

DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS

DIVISION 23 • HEATING VENTILATION AND AIR CONDITIONING

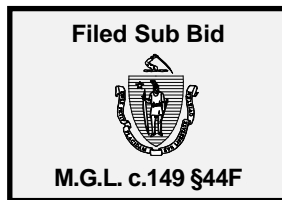
23 00 00 • HEATING VENTILATION & AIR CONDITIONING

SECTION INCLUDES

Heating System
Air Supply System
Fuel Tanks
Ventilation

RELATED SECTIONS

02 65 50 Underground Storage Tank Removal
11 31 00 Residential Appliances
22 00 00 Plumbing
26 00 00 Electrical



*Heating, Ventilating, and Air Conditioning is a stipulated filed sub-bid category under M.G.L. Chapter 149, §44F. If the cumulative estimated value of the work in this section **exceeds \$20,000** and the projects total cost is over \$100,000, it triggers the filed sub-bid requirement.*

*In addition, if any subcategories of this trade, such as pipe Insulation, sheet metal, duct insulation, temperature controls, etc. are estimated to cost **over \$10,000** the filed sub-bidders for this trade shall be explicitly instructed to list sub-subs on their Form for Sub-bid.*

FUEL CHOICE

RESEARCH AND INVESTIGATION

The first choice of fuel is natural gas with No. 2 fuel oil as second choice if gas is not available. Natural gas is generally a cleaner burning fuel and thus will theoretically be less maintenance intensive. Additionally, by using natural gas, fuel storage and its associated regulatory and environmental problems do not become issues.

SYSTEM DESIGN CONSIDERATIONS



High efficiency equipment (e.g. condensing boilers) is preferred and designs should follow these criteria:

- Choose a boiler manufacturer with at least 5 years of operating experience and a well developed support organization in Massachusetts
- Provide connections for the installation of an indirect water heater.
- In multiple boiler installations, the indirect fired water heater should be piped independent of the heating loop.
- Confirm that the installed radiation is adequate for the proposed system temperature.
- The piping system should be cleaned to prevent debris from being dislodged during installation potentially causing heat exchanger failure.
- Provide low temperature operation for new construction.
- Provide outdoor reset for high efficiency equipment.

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- Provide domestic hot water priority, where applicable.
- Clearly state the sequence of operation in the contract documents as required by the energy code.
- Manufacturer's start up and training is required on all installations.

Stress to the LHA that condensing technology is more sophisticated and that the manufacturer's maintenance requirements should be followed.

Make sure the existing electrical power supply is adequate for the equipment you are considering.

AIR VS. HYDRONIC

Air and hydronic systems, including radiant floor each have their advantages and disadvantages. Except in replacement situations, the type of system should be determined primarily by project design considerations such as expected tenancy and the ability of the LHA to maintain the system.

In replacement situations, the type of system should be determined by the existing distribution system. The exception is steam systems, which should be reconfigured to hydronic or air.

Provide combustion air/ventilation to the mechanical room as required by the manufacturer's installation requirements and the applicable codes.

In New Construction, the type of Development will dictate the distribution system:

- Family Air or Hydronic
- Elderly Air or Hydronic
- Special Needs, Congregate Air with cooling

LHA CAPACITY

Routine LHA maintenance and service requirements of the installed equipment need to be reviewed. Equipment that requires extraordinary maintenance procedures or require the services of specially trained service technicians (technicians that require significant additional training for a specific piece of equipment) should be avoided.

The LHA should be consulted regarding the capabilities of their maintenance staff as well as the availability and capability of local service companies. The specified equipment should be able to be serviced by at least three vendors located within 30 miles of the installation.

HYDRONIC SYSTEMS

DESIGN

Size, location and construction of the mechanical room are critical. Where central boilers are utilized, mechanical rooms located directly adjacent to tenant spaces should be avoided unless given significant consideration to noise and vibration control.

Ensure adequate service space is provided around equipment (not necessarily limited to the minimum manufacturer's requirements).

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All boiler room components and zone valves are to be installed with isolation valves to facilitate replacement.

Boilers and equipment should be located off the floor on concrete blocks or poured in place concrete pads a minimum of 4" thick.

Through the roof, flues are preferred.

Pumps should be selected for low noise.

Air separation devices are mandatory.

Membrane expansion tanks are mandatory.

If the existing pumps are to be reused, have the pumps tested to insure the required flow is being achieved.

In multiple boiler installations, two or more boilers should be piped to service the indirect water heater independent of the heating loop.

A primary, (building loop)/secondary, (boiler loop) piping/pumping configuration is required for condensing boiler installations.

Calculate heating loads: use the most current standards for residential construction e.g. ASHREA, ACCOA manual J etc., using the following assumptions:

- Do not assume the existing boiler is sized correctly. Replacement boilers should be sized to the larger of the current design load or the connected load.
- Confirm that the installed radiation is adequate.
- Heating plants should be sized at no more than 125% of the design load (as required by the energy code).
- Where two or more boilers are installed, with one as primary and one as backup, each boiler shall be sized for 2/3 capacity of the design or connected load, whichever is larger.

Where piping passes through walls or floors, holes should be large enough that the piping does not touch the structure directly. If necessary, provide appropriate sleeves at penetrations to prevent pipe from rubbing against the structure.

Fire stop and water seal these penetrations as applicable.

Locate zone valves in accessible locations, e.g. within the unit under the baseboard radiator cover, in the boiler room, not in crawl spaces.

Heating zones should be piped in series loops for ease of balancing. Branch loops should be piped in a reverse return configuration. Monoflow fittings should be used if no other alternative exists.

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Two story apartments should be separated into two heating zones where practical. Self-contained control valves should be avoided.

Evaluate the reuse of existing steam radiators or convectors in steam-to-hydronic conversions.

Lay out residential baseboard radiators for economy, ease of construction, and efficiency of operation.

- Baseboard radiation should be located under windows or at exterior walls.
- Do not locate baseboard heaters near toilets especially in family units. They tend to rust. Use durable products that minimize this tendency.
- Piping should not be installed in unheated spaces that are subject to freezing temperatures. If unavoidable, provide insulation above that required by code and provide heat to keep above freezing.
- Piping should always be concealed in finished spaces. This may be accomplished by concealing the piping in walls or floors, or by providing baseboard enclosures. If piping is run in walls or floors, it should be located such that accidental puncturing by nails, screws, etc. can be avoided.
- Piping runs should be as short as possible.

MATERIALS

Equipment manufacturers should be able to provide documentation demonstrating that their products have proven reliable for a significant period in similar installations.

Equipment manufacturers must also be willing to inspect the finished installation and certify in writing that the installation is in accordance with their requirements.

Solder containing lead is not allowed.

PEX piping is suitable for underground piping applications and should be considered to facilitate retrofitting existing systems if piping needs to be replaced. If PEX tubing is specified, require the contractor provide the LHA with the tools and training to be able to repair the tubing.

PEX tubing is permissible for distribution piping in concealed areas. For exposed basement ceiling distribution piping, copper tubing is preferred.

For ease of maintenance and repair, there should be no PEX tubing connections that are inaccessible or concealed.

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If using copper piping for interior distribution use Type L. ProPress type fittings may be used in accessible locations only.

Ball valves should be used for shut-offs.

Outdoor reset and hot water priority are two preferred control options, where applicable.

Thermostats for elderly units should be mercury free, non-programmable, with ½" numbers and have operating limit features.

Baseboard radiation for family developments should be heavy gauge materials with a top that is narrow, be sloped and have no damper.

Baseboard radiation for elderly developments should be rust-resistant, galvanized steel

Chemical feeds should be considered for systems larger than 400,000 BTUH

Low water cut offs and high temperature alarms are required for all boiler systems

AIR SUPPLY SYSTEMS

DESIGN

Reference SMACNA standards for duct construction.
<http://www.smacna.org>

Place the mechanical equipment in a central location to simplify the duct layout and reduce duct size. The equipment should be easily accessible for service.

Provide slightly more fresh air than what is being mechanically exhausted.



All air systems should be balanced.

Thermally insulate ducts and locate them below the attic, if possible, in order to maximize energy conservation and eliminate ceiling penetrations.

Duct joints should be sealed with mastic. Do not use duct tape.

For non-sleeping spaces, provide a common return in the hall or ideally in the entry.

Provide bedrooms with their own return and supply; venting through a closet door helps to ventilate that space.

Undercutting or louvering of bedroom doors compromises acoustic privacy.

Avoid floor registers.

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For DMH units which will be occupied by cigarette smokers, consider providing at the return air handler a rack of filters including an electrostatic air cleaner.

If you are scoping a forced hot air replacement project, make sure the existing ductwork is properly sized and is of sound construction and repair. Also, investigate how long it has been since the ducts have been cleaned. If more than five years will have elapsed between the when the ducts were cleaned and when the project is underway, please include duct cleaning as part of your project.

COOLING

Cooling load calculations (applicable to special needs housing only) should reflect residential occupancy, not commercial standards, and account for shading of windows.

Locate air conditioning condensers in shade to maximize operating efficiency. Minimize pipe runs. Ensure that the equipment is accessible for maintenance and repair by providing service access on at least three sides. The condenser should be located away from bedroom windows so that residents are not disturbed by the noise.



Whenever feasible use the efficient ductless air conditioners for cooling Community Buildings, office space and public areas.

EQUIPMENT VENTING

DESIGN

Condensing Equipment Venting should preferably terminate through the roof where practical.

Each piece of equipment should be vented separately.

The lengths of vents on high efficiency equipment must be per the manufacturer's recommendations.

Where equipment is sidewall horizontally vented, attempt to locate the vent termination not less than seven (7) feet above finished grade. Where this cannot be accomplished, comply with NFPA-54 Chapter 10 requirements.

When removing a combustion appliance from a chimney confirm the chimney is not too big for the remaining combustion appliance.

The reuse of chimneys, particularly exterior masonry chimneys, must be in accordance with code. If you are planning to use an existing chimney, make sure, the chimney is the proper size for the equipment being considered and that the chimney is of sound construction and repair.

When converting from oil to gas check to see if the chimney needs to be cleaned.

Confirm that the existing flue does not need to be relined.

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Do not use any material containing asbestos.

Combustion air requirements must be provided in accordance with code.

BUILDING VENTILATION

DESIGN

ANSI/ASHRAE STANDARD 62.2-2400: Is the recommended guide for residential ventilation:

Mechanical bathroom ventilation must be provided, particularly in new or modernized building envelope construction even if the bathroom has a window.

Utilize fans that will operate on some type of timing device. Systems that are controlled solely from a light switch or wall switch do not operate for sufficient lengths of time to adequately remove the moisture generated from showering (particularly in family housing). Some switches will allow the fan to operate for a fixed period of time (field adjustable) after the lights have been turned off.

In exceptionally humid situations, it may be necessary to install a humidistat.

Kitchen fans should be vented to the exterior, where possible.

MATERIAL

Fans should be as quiet as possible (<2.0 sones) to resist attempts at tampering by the residents.



Fans should be rated for the intended uses i.e. UL rated for bath and shower area.

Use Energy Star certified products if possible.

Ductwork should be rigid and corrosion resistant. Flexible ductwork is not acceptable.

Small capacity in-line fans installed in attic spaces that are not accessible by the residents but are accessible to the LHA staff have been used effectively.

Ductwork in unheated space should be insulated.

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ROOF TOP VENTILATION UNITS (REPLACEMENT AND NEW)

Electric systems should be converted to natural gas. Gas piping sizing for roof top units should consider other potential conversions i.e. if they have electric water heaters, clothes dryers, etc.

Ventilation rates should be based on current code requirements.

Exhaust fan operation for multiple unit mid and high-rise buildings in conjunction with the operation of make up air ventilation should provide a positive pressure within the building.

FUEL TANKS

Wherever possible, fuel oil tanks should be located within the buildings.

When the work requires the removal of existing tanks this work is best done by separate contract.

When converting to gas, remove all fill piping and all accessory piping. Fill in wall penetrations and patch exterior walls.