I recall to the designated level from actuation of smoke detectors other than at the designated level lobby.

b. Input to elevator controller for Phase I recall to the alternate level from actuation of a smoke detector at the designated level lobby.

c. Input to elevator controller to flash the firefighter helmet signal when recall is initiated by a smoke detector in the elevator machine room or hoistway.

d. Input to elevator main line power shunt trip breaker for power shut down from actuation of heat detectors in the hoistway or machine room.

e. Supervision of the 110-vac power source to the shunt breaker.


Pictorial Representation of Fire Alarm Interface with Elevators
Interface Relays
Install within 3' of Elevator Controller
R 1
R 2
R 3
EOL
Fire Alarm Control Unit
SCC 1
SCC 2
SCC 3
SCC 4
actuation causes recall to alternate level
actuation causes recall to designated level
actuation causes flashing of warning signal
actuation causes disconnect of main line elevator power
IDC 1 (Supervisory)
actuation causes supervisory signal
Conventional or Addressable Zone / Circuit Module
R 4
R 5
Shunt Trip Breaker
Hot
Neut
120 VAC Circuit
(Power to Operate Shunt Trip Breaker)
From Emergency Power Source
* relay R5 contacts shown in deenergized position
Elevator Holistway Smoke Detector(s)
Elevator Machine Room Smoke Detector(s)
Elevator Machine Room Heat Detector(s)
Elevator Holistway Heat Detector(s)
Elevator Lobby Smoke Detector 5th Floor
Elevator Lobby Smoke Detector 4th Floor
Elevator Lobby Smoke Detector 3rd Floor
Elevator Lobby Smoke Detector 2nd Floor (Alternate Level)
Elevator Lobby Smoke Detector Ground Floor (Designated Level)
Elevator Lobby Smoke Detector Basement
Notes:
• Fire alarm circuits are to be designed and installed in accordance with NFPA 72, National Fire Alarm Code and NEC 70, National Electrical Code
• Refer to accompanying page which provides explanation and details of intended operation

Explanation of Fire Alarm Interface with Elevators

Notes:

- There can be many variations of the accompanying “Pictorial Representation of Fire Alarm Interface with Elevators.”
- In this example, the smoke and heat detectors are addressable initiating devices and the operating relays are “hardwired.”
- To achieve supervision, the relay circuits are operated from supervised control circuits. Sometimes NACs (Notification Appliance Circuits) are used to accomplish this function.
- The supervisory initiating device that monitors the power for the shunt trip circuit is connected to a supervisory IDC (Initiating Device Circuit).
- The scenario assumes that:
- There is a sprinklered elevator hoistway.
- Means to disconnect the main line power to the elevator is via a shunt trip breaker.
- System operation is in accordance with NFPA 72.

4) Relay (R5) and an IDC (Initiating Device Circuit) have been included to provide indication (via a supervisory alarm) of absence of voltage (power) to operate shunt trip breaker.

Components Function

R1 ----------Signal to elevator controller for recall to designated level.

R2 ----------Signal to elevator controller for recall to alternate level.

R3 ----------Signal to elevator controller for firefighter notification.

R4 ----------Signal to activate shunt trip relay.

R5 ----------Supervisory relay to monitor presence of voltage (power) to operate shunt trip breaker.

SCC1 ----------Supervised Control Circuit for operating R1.

SCC2 ----------Supervised Control Circuit for operating R2.

SCC3 ----------Supervised Control Circuit for operating R3.

SCC4 ----------Supervised Control Circuit for operating R4.

IDC1----------Initiating Device Circuit to supervise R5 contacts (monitoring power to operate shunt trip breaker).

Division 31 – Earthwork

31 10 00 Site Clearing

1. Topsoil shall be stripped to the depth determined by the Engineer, usually not less than 4 inches. Topsoil shall be stockpiled in accordance with the requirements of the approved E&S Plan in locations as coordinated with the University. Under no circumstances shall topsoil be removed from University property without written University Approval. Topsoil shall not be mixed with subsoil or other site debris.

31 20 00 Earth Moving

1. The Contractor shall obtain any appropriate permits prior to any onsite activities. All work shall be in accordance with the permit requirements where applicable. A Preconstruction meeting shall be held with the University prior to land disturbance.

31 23 00 Excavation and Fill

1. All excavation for Clarkson projects shall be unclassified excavation, meaning that whatever material is encountered during excavation must be removed. If the soils reports indicate large quantities of rock at the elevations of the building footings, this procedure may be modified, with the permission of the University. The Contractor shall be instructed to stop excavation if anything of archaeological value is encountered. Contact appropriate utilities prior to excavation.
2. Contractor is required to coordinate with Clarkson's Engineer to perform inspection and testing of all earthwork. Contractor shall provide all field and laboratory services required to:
    - Test and evaluate all samples of proposed fill materials to determine optimum moisture density relationship in accordance with VTM-1.
    - Test all samples to assure compliance with gradation requirements of this Specification. Grain size analysis shall be performed in accordance with ASTM D 422.
    - Determine depth of topsoil stripping. Existing site topsoil shall be reviewed to determine the need for importing offsite topsoil for use in final landscaping. Existing university topsoil at the Fairfax, Prince William and Arlington Campuses have not produced desired finished lawns around new facilities. Augmenting or supplementing onsite topsoil may be required.
    - Inspect all proof rolling and determine the presence of any local soft pockets.
    - Inspect excavation in natural soil to determine if bearing stratum meets design criteria.
    - Inspect and test compacted fill to determine compliance with these Specifications. Field densities shall be determined by VTM-1.
    - Keep written records of all tests and field instructions, and summaries of these reports shall be mailed weekly to A/E, the Contractor, and the University. Final written summaries shall be provided to The University upon completion of work.

31 25 00 Erosion and Sedimentation Controls

1. All erosion and sediment control measures will meet the requirements of the state of NYS's Department of Environmental Conservation and Recreation's "Erosion and Sediment Control Manual" and Clarkson's Construction and Design Standards.

Division 32 – Site Improvements

1. Except as otherwise supplemented in this manual, these items must meet the requirements and standards of NYS DOT.

32 06 10 Pedestrian Walkway Schedule (Sidewalks)

1. In general all permanent sidewalks shall be cast-in-place concrete. If temporary walkways are required, they may be asphalt. Concrete will not be accepted if graffiti is present. Concrete with graffiti shall be removed by the Contractor and replaced at Contractor's expense. Cracked concrete will not be accepted, except as approved in writing by the University.
2. Clarkson's standard sidewalk is minimum 6 feet wide, 4 inch slab. The precise geometry of the cross section of the sidewalk shall be determined based upon the hierarchy established elsewhere in this manual. Thickness shall be provided proportionally to the width as noted in the details. Sidewalks shall be constructed of 3000 psi, 4 – 6% air entrained concrete reinforced with 6 x 6 #10 welded plan cold drawn steel flat panel wire mesh, with broom finish. Wire mesh shall be supported by, and attached to, 2 inch rebar chairs that are spaced adequately to ensure support of the mesh during the concrete pour. Sidewalks shall be on a compacted base of NYSDOT approved crushed stone. Aggregate used within the sidewalk shall be rounded. Sidewalks shall be graded so as to drain fully and away from buildings/entrances, shall have no surface indentation that permits standing water (e.g. "bird baths"), or back-up into curb/yard inlets.
3. Install 3'chamfers at all sidewalk intersections for electric carts.
4. Install ramps where sidewalks intersect roads for general accessibility and electric cart access. Consult Clarkson Facilities for exceptions.
5. Control, construction, and contraction joints shall be coordinated with the architectural and landscape designs to ensure the pattern is acceptable. Transverse control joints shall occur 6 feet on center for 6 foot wide sidewalks. Transverse contraction joints with premolded joint fillers shall occur 48 feet on center. Premolded joint fillers shall be ½ inch thick asphalt impregnated fiber board conforming to ASTM C 1751. Control joints shall be made with tools that provide slightly curved edges and no flats on the surface of the sidewalk.
6. Use non-slip finish on sidewalks, steps, and metal grates where a slipping hazard may exist.
7. Ensure that any and all drainage grates that are provided in pedestrian walkway areas provide an opening of no more than ½ inch diameter (i.e. "heel safe").

32 12 00 Flexible Pavement

1. All asphalt pavements shall conform to the following minimum thickness for the use intended as noted below. The subgrade bearing capacity shall be determined by tests. During preparation of the subgrade, the Contractor shall request CBR tests be performed. Final pavement design shall be based on CBR results, but at a minimum thickness as shown below. Pavement designs shall be in conformance with VDOT requirements. Proof rolling with a fully loaded, 3 axle, tandem dump truck shall be required with the University. The proof rolling is to identify any localized soft spots in the subgrade. Areas not acceptable to the Geotechnical engineer shall be undercut and have acceptable material installed until an acceptable proof roll is achieved

VALUE PAVEMENT TYPE	MIN. CBR TYPE	TYPE & THICKNESS OF BASE COURSE	TYPE & THICKNESS OF SURFACE COURSE

Primary Arterial roads and service roads with heavy truck & bus traffic	5 FX	3" Intermediate Mix, 3" Base Mix, 8" Untreated Aggregate	1 ½" Surface Mix
	10 PW		
SecondaryFeeder Roads which carry bus & truck traffic and bus & truck parking lots	5 FX	3" Intermediate Mix, 3" Base Mix, 6" Untreated Aggregate	1 ½" Surface Mix
	10 PW		
Tertiary Driveways which carry only passenger cars and passenger car parking lots	5 FX	3" Base Mix, 7" Untreated Aggregate	1 ½" Surface Mix
	10 PW		

32 13 13 Rigid Paving (Concrete Paving)

1. Specify cast-in-place concrete for permanent sidewalks. If temporary walkways are required, they may be asphalt.

    - Specify that the Contractor protect newly placed concrete exposed to the public to insure that concrete is not defaced prior to complete setting up. Replacement of defaced concrete is included in the Contract Sum.
    - Specify 3000 psi air-entrained concrete for exterior paving, reinforced with 6 x 6 #10 welded wire fabric delivered in flat sheets and not rolled. Design paving with a 6 inch aggregate base. Specify a heavy broom finish perpendicular to the direction of travel, with sawn or tooled joints at a maximum of 6 feet on-center. Specify premolded 1/2-inch thick asphalt impregnated fiber board joint filler for construction joints and where full separation is required.
    - See above for Clarkson's standard sidewalk information.
    - Control, construction, and contraction joints shall be coordinated with the architectural and landscape designs to ensure the pattern is acceptable. Transverse control joints shall occur 10' on center for wide slabs, each direction. Coordinate with Clarkson and Landscape Architect. Transverse contraction joints with premolded joint fillers shall occur 48' on center, conforming to ASTM C 1751 and caulked with an appropriate type for this application. Control joints shall be made with tools that provide slightly curved edges and no flats on the surface.
    - Hill Campus concrete paving: Specify naturally buff-colored concrete, or include some color admixture, avoiding cool-gray toned concrete.
    - Beacon Institute Campus concrete paving: Intermix concrete and unit pavers incorporating the same tones as indicated above for pavers on this campus. Avoid strong yellow or brown tones.
    - Downtown Campus concrete paving: Specify concrete with tan or beige tones.
    - Additional requirements for concrete work are included in Division 03.
    - Requirements for exterior railings are included in Division 05.

32 14 00 Unit Pavers

1. Specify a mixture of paving colors, textures, patterns, and materials.

    - Specify paver patterns with high Solar Reflectance Indices (SRIs) of at least 29.
    - Hill Campus pavers: specify red, buff, tan, and clay tones.

    Cambridge Pavingstones (Lyndhurst, NJ) KingsCourt or RoundTable Collections with ArmorTec or equivalent in the following colors:

    - Chestnut
    - Chestnut/Salmon
    - Toffee/Onyx
    - Sahara
    - Onyx/Chestnut
    - Salmon/Onyx
    - Golden/Onyx
    - Onyx/Natural
    - Sahara/Chestnut
    - Chestnut/Bronze
    - Salmon

    - Beacon Institute Campus pavers: specify brick red, grays, and white tones.

    Cambridge Pavingstones KingsCourt or RoundTable Collections with ArmorTec or equivalent in the following colors:

    - Onyx
    - Ruby
    - Salmon
    - Onyx/Natural
    - Ruby/Onyx
    - Salmon/Onyx

    - Downtown Campus pavers: specify brick red, grays, and white tones. Traditional brick pavers may also be used.

    Unilock (Brewster, NY) Series 3000 or equivalent

    - Black Granite
    - Coral Gem
    - Crystal Rose
    - Ice Grey
    - Renaissance
    - Starlight

32 14 43 Porous Surfaces

1. Where possible specify permeable surfaces that allow water to relieve into the strata below.

32 16 13 Concrete Curbs and Gutters

1. Concrete curbs shall be formed of minimum 4000 psi concrete. Voids will not be accepted in the back of curbs. Cracked concrete will not be accepted, except as approved in writing by the University.

32 17 00 Paving Specialties

1. Requirements for bollards are in Division 03.

32 17 23 Parking Space Marking

1. Non-handicap parking stalls shall normally be 8.5 foot wide and 18 feet deep with a 22 foot aisle. Stall line markings shall be 4 inches wide single line, white color. If required include directional arrows in the contract.

32 31 00 Fences and Gates

1. Fencing is required around all climbing hazards and grade installed mechanical and electrical equipment (i.e. cooling towers, emergency generators, etc.).

32 32 00 Retaining Walls

1. Finishes and materials must be approved by the University.

32 70 00 Wetlands

1. All projects must fully conform with the requirements of the U.S. Army Corp of Engineers and the State of New York Department of Environmental Conservation as it relates to regulatory wetlands and waters of the U.S. See the Campus Environmental Constraints Maps for additional information. Corps JD letter must be provided by the Contractor unless otherwise specified by the University.

32 80 00 Irrigation

1. All new buildings shall be prepared for irrigation systems whether these systems are part of the project or not. Systems shall be vandal-proof and include programmable boxes and rain meters. Sprinkler heads shall be "pop-up" type that fully retract when not in use. The system must also possess a drain valve(s) so the system can be flushed or drained using air pressure. Preparation shall include a location within an appropriate Mechanical or Electrical equipment Room for a controller, with a designated circuit breaker, and an empty 1 inch conduit with pull rope to a point 5 foot outside the building, 3feet below grade, with shutoff valve inside the building in an accessible location. Regardless of the system being installed, a backflow preventer must be installed as part of irrigation system under the building contract. Additionally, all irrigation systems must be separately metered.
2. New buildings shall also be provided with outside water access. Coordinate locations and quantity of outside water hydrants/hose bibs with the university. Turn-on valves must fit a standard four way universal water key with hose connections sized for a standard garden hose.

32 91 00 Planting Preparation

1. Preparation of Subgrade: Specify that subsoil shall be loosened to a depth of 5 inches and graded to remove all ridges and depressions so that it will be parallel to proposed finished grade. Remove stones over 1 inch in any dimension, sticks, rubbish and other extraneous matter.

32 91 19 13 Topsoil Placement and Grading

1. Specify that all topsoil shall be tested against the following Specifications:

Quantity	Size Fraction	Range of Particle Diameter
Percent by oven dry weight	inches	mm
Less than 2% gravel	Larger than 1	25
Less than 3% gravel	¼ to 1	6-25
Less than 10% gravel	2/25 to ¼	2-6
40% to 65% sand	1/500 to 2/25	.05-2.00
25% to 60% silt	1/12,500 to 1/500	.002-.05
Less than 20% clay	Smaller than 1/12,500	.002

- Amounts of sand, silt, and clay – determined by official hydrometer method or mechanical analysis of the soil. Gravel sized particles should be determined by separation on screens with appropriate size openings.

- Soil should be relatively free of under composed organic material like roots, sticks, leaves and paper and of any other undesirable trash like glass, plastic or metal fragments that would have to be removed before seeding or planting. Topsoil should be 4 inches-6 inches compacted 85%.
- Organic matter content (% over dry weight of soil): Sandy loam 1.25% to 20%, Loam and Silt Loam 2.5% to 20%.
- On soil with less than 10% organic matter, use wet oxidation method of analysis. On soil with more than 10% organic matter, use loss on ignition method of analysis.
- Soil reaction – pH of 4.5 to 7.0
- Soluble salt content: conductivity (ECe, milliohms per centimeter)

  Less than 1.00 mmhos/cm for a 1:1 soil: water ratio,

  Less than 0.50 mmhos/cm for a 1:2 soil: water ratio,

  Less than 0.33 mmhos/cm for a 1:3 soil: water ratio.

32 92 00 Turf and Grasses

1. Lawns and plantings may have an underground irrigation system based on the direction of the University. See Section 32 80 00.
2. Sod shall be used for ground cover for all disturbed areas on the East Campus, in the grass strip of the typical road section, and within five (5) feet of either side of walkways and buildings, sports fields. Seeding is acceptable for Erosion and Sediment Controls but must be replaced with sod. Hydro-seeding is not preferred. Clarkson will indicate the type of lawn treatment that will prevail.
3. Preferred sod shall be turf type tall fescue. Sod should be ½ inch-1 inch thick rolled sod is acceptable upon approval of the Project Manager.
4. All new lawn sodded areas shall have the entire perimeter staked and roped off immediately upon completion. Stakes shall be no less than 30 inches high installed and string banner shall be two strands stake to stake. After turf establishment (2-3 weeks), watering and regular mowing is required by the contractor for 60 days beyond establishment of turf, and a 6 month final inspection of the turf shall be conducted at which time areas requiring additional treatment at the contractor's expense will be identified.
5. Straw Mulching: Salt hay with nonasphaltic liquid tackifier is preferred. For finished grades having slopes in excess of 20% shall be mulched with erosion control fabric run vertically from top to bottom of slope and stapled with wire staples .125 inches in diameter or greater and spaced at 48 inch intervals. In areas of high velocity runoff such as receiving swales and drainage ditches fabric of sufficient strength and density shall be used and installed in direction of flow and stapled at 24 inch intervals.
6. AOSCA (Association of Seed Certification Agencies) certified seed. Sowed at a rate of 4-5 lbs/1,000 square feet.

   - Full Sun Mixture: 50% Kentucky Bluegrass
     10% Perennial Ryegrass
     10% Perennial Ryegrass
     15% Chewing Fescue
     15% Creeping Red Fescue
   - Shade Mixture: 30% Chewing Fescue
     15% Creeping Red Fescue

30% Kentucky Bluegrass

35% Hard Fescue

- Tri-Plex Rye Mixture: 33.3% Perennial Ryegrass

  33.3% Perennial Ryegrass

  33.3% Perennial Ryegrass

- Drought Mixture: 90% Turf-type Tall Fescue

  10% Kentucky Bluegrass

7. Inspections will be made at completion of the following tasks:
   - At completion of the soil loosening phase to insure that the minimum depths have been achieved.
   - At completion of the removals and/or screening phase to insure that specified dimension material has been removed.
   - At completion of the top soiling phase to insure that full depth of cover has been achieved.
   - At completion of the fine grading phase to insure that specified slopes, uniformity and positive drainage have been achieved.
   - At completion of the seeding and mulching phase to insure adequate coverage.
   - At the end of the 60 Day Maintenance Period to insure adequate percentage of growth and coverage as specified has been achieved.
8. It is the responsibility of the Contractor to notify the Project Manager of the completion of each task in writing for approvals prior to proceeding to the next phase. Unsatisfactory conditions much be corrected at Contractor's expense before beginning next phase tasks.

32 93 00 Plants

1. Specify that the Contractor shall guarantee newly installed plants for a period of one year after date of acceptance against defects, including death and unsatisfactory growth. Trees which are not healthy, dying, or the design value of which, in the opinion of the A/E or Clarkson, has been destroyed through root damage, loss of branches, bark damage, etc. shall be replaced by the Contractor at no cost to the University. Exceptions are defects resulting from abuse or damage by others, or unusual phenomena or incidents which are beyond landscape installer's control.
2. Specify that plants which are determined to be defective shall be replaced at the proper season or planting time after the guarantee period is complete and replacement plants will be guaranteed by the Contractor for an additional growing season under an extended guarantee at no addition cost.
3. Specify that, during the guarantee period, the Contractor shall, from time to time, inspect the watering and other maintenance practices carried on by the University and promptly report to the University any practices which he considers unsatisfactory and not in his interests or good horticultural practices. The failure of the Contractor to inspect or report shall be construed as an acceptance by him of the University's maintenance practices and shall not thereafter claim that any defects which may later develop are the result of such practice.

32 93 43 Trees

1. Trees shall be from the University Planting pallet.

32 94 13 Landscape Edging

1. A Mowing Edge shall be installed at all trees and around perimeter of the building. This edge shall be of steel or metal quality and not rubber/plastic.

32 94 33 Planters

1. Install drainage in outdoor plant boxes.

Division 33 – Utilities

1. Clarkson is the sole owner and maintainer of the following utility infrastructure:
    - Storm sewer system
    - Hot Water (HW) distribution system
    - Chilled Water (CW) distribution system
    - Data/Comm (except for the trunk lines feeding the campuses)
    - Site lighting

2. The remainder of the utility infrastructures servicing the various campuses are owned and/or maintained by the following:

Campus	Utility	Owner	Pt. of Departure	Reference
Hill	Domestic Water	Village of Potsdam	Water Meter	Potsdam DPW
	Sanitary Sewer	Village of Potsdam	1st MH (≥8" only)[a]	
	Electric Power	National Grid	Service Point Enclosure[b]	NatGrid
	Natural Gas	Enbridge St. Lawrence Gas	Gas Meter	Endridge
Downtown	Domestic Water	Village of Potsdam	Water Meter	Potsdam DPW
	Sanitary Sewer	Village of Potsdam	1st MH (≥8" only)[a]	
	Electric Power	National Grid	Service Point Enclosure[b]	NatGrid
	Natural Gas	Enbridge St. Lawrence Gas	Gas Meter	Endridge
Beacon Institute	Domestic Water	RESERVED	RESERVED	RESERVED
	Sanitary Sewer	RESERVED	RESERVED	RESERVED
	Electric Power	RESERVED	RESERVED	RESERVED
	Natural Gas	RESERVED	RESERVED	RESERVED

33 00 00 Utilities

1. Underground steel pipe systems shall be cathodically protected using Pikotec or approved equal.
2. Utility Marker
    - All underground utility runs, mechanical, electrical, plumbing, or what have you, shall be protected with buried marker. Markers are to be of a marker ball type; see detail. Marker balls must be compatible with university detection equipment.
    - Balls to be placed 12 inches directly above top of pipe, over entire length of run.
    - Balls to be placed on top of 4 inches deep x 6 inches wide layer of clean white sand.
    - Any existing tape which is encountered, removed or disturbed during excavation shall be replaced in conformance with items no 1-3 above and to the approval of the University, prior to backfilling.

33 10 00 Water Utilities

1. Major water mains shall comply with local utility design requirements.
2. Provide a water meter for each separate facility that is constructed.

33 30 00 Sanitary Sewer Utilities

1. Comply with local utility design requirements.

2. Provide a sanitary meter for any building where the sanitary outflow is less than 20% of the designed water inflow.
3. Minimum cover under roads for Sanitary Sewer systems shall be 42 inches and minimum slope shall be 1 inch in 15 feet (.55% slope).

33 40 00 Storm Drainage Utilities

1. Unless otherwise supplemented here, storm drainage facilities and construction must meet the requirements of NYDOT's "Road and Bridge Specifications" and "Construction Manual". (https://www.dot.ny.gov/doing-business)

33 41 00 Storm Drainage

1. Trench type storm drains are to be avoided.
2. Road grates shall be NYDOT approved All grates shall be bicycle safe grates.
3. The top of lawn grates shall be set minimum ½ inch below finished grade level to facilitate drainage. Lawn grates smaller than 2 feet shall be round.
4. Contractor shall clean interior of piping after installation, see below.
5. Where down spouts are utilized, these should be tied into adjacent storm drainage. All buried down spouts are required to be 6 inches or larger. No corrugated plastic pipes are allowed..

33 42 00 PIPE SEWER TV INSPECTION

GENERAL

1. SCOPE

   A. Work consists of furnishing all materials, labor, supervision, and equipment for the television inspection of new pipe sewers.

   B. Related Work Specified Elsewhere May Include But Is Not Limited To:
      1. Sanitary Sewer Utilities
      2. Storm Drainage Utilities
      3. Storm Drainage

2. QUALITY ASSURANCE

   A. Experience:
      1. Video inspection work shall be performed by a Contractor who is regularly engaged in work of the character required.

   B. Equipment:
      1. All equipment, devices and tools required for the contract shall be owned (or leased) and operated by the Inspection Contractor.

3. SUBMITTALS

   A. Before commencing work, the Contractor shall submit to the University for approval:

1. Specific documentation, information, and references that the Inspection Contractor and the on-site supervisor for the work have had successful experience in similar work under similar conditions.
2. Detailed written descriptions, including pertinent supplemental drawings, literature, tables and other material, of equipment, methods, procedures and scheduling proposed for the work.

B. A video inspection log shall be maintained during the video inspection work. This log shall be on a printed form and shall include the following:
1. Job/work assignment number;
2. Date of inspection;
3. Location and identification of sewer section televised;
4. Size and type of pipe;
5. Length of sewer section televised;
6. Locations of all service connections;
7. Locations of all structural problems encountered such as cracked or broken pipe; offset or open joints; protruding service connections;
8. Sags (including length and estimated depth);
9. Incidence of root intrusion;
10. Areas where further cleaning is required;
11. Recommendation of lining requirement.
12. Locations of service connections as referenced by horizontal distance from identified manhole and circumferential position with respect to pipe axes.

C. A summary report shall be submitted to the University within ten days of the conclusion of the video inspection work including copies of all inspection logs. The report shall be neatly bound in a protective cover.
1. DVD/CDs shall be submitted to the University within ten days of the conclusion of fieldwork.

4. MEASUREMENT

Unit of measure will be the job with no direct measure taken, or per linear foot as provided in the Schedule of Prices and the Contract.

5. PAYMENT

Payment for Pipe Sewer Inspection will be made at Contract price, as specified, which price and payment will include preparation of logs for all sections inspected, television equipment, and a complete DVD of each section, and all labor, materials, tools, equipment, and incidentals needed to perform television inspection as specified.