

UNIVERSITY OF NEW HAMPSHIRE
CONSTRUCTION AND RENOVATION STANDARDS

SECTION 15600 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 The University requires for new construction and retrofits:

- A. Energy efficient equipment as determined by these industry standards shall be used, unless exempted on a case-by-case basis by the Facilities Services Energy Office:
 - 1. ASHAE Standard 90.1 - 1999
 - 2. BOCA National Energy Conservation Code - 1996
 - 3. N.H. State Energy Code (most current)
- B. Electric heat for any space shall be considered on a case-by-case basis by the Facilities Service Energy Office.
- C. Air-conditioners and heat exchangers that are water-cooled once-through flow systems **are not acceptable.**
- D. Temperature Control: Through BAS – See Section 17000.

1.02 The University requires that for new spaces created by partitioning of existing rooms/buildings or by additions shall meet the following **minimum** standards.

- A. Ventilation: to provide a healthy working environment, all occupied spaces shall be ventilated to meet current ASHRAE standards. Based on present ASHRAE standards, 15-20 CFM of outdoor air per person shall be provided by means of operable windows, mechanical ventilation systems, or a passive ventilation system consisting of a positive pressure supply and a negative pressure exhaust.
- B. Temperature Control: same requirement as 1.01 D above.

1.03 Back flow prevention shall be provided. All equipment with makeup water connections to the domestic water system (exchangers, cooling towers, heating & chilled water loops, etc.) shall be protected on the domestic side with an approved backflow prevention device in accordance with the National Plumbing Code.

1.04 All University departments purchasing and/or installing refrigeration and/or air-conditioning units shall notify Facilities Services Plant Maintenance of said purchase so that equipment records and inventory can be kept current.

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- 1.05 The purchase or installation of refrigeration and/or air-conditioning systems utilizing chlorofluorocarbons, CFC's, are not acceptable.
- 1.06 All University departments purchasing equipment utilizing the following refrigerants: **R-12, R-22, R-502, R-134a, R-11, R-113 or R-402b** shall submit to Plant Maintenance all specification sheets, maintenance manuals and any other pertinent data pertaining to said equipment.
- 1.07 No new refrigeration/air-conditioning equipment with alternative refrigerants, with the exception of R-134a and R-402b, shall be purchased for use in University buildings unless approved in writing by the proper University owner.
- 1.08 At a minimum, HVAC design shall meet all requirements of the current New Hampshire State Energy Code. Design firms shall provide UNH with economic analysis of premium energy efficiency measures such a variable speed drives, cog belt drives, and premium efficiency motors. Minimum motor efficiencies shall be as follows:

**University of New Hampshire
Minimum Electric Motor Efficiencies**

All motors, including OEM installations, shall meet these minimum efficiency levels
(Revised 2/22/01)

OPEN DRIP (ODP)				TOTALLY ENCLOSED (TEFC)			
HP	Speed (RPM)			HP	Speed (RPM)		
	3600	1800	1200		3600	1800	1200
1	80.0	85.5	82.5	1	78.5	85.5	82.5
1.5	85.5	86.5	86.5	1.5	85.5	86.5	87.5
2	86.5	86.5	87.5	2	86.5	86.5	88.5
3	86.5	89.5	89.5	3	88.5	89.5	89.5
5	89.5	89.5	89.5	5	89.5	89.5	89.5
7.5	89.5	91.0	91.7	7.5	91.0	91.7	91.7
10	90.2	91.7	91.7	10	91.7	91.7	91.7
15	91.0	93.0	92.4	15	91.7	91.4	92.4
20	92.4	93.0	92.4	20	92.4	93.0	92.4
25	93.0	93.6	93.0	25	93.0	93.6	93.0
30	93.0	94.1	93.6	30	93.0	93.6	93.6
40	93.6	94.1	94.1	40	93.6	94.1	94.1
50	93.6	94.5	94.1	50	94.1	94.5	94.1
60	94.1	95.0	95.0	60	94.1	95.0	94.5
75	94.5	95.0	95.0	75	94.5	95.4	95.0
100	94.5	95.4	95.0	100	95.0	95.4	95.4
125	95.0	95.4	95.4	125	95.4	95.4	95.4
150	95.4	96.8	95.4	150	95.4	95.8	95.8
200	95.4	96.8	95.4	200	95.8	96.2	95.8

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PART 2 - PRODUCTS

2.01 Preferred Brands:

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|----|-------------------------|---|
| A. | Valves - Steam Reducing | Spence, pilot operated
Sarco, pilot operated |
| B. | DHW Heaters | Lochinvar
Patterson Kelley
Delaval - exchanger
Aerco - steam converter |
| C. | Heating Specialities | Yarway, Bell & Gossett, Warren
Webster |
| D. | Refrigeration - AC | Carrier, Trane, ACME |
| E. | Air Handling Units | Westinghouse, Carrier, Trane |
| F. | Oil Burners | Carlin, Weil-McLean, Beckett |
| G. | C.I. Boilers | Smith(Westport, MA), Weil-McLean |

2.02 In addition to performance characteristics, specific product standards are designed to control the University's maintenance and operations costs by minimizing spare parts stocks and personnel training requirements.

2.03 All valve actuators shall have sufficient power and response time for the application. All valves shall have sufficient power to close against system pressures. The primary district heating system supply pressure against primary control valve inlet ports can be as high as 85 PSI at 220 degrees F. Full-port Apollo ball valves with spring-return Belimo actuators, or suitable substitutes, may be required for tight close-off on primary district heating system control valves, multiple parallel valves may be required for buildings with high heat loads.

2.04 Gas, water, and electric meters shall be provided with dry contact pulse generators or transducers wired to the BAS. **Meters with pulsing units that generate a voltage impulse are not acceptable.** Pulse rates shall be no faster than 1 pulse per second, and no slower than 1 pulse every minute at full load conditions.

2.05 Meters shall also have standard numerical register for local reading. **Water meters shall read in gallons, and gas meters shall read in cubic feet.**

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- 2.06 Water flow meters shall be installed in each secondary hot water loop in the building. Water flow meters shall accurately record both maximum flow during the winter, and minimum flow during the spring and fall. Compound volumetric meters may be required instead of velocity meters in order to accurately measure both high and low flow conditions. Strainers shall be installed on the inlet side of all meters. Bypass lines with lockable isolation valves shall be installed across all district heating water and condensate meters.

PART 3 - EXECUTION

- 3.01 District heating connections for space heating are indicated on the drawing on the last page in this section. For domestic hot water (DHW) connections, similar piping shall feed a water to water heat exchanger. DHW heat exchanger and storage tank shall be sized to meet the maximum building demand with varying district heating supply water temperatures as indicated on the space heating drawing. Backup DHW heating for summer operation shall be supplied as follows, in order of preference:
- A. Campus central steam, if available in the building.
 - B. Gas or oil fired equipment.
 - C. Electric backup DHW heating is generally not acceptable.
- 3.02 Controls for DHW systems connected to the district heating system shall meet the following general design guidelines:
- A. If UNH district heating supply water temperature is greater than switchover setpoint (125-140 degrees, adjustable), backup heating source shall be off. If district heating supply water temperature falls below switchover setpoint, secondary pump shall stop, and secondary control valve shall shut. Switchover to backup heat source shall be automatic if district heating supply water temperature drops below switchover setpoint.
 - B. Secondary pump shall be off and secondary control valve shall shut if storage tank temperature approaches district heating supply water temperature or storage tank approaches setpoint.
 - C. When testing for temperature of district heating supply water, controls shall utilize a suitable time delay or other means to avoid false readings caused by stagnant water in the district heating supply tap.
- 3.03 Provide access through ceilings, walls, and ductwork to all HVAC and control equipment requiring maintenance service or inspection. Access doors shall be labeled to indicate type of equipment inside. Provide hinged and latched access doors for service of all dampers, coils, sensing elements, and other equipment located inside ductwork or air handlers. Access openings shall be large enough to reach any area of the equipment that may require inspection, cleaning, lubrication, tightening, adjustment, replacement, or other maintenance service.

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- 3.04 All exposed pneumatic tubing shall be hard-drawn copper tubing, FR rated plastic tubing in raceway, or FR rated plastic tubing in a jacketed cable assembly. At point of connection to actuators, less than 3 feet of exposed plastic tubing is acceptable. All plastic tubing splices that are part of exposed tubing runs shall be in junction boxes.
- 3.05 Pneumatic air dryers shall be of the non-CFC refrigerant type. HVAC control air compressors shall be of the duplex type with automatic alternating/lead-lag controls. Air compressor tank and air dryer drains shall be piped to the nearest floor drain. Drain line piping shall be minimum 3/8" OD copper with a metal protective cover plate where piping runs along the floor.
- 3.06 Pneumatic control systems shall have dual filtering at the compressor. The initial particulate filter shall be followed by an aerosol filter with minimum 99% aerosol removal rating. Both filters shall have automatic drains.
- 3.07 All pneumatic actuators shall be controlled by a 4-20 milliamp signal to an I/P transducer. All transducers, except for VAV box controllers, shall be mounted in a hinged, locked interface panel. Transducer output shall fail to 0 PSI on loss of power or control signal. Transducers shall have adequate air capacity and response time for the application. **Pneumatic relays or pilot-positioning devices are not an acceptable substitute for a properly sized transducer.** If a pneumatic actuator is not located within sight of its associated transducer, a branch line pressure gauge shall be installed at the actuator air port.
- 3.08 Pneumatic interface panels containing I/P transducers shall have **one** properly sized minimum 0.025 micron coalescing type oil/water filter where the main air line enters each interface panel. Individual in-line filters on each transducer are not acceptable. Interface panel filters shall have automatic drains, and the automatic drain shall **not** be of the constant bleed type. The filter drain shall be piped outside the interface panel to an appropriate location. All pneumatic interface panels shall include a main air gauge, and individual pressure gauges on all transducer branch lines.
- 3.09 Electric modulating actuators shall directly accept a variable voltage or 4-20 milliamp control signal. Pulse-width modulation or other methods of modulating control are not acceptable. Electric actuators shall be as manufactured by Belimo unless otherwise approved in writing by the University.
- 3.10 **Actuators, including VAV inlet vane damper actuators, shall not be mounted inside ductwork or air handling units.**
- 3.11 All output transducers and control relays shall be mounted in a metallic field interface panel with a hinged, locked door. All devices in the interface panel shall be clearly labeled as to their function. Labels shall be fully descriptive, not software code names.

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- 3.12 Outside air temperature and humidity sensing elements shall be located on the building exterior, north exposure, away from windows, doors, exhaust openings, roof surfaces, and other areas that may affect accuracy. Sensors shall be located at least 15 feet above grade, and shall have physical protection for the sensing element.
- 3.13 All contractors installing, servicing or repairing heating, air-conditioning and/or refrigeration equipment must certify to the University owner that their company and service/installation personnel are in compliance with all requirements of Section 608 of the Clean Air Act of 1990, and any and all subsequent amendments.
- 3.14 The University, specifically Facilities Services Plant Maintenance, reserves the option of recovering refrigerants from all equipment being removed by outside contractors due to replacements, repairs and/or renovations.
- 3.15 All obsolete HVAC & refrigeration equipment shall be removed and discarded properly, not abandoned in place.

END OF SECTION