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ASHRAE 90.1 Combined DHW/Space heating requirements

Additional submitted attachment is included below.

4.2

- g. If a heat pump equipped with auxiliary internal electric resistance heaters is installed, controls shall be provided that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Two means of meeting this requirement are (1) a digital or electronic thermostat designed for heat pump use that energizes auxiliary heat only when the heat pump has insufficient capacity to maintain setpoint or to warm up the space at a sufficient rate or (2) a multistage space thermostat and an outdoor air thermostat wired to energize auxiliary heat only on the last stage of the space thermostat and when outside air temperature is less than 40°F. Heat pumps whose minimum efficiency is regulated by NAECA and whose HSPF rating both meets the requirements shown in Table 6.8.1B and includes all usage of internal electric resistance heating are exempted from the control requirements of this part (Section 6.3.2[g]).
- h. The *system* controls shall not permit reheat or any other form of simultaneous heating and cooling for humidity control.
- i. *Systems* serving spaces other than hotel/motel guest rooms, and other than those requiring continuous operation, which have both a cooling or heating capacity greater than 15,000 Btu/h and a supply fan motor power greater than 0.75 hp, shall be provided with a time clock that (1) can start and stop the system under different schedules for seven different day-types per week, (2) is capable of retaining programming and time setting during a loss of power for a period of at least ten hours, (3) includes an accessible manual override that allows temporary operation of the system for up to two hours, (4) is capable of temperature setback down to 55°F during off hours, and (5) is capable of temperature setup to 90°F during off hours.
- j. Except for piping within *manufacturers'* units, HVAC piping shall be insulated in accordance with Table 6.8.3. Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation.
- k. Ductwork and plenums shall be insulated in accordance with Tables 6.8.2A and 6.8.2B and shall be sealed in accordance with Table 6.4.4.2A.
- l. Construction documents shall require a ducted *system* to be air balanced in accordance with industry-accepted procedures.
- m. Where separate heating and cooling equipment serves the same temperature zone, thermostats shall be interlocked to prevent simultaneous heating and cooling.
- n. Exhausts with a design capacity of over 300 cfm on *systems* that do not operate continuously shall be equipped with gravity or motorized dampers that will automatically shut when the *systems* are not in use.
- o. *Systems* with a design supply air capacity greater than 10,000 cfm shall have *optimum start controls*.

6.4 Mandatory Provisions

6.4.1 Equipment Efficiencies, Verification, and Labeling Requirements

6.4.1.1 Minimum Equipment Efficiencies—Listed Equipment—Standard Rating and Operating Conditions.

Equipment shown in Tables 6.8.1A through 6.8.1G shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure.

Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements, unless otherwise exempted by footnotes in the table. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum *efficiency* requirements for operation at minimum capacity or other than standard rating conditions. Equipment used to provide water heating functions as part of a combination system shall satisfy all stated requirements for the appropriate space heating or cooling category.

Tables are as follows:

- a. Table 6.8.1A—Air Conditioners and Condensing Units
- b. Table 6.8.1B—Heat Pumps
- c. Table 6.8.1C—Water-Chilling Packages (see Section 6.4.1.2 for water-cooled centrifugal water-chilling packages that are designed to operate at nonstandard conditions)
- d. Table 6.8.1D—Packaged Terminal and Room Air Conditioners and Heat Pumps
- e. Table 6.8.1E—Furnaces, Duct Furnaces, and Unit Heaters
- f. Table 6.8.1F—Boilers
- g. Table 6.8.1G—Heat Rejection Equipment

All furnaces with input ratings of $\geq 225,000$ Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75% of the input rating.

6.4.1.2 Minimum Equipment Efficiencies—Listed Equipment—Nonstandard Conditions. Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI Standard 550/590 test conditions (and, thus, cannot be tested to meet the requirements of Table 6.8.1C) of 44°F leaving chilled-water temperature and 85°F entering condenser-water temperature with 3 gpm/ton condenser-water flow shall have a minimum full-load COP and a minimum *NPLV* rating as shown in the tables referenced below.

- a. Centrifugal chillers <150 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 6.8.1H.
- b. Centrifugal chillers ≥ 150 tons and <300 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 6.8.1I.
- c. Centrifugal chillers ≥ 300 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 6.8.1J.

The table values are only applicable over the following full-load design ranges:

- Leaving Chiller-Water Temperature: 40°F to 48°F
- Entering Condenser-Water Temperature: 75°F to 85°F
- Condenser-Water Temperature Rise: 5°F to 15°F

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7.4.5 Pools

7.4.5.1 Pool Heaters. Pool heaters shall be equipped with a readily accessible ON/OFF switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

7.4.5.2 Pool Covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60% of the energy for heating from *site-recovered energy* or *solar energy source*.

7.4.5.3 Time Switches. Time switches shall be installed on swimming pool heaters and pumps.

Exceptions:

- Where public health standards require 24-hour pump operation.
- Where pumps are required to operate solar and waste heat recovery pool heating systems.

7.4.6 Heat Traps. Vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a nonrecirculating system shall have heat traps on both the inlet and outlet piping as close as practical to the storage tank. A heat trap is a means to counteract the natural convection of heated water in a vertical pipe run. The means is either a device specifically designed for the purpose or an arrangement of tubing that forms a loop of 360 degrees or piping that from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downward before connection to the vertical piping of the supply water or hot-water distribution system, as applicable.

7.5 Prescriptive Path

7.5.1 Space Heating and Water Heating. The use of a gas-fired or oil-fired space-heating boiler system otherwise

complying with Section 6 to provide the total space heating and water heating for a building is allowed when one of the following conditions is met:

- The single space-heating boiler, or the component of a modular or multiple boiler system that is heating the service water, has a standby loss in Btu/h not exceeding

$$(13.3 \times pmd + 400) / n,$$

where *pmd* is the probable maximum demand in gal/h, determined in accordance with the procedures described in generally accepted engineering standards and handbooks, and *n* is the fraction of the year when the outdoor daily mean temperature is greater than 64.9°F.

The standby loss is to be determined for a test period of 24 hours duration while maintaining a boiler water temperature of at least 90°F above ambient, with an ambient temperature between 60°F and 90°F. For a boiler with a modulating burner, this test shall be conducted at the lowest input.

- It is demonstrated to the satisfaction of the *authority having jurisdiction* that the use of a single heat source will consume less energy than separate units.
- The energy input of the combined boiler and water heater system is less than 150,000 Btu/h.

7.5.2 Service Water Heating Equipment. Service water heating *equipment* used to provide the additional function of space heating as part of a combination (integrated) *system* shall satisfy all stated requirements for the service water heating *equipment*.

7.6 Alternative Compliance Path (Not Used)

7.7 Submittals

7.7.1 General. The *authority having jurisdiction* may require submittal of compliance documentation and supplemental information, in accord with Section 4.2.2 of this standard.

- **Equipment not listed** in the tables has no minimum performance requirements. These products may be used regardless of their efficiency. Examples include pumps and electric resistance heaters.
- **Multiple efficiency requirements.** Some equipment has more than one efficiency requirement. For example, a typical air-conditioning unit with gas furnace will have: a full-load efficiency (EER) from Table 6.8.1A; an integrated part-load efficiency (IEER) from Table 6.8.1A; and a furnace efficiency (Et) from Table 6.8.1D. To comply, equipment must satisfy all stated requirements.
- **Combined space and water heating equipment.** Equipment that provides both space and water heating must comply with the efficiency requirements of the primary function. For example, a space heating boiler that also provides service hot water must comply with the boiler efficiency requirements in Table 6.8. A water heater that also provides space heating must comply with the efficiency requirements in Table 7.8.
- **Components from multiple manufacturers.** Where components from different manufacturers are used to field-build a product listed in the tables, the system designer must specify the performance of each component so that their combined efficiency meets the minimum equipment efficiency requirements in the tables. The most common example of this is a split system heat pump or air conditioner built using an indoor coil and air-handler from one manufacturer and an outdoor condensing unit or heat pump unit from another manufacturer. This is permitted, but the designer (using data from the manufacturers) must ensure that the combined performance meets the Standard's requirements.
- **Relevant dates.** Some of the tables (see, for example, Table 6.8.1B for air-cooled equipment <65,000 Btu/h (19 kW)) have multiple requirements that change on or after a specific date. Although it is not explicitly listed in the Standard, the SSPC 90.1 has interpreted this to be the date of manufacture. The equipment efficiencies established in federal code (for example, those for NAECA and EPACK) all reference the date of manufacture, not the date of sale or installation. See for instance U.S. Code, Title 42, Sec. 6295.

Comparing Equipment Efficiencies

The equipment efficiencies listed in Tables 6.8.1A through K are for standard rating conditions. Actual efficiency will vary depending on how the equipment is applied and how it is controlled.

Also, the equipment efficiency data in the tables apply only to the equipment itself and not to any other equipment that may be required to complete the system. When determining which type of system to select, it is usually not possible to compare the efficiency of different equipment types simply by looking at the values in the table. For instance:

- **Air- vs. water-cooled equipment.** Any comparison of air- and water-cooled equipment needs to include the seasonal variation in dry- and wet-bulb temperatures coincident with the variations in the loads. Also, the efficiency ratings for water-cooled equipment cannot be directly compared to those for air-cooled equipment. Water-cooled equipment ratings do not include the energy used by condenser water pumps and cooling tower fans while air-cooled package ratings include condenser fan energy. The ratings don't include the energy used by auxiliary systems like crankcase heaters or ventilation/cooling of equipment rooms where open drive machines are used.
- **Direct expansion equipment.** The ratings of DX equipment don't account for the operational changes in efficiency from supply air temperature reset, variations in condenser operating temperatures and systems like crankcase heaters and hot-gas bypass.