

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 – DESIGN DIRECTIVES

1.1 SUMMARY

- A. The Dartmouth College Design & Construction Guidelines include general administrative, design requirements, products, and installation of mechanical systems. It is the intent of Dartmouth College that the consultant incorporate the requirements contained herein with the consultant's specifications to produce a document that is a cohesive, coordinated, non-conflicting project specific specification. Deviations from these standards shall be discussed with the appropriate DC-FO&M representative.

1.2 DESIGN CRITERIA / ENVIRONMENTAL PROGRAM

- A. Consultants shall state the design parameters upon which the building is designed. Include the following criteria:
 - 1. Winter dry bulb air temperature, indoor & outdoor. (Exterior design condition shall be -20°F.)
 - 2. Summer dry bulb air temperature, indoor & outdoor, non-air conditioned bldgs.
 - 3. Summer wet bulb air temperature, indoor & outdoor, air conditioned bldgs.
- B. Consultants shall state the applicable major building codes upon which the building has been designed.
- C. Designers shall provide a narrative to be included in the specifications that describes the intent and design parameters of each mechanical system in the project.
- D. All drawings shall be prepared in electronic format compatible with AutoCad. References to alternate bids, changes due to value engineering, or other reasons shall be incorporated into the Construction drawings indicating only the actual work to be installed. Sketches issued during construction shall be made by modifying the original documents. This will allow a solid base from which the contractor can prepare the as-built drawings.
- E. Development of design documents is an evolutionary process. In order to provide appropriate feedback to consultants in a timely manner, Dartmouth College expects to see, as a minimum, the following information at the stated design stage:

Design Document Information Matrix	
Programming	<ul style="list-style-type: none"> • Peak, average peak, & design peak outdoor dry & wet bulb temperatures for both heating & cooling seasons. • Heating & cooling degree hours. • Estimated loads of utilities & proposed connection points. • Applicable zoning, building, fire, sanitary, & energy codes. • Required environmental conditions for each space defined: <ul style="list-style-type: none"> ○ Wet & dry bulb, occupied & unoccupied; ○ Ventilation requirements; ○ Indoor air quality requirements; ○ Special conditions (humidity levels, noise / vibration sensitive areas, redundant life safety or security areas, etc.); ○ User acceptable ranges of above.
Schematic Design	<ul style="list-style-type: none"> • Drawing convention established, floor plans drawn indicating primary mechanical routes and shaft sizes & locations, standard details, legend, mechanical rooms identified, space requirements indicated, preliminary ATC sequence of operations, and emergency power requirements. • Heat loss/gain calculations performed. • Seismic requirements shall be determined & submitted to owner. • Infrastructure support data compiled and evaluated (water pressure & flow, steam and condensate requirements, etc.). • System types shall be proposed, including energy saving schemes. • Fuel & electrical use. • Acoustical requirements. • Initial construction & operating costs. • Energy saving scheme developed with payback calculations.
Design Development	<ul style="list-style-type: none"> • Floor plans furthered developed, some distribution into individual areas shown, mechanical rooms 50% complete, flow schematics 75% complete, some equipment schedules shown, and final ATC sequence of operations. • Specifications 75% complete and in conformance with DC Design & Construction Guidelines. • Energy savings schemes limited to two or three systems with associated payback analysis for review with DC. • Impact on infrastructure fully analyzed addressed.
50% Const. Drawings	<ul style="list-style-type: none"> • Floor plans show more detail into individual areas, mechanical spaces 75% complete, flow schematics substantially complete, all equipment schedules shown and ATC point schedule & sequence of operations 75% complete, some cross sections &/or elevations. • Specifications 90% complete.
90% Const. Drawings	<ul style="list-style-type: none"> • Drawings substantially complete: flow schematics & ATC point schedule 100%, mechanical spaces, equipment schedules, cross sections/elevations, details 99% complete. • Specifications 100% complete.

Dartmouth College will review & comment on the documents at each phase.

- F. CAD drafting standards shall incorporate as a minimum the following:
1. Text is not written over room names or over walls.
 2. Call-outs (leader lines) shall be used wherever possible, shall not be at the same angle as the architecture, and shall not cross each other.
 3. Locate schedules, details, sections, etc. from the right side of the page to the left.
- G. Designer shall include flow schematics for all hydronic systems, steam & condensate systems, and air systems.

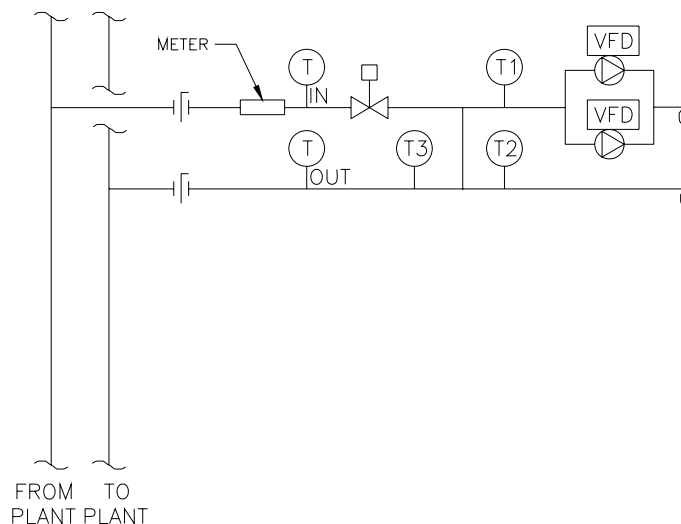
- H. All Steam systems shall be designed to withstand 30 psig. This includes, but not limited to, steam traps, coils, valves, PRV's. Minimum steam pressure for design purposes shall be 15 psig.
- I. Equipment schedules shall include the following:
 - 1. Brake horsepower ratings for all motors.
 - 2. Steam usage of all steam fired devices.
 - 3. Minimum energy efficiency rating.
- J. All designs shall consider energy savings measures. The consultant shall prepare estimated energy consumption data for review by Dartmouth College.
- K. All consultants shall thoroughly review the site conditions and all available prints prior to designing modifications or additions to existing structures.
- L. All electric transformer vaults and major electric rooms shall be ventilated. Intake air for these spaces shall be filtered.
- M. Mechanical Room design must consider the following criteria:
 - 1. Plan for adequate space to service all equipment.
 - 2. Show all coil pulls and filter pulls on the drawings.
 - 3. Provide floor drains near equipment for condensate, backflow preventers, etc.
 - 4. Where headroom does not allow for air handlers to be elevated to allow steam condensate to gravity drain to a condensate pump, provide a steam condensate pump in the floor. Lift cannot be used when the steam device is controlled with a modulating valve. Condensate pipe shall be placed in concrete trenches and covered at floor level with steel grate.
- N. Accessibility:
 - 1. Every effort shall be made by the designer to position and locate equipment and devices so as to facilitate access for inspection, maintenance and repair.
 - 2. Accessible is defined as being visible and able to be reached, tested, rewired, etc. from the ground or from a legal stepladder height without requiring the removal of any building component or MEP equipment or parts. Maintenance personnel shall not be required to climb into a space above a ceiling &/or crawl or lay on ductwork or mechanical equipment to reach the item to be serviced.
 - 3. Apparatus such as air-handlers, pumps, and controls shall not be suspended over stairs, auditorium seating or other uneven planes unless a permanent means for accessing is installed.
 - 4. Equipment shall be installed at such a height that the serviceable parts are accessible from a standard stepladder that can be raised & opened in the space under the ceiling.
 - 5. Refer to DC Standards, 01000 General Requirements for requirements pertaining to VFD's and ATC panels.
- O. Dartmouth College FO&M has reviewed the requirements of NFPA 96 with the Hanover Fire & Building Departments relative to the proper application in Dartmouth College properties. Each application needs to be reviewed with the Town during design to determine the appropriate system. As a basis of the discussion, the following system types have been developed:
 - 1. System One: Installations conforming to the requirements of NFPA 96. Recommended applications are commercial kitchens creating grease laden vapors.
 - 2. System Two: Installations with deep stainless steel hoods with lock seams or welded seams (Vent A Hood model SLH18-142SS) and one integral fan. On both sides the hood shall extend 6" further than the range. Ductwork shall be galvanized steel conforming to the requirements of this Guideline. A potassium carbonate based fire suppression system

shall be installed (refer to DC Standard 15300) and, if the building is so equipped, connected to the fire alarm system (separate zone, if available). The fire suppression system shall deactivate the fuel (electric or propane) to the appliances under the hood. Recommended applications shall be dormitory buildings and residence halls.

3. System Three: Installations using residential style, white hoods with self contained fans (Broan #4000; Nutone #SM6530WW). Hood width shall be the same as the range. Ductwork shall be galvanized steel conforming to the requirements of this Guideline. A potassium carbonate based fire suppression system shall be installed (Guardian III or approved equal) and, if the building is so equipped, connected to the fire alarm system (separate zone, if available). The fire suppression system shall deactivate the fuel (electric or propane) to the appliances under the hood. Recommended applications shall be business uses for occasional use by the building occupants and the reheating of foods by caterers.
- P. Dartmouth College has elected to abide by the requirements of ASHRAE Standard 15, ‘Safety Code for Mechanical Refrigeration’. Where refrigerant sensors are required by the standard, provide the device specified herein. A visible device shall be located on the exterior of each entrance to the mechanical room housing the refrigerant device. A single point shall notify the Central Heating Plant, via the DDC control system, of any alarm or mechanical failure of the refrigerant monitoring system. Dartmouth College is currently writing a Standard Operating Procedure for actions to be taken when the sensor is in alarm. The consultant shall obtain this document to ascertain signage requirements.
 - Q. Consultants to coordinate with architects to insure that the floor of all mechanical spaces are sealed for dust reduction.
 - R. All significant projects will be commissioned as outlined in DC Standards, ‘Commissioning’.
 - S. Wherever possible, all water and waste piping shall not be located in high value rooms (i.e., computer server rooms).
- 1.3 CONNECTIONS TO THE CHILLED WATER PLANT
- A. T_1 , T_2 , and T_3 are connected to the building control system. The building chilled water pumps (tertiary pumps) are controlled by a pressure differential sensor in the building. The design engineer shall select an appropriate location for the dp sensor.
 - B. The chilled water energy meter shall be an ultrasonic meter as specified in DC Standards, “15130 – METERS AND GAGES”. The meter shall calculate chilled water energy use by using water flow, supply and return ΔT . The energy shall be calculated in ton-hours and shall be sent to the building control system.
 - C. The basis of design for chilled water supply temperature is 46°F.
 - D. The building chilled water control valve shall modulate so that the chilled water return temperature to the chilled water plant (T_3) is 58°F or higher.
 - E. The decoupler shall be full pipe size and be at least 10 pipe diameters long. The decoupler shall be equipped with a flanged spool-piece with the following face-to-face dimension:

Pipe	Face to face
3"	9.5"
4"	11.5"
6"	14.0"
8"	19.5"
10"	24.5"
12"	27.5"

- F. Please note that the sketch is schematic in nature and does not show all valves, strainers, gauges, etc that is necessary for a complete design. The design engineer shall clearly show all these devices to provide a complete installation.



1.4 CODE CONFORMANCE

- A. Install all systems of Division 15 sections in conformance with all applicable State of New Hampshire and Town of Hanover codes (Ordinance #15 dated September 1, 2001) as outlined in section 01000, in addition to all the specific codes and standards listed in the various Division 15 sections.
- B. Codes include but are not limited to:
1. State of New Hampshire, "State Fire Code", current edition, including all applicable references.
 2. ANSI/ASME Power Piping Code B31.1 – 1988.
 3. The most recent applicable codes and standards.

1.5 MANUFACTURERS AND EQUALS

- A. The manufacturer's products are scheduled on the drawings and /or within these Standards.
- B. Dartmouth College encourages the use of domestic fabricated products. However, we realize that not all products are made in North America or are shipped from manufacturers from both domestic

and foreign plants. Hence, non domestic products are acceptable except where specifically noted to be domestic. Most notably, steel pipe and fittings must be of North American (USA or Canada) manufacture.

1.6 QUALITY ASSURANCE

- A. Equipment and appurtenances shall be designed in conformity with ANSI, ASME, IEEE, NEMA, OSHA, AGMA and other generally accepted applicable standards.
- B. All machinery and equipment shall be safeguarded in accordance with the safety codes of the ANSI, OSHA, and local industrial codes, including but not limited to, shaft guards on all rotating shafts, cages around exposed fan blades, etc.
- C. All mechanical work shall be performed by mechanics who are qualified to do such work and who are normally engaged in this type of work.

1.7 DOMESTIC HOT WATER SYSTEMS

- A. Dartmouth College is concerned with the potential development of Legionella in domestic hot water systems which the plumbing code does not specifically address. The maximum allowable temperature delivered to the plumbing fixtures varies on the type of fixture and building type. The plumbing designer must consult with FO&M Engineering during the Design Development stage to determine the design criteria of the domestic hot water system.
- B. Domestic hot water recirculation systems shall be designed per ASPE (American Society of Plumbing Engineers) recommended procedures per the following requirements:
 - 1. The temperature difference between the outlet temperature at the supply source (mixing valve discharge, if applicable) and the recirculation return shall be $\leq 5^{\circ}$ for small systems. Larger systems shall be designed for $> 5^{\circ} - 10^{\circ}$.
 - 2. Recirculation lines shall be located to insure hot water shall reach the fixtures in 15 seconds or less.
- C. The designer is to carefully examine the requirements of water tempering valves where there are recirculation pumps. Specifically, minimum flows through the mixing valve and the flow rate required to insure proper mixing.

PART 2 – PRODUCTS

2.1 REFRIGERANT MONITORING SYSTEM

- A. Refrigerant monitoring systems shall be refrigerant specific. Sensors shall be non-calibrating type. The sensor module shall continuously self calibrate. The remote alarm shall be a visual (strobe light) only. Provide a refrigerant test kit for the project. Manufacturer shall be Thermal Gas Systems, model Haloguard or Haloguard II.

2.2 PAINTING

- A. The mechanical contractor shall clean and paint to match original finish, all items scratched or otherwise damaged.
- B. Paint with one coat of rust inhibitive primer and one coat of finish black rust inhibitive paint all steel brackets, supports, stands, hangers, etc., furnished and installed by this contractor.

PART 3 – EXECUTION

3.1 COORDINATION

- A. It is the responsibility of the mechanical contractor to coordinate the work of his trade with all other trades prior to the commencement of construction. It is the responsibility of the contractors to provide, in his original bid, all necessary offsets, fittings, and transformations to provide a complete project. Any conflicts must be brought to the attention of the architect/engineer/owner. Any work requiring removal and reinstallation due to the lack of coordination shall be the responsibility of the contractors with no additional cost to the owner.
- B. Where specified by the design consultant, or where deemed necessary by the contractors or owner, prepare coordination drawings to a scale of 3/8"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components.
 - 1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - b. Equipment connections and support details.
 - c. Clearance to access all electronic equipment such as VAV controllers.
 - d. Fire-rated wall and floor penetrations.
 - e. Sizes and location of required concrete pads and bases.
 - f. Valve stem movement.
 - g. Seismic bracing locations.
 - 2. During coordination meetings discuss amongst the contractors scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 - 3. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- C. Pipe appurtenances requiring service are not allowed in electric rooms.

3.2 RECORD DOCUMENTS

- A. Refer to DC Standard, "GENERAL REQUIREMENTS", section 'CLOSE OUT PROCEDURES', for requirements.

3.3 INSPECTION

- A. Prior to performing work required under Division 15, carefully inspect all existing conditions and the installed work of all other trades and verify that all conditions and all such work is complete to the point where the mechanical work may properly commence.
- B. In the event of discrepancy, immediately notify Architect/Engineer/owner.

3.4 QUALITY ASSURANCE

- A. Ample clearance shall be provided for repairs, inspection and adjustment. Protruding members such as joints, corners and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.
- B. Secure and pay for all necessary fees, permits and approvals, as required for the work of this Section.

3.5 CUTTING AND PATCHING

- A. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
- B. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- D. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers.

3.6 PERFORMANCE

- A. If the project is to be commissioned, the contractor is required to work with the commissioning agent and related sub-contractors as required to fulfill the requirements of section 18000. The costs associated with this requirement shall be included in the contractor's base bid.
- B. Perform all work that is essential in completing the intended installation in the proper manner.
- C. Field verification of all dimensions is required.
- D. Wherever obstructions are encountered in the path or course of the work that are not shown nor anticipated in the Contract Documents, do not proceed with the installation of the work before advising the Architect/engineer/owner and receiving detailed information or drawings or both.

3.7 INSTALLATION OF EQUIPMENT

- A. All equipment shall be installed true, level and in the location shown on the Drawings. Precision gauges and levels shall be used in setting all equipment.
- B. Furnish, install and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances required for the installation of equipment.
- C. All equipment shall be installed in such a manner as to provide access for routine maintenance, including lubrication.
- D. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division, shall be provided and installed.

- E. All foundations, anchor pads, piers, thrust block, inertia blocks and structural steel supports shall be built to template and reinforced as required for loads imposed on them.

3.8 MECHANICAL ROOM SAFETY ISSUES

- A. The FO&M project representative shall determine the normal walking paths within mechanical spaces. Projections of any objects in this walking space that are less than 6'-8" that create a safety hazard shall have rounded edges and be equipped with a protective covering. The protective may be 3/4" thick elastomeric insulation or other similar product approved by FO&M.

3.9 CLEANING

- A. Protect equipment against mortar, dust, weather, etc., during construction and leave all equipment clean. Remove from the premises, all debris and unused material and leave premises in a clean and neat condition.

END OF SECTION 15010