1416.3.4.2 Record Documents. Construction documents shall be updated to convey a record of the alterations to the original design. Such updates shall include updated mechanical, electrical and control drawings red-lined, or redrawn if specified, that show all changes to size, type and location of components, equipment and assemblies.

1416.3.4.3 Systems Operating Training. Training of the maintenance staff for each equipment type and or system shall include as a minimum:

1. Review of systems documentation.
2. Hands-on demonstration of all normal maintenance procedures, normal operating modes, and all emergency shutdown and start-up procedures.
3. Training completion report.

1416.3.5 Commissioning Report. The commissioning report shall be completed and provided to the owner. The commissioning report shall include:

1. Completed Functional Test forms including measurable criteria for test acceptance.
2. Issues log of corrected and uncorrected deficiencies with the anticipated date of correction.
3. Deferred tests, which cannot be performed at the time of report preparation, with anticipated date of completion.
4. Record of progress and completion of operator training.
5. Completed Commissioning Compliance form.

1416.4 Commissioning Compliance Form. A commissioning compliance checklist shall be submitted to the building official upon substantial completion of the work included in each permit((building)). The checklist shall be completed and signed by the building owner or owner's representative. The building official may require that the Commissioning Compliance form components be submitted to verify compliance with Sections 1416 and 1513.8 requirements. Completion of the Commissioning Compliance Checklist (Figure 14B) is deemed to satisfy this requirement.

FIGURE 14B

COMMISSIONING COMPLIANCE CHECKLIST

Project Information	**Project Name:** **Project Address:** **Commissioning Authority:**
Commissioning Plan (Section 1416.3.1)	❑ **Commissioning Plan was used during construction and included items below** • A written schedule including Systems Testing and Balancing, Functional Testing, and Supporting Documentation. • Roles and Responsibilities of the commissioning team • Functional Test procedures and forms.
Systems Balancing (Section 1416.3.2)	❑ **Systems Balancing has been completed** • Air and Hydronic systems are proportionately balanced in a manner to first minimize throttling losses. • Test ports are provided on each pump for measuring pressure across the pump
Functional Testing (Section 1416.3.3)	❑ **HVAC Systems Functional Testing has been completed (Section 1416.3.3)** HVAC systems have been tested to ensure that equipment, components, and subsystems are installed, calibrated, adjusted and operate in accordance with approved plans and specifications. ❑ **HVAC Controls Functional Testing has been completed (Section 1416.3.3)** HVAC controls have been tested to ensure that control devices are calibrated, adjusted and operate properly. Sequences of operation have been functionally tested to ensure they operate in accordance with approved plans and specifications. ❑ **Lighting Controls Functional Testing has been completed (Section 1513.((7))8)** Lighting controls have been tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications
Supporting Documents (Section 1416.3.4)	❑ **Systems documentation, record documents and training have been completed or are scheduled.** • System documentation has been provided to the owner or scheduled date: • Record documents have been submitted to owner or scheduled date: • Training has been completed or scheduled date:__________
Commissioning Report (Section 1416.3.5)	❑ **Commissioning Report submitted to Owner and includes items below.** • Completed Functional Tests documentation • Deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction. • Deferred tests, which cannot be performed at the time of report preparation due to climatic conditions or other circumstances beyond control of Commissioning Authority.
Certification	❑ I hereby certify that all requirements for commissioning have been completed in accordance with the ((Washington State))Seattle Energy Code, including all items above. __________ Building Owner or Owner's Representative Date

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1431.2 System Sizing Limits: Heating and cooling design loads for the purpose of sizing systems shall be determined in accordance with one of the procedures described in Chapter 29 of Standard RS-1 listed in Chapter 7 or an equivalent computation procedure. For interior temperatures, 70°F shall be used for heating and 75°F for cooling, except where different values are specified in the Washington Administrative Code (WAC). For exterior temperatures, 24°F shall be used for heating and 82°F dry bulb and 66°F for wet bulb for cooling.

Building mechanical systems for all buildings which provide space heating and/or space cooling shall be sized no greater than 150 percent of the design load as calculated above, except that cooling towers shall comply with the sizing requirements in Section 1411.1. No additional safety factor is allowed.

For buildings with a total equipment cooling capacity of 300 tons and above, the equipment shall comply with one of the following:

1. No one unit shall have a cooling capacity of more than 2/3 of the total installed cooling equipment capacity;
2. The equipment shall have a variable speed drive; or
3. The equipment shall have multiple compressors.

EXCEPTION: The following limited exemptions from the sizing limit shall be allowed; however, in all cases heating and/or cooling design load calculations shall be submitted.

1. For a single piece of equipment which has both heating and cooling capability, only one function, either the heating or the cooling, need meet the requirements of this section. Capacity for the other function shall be, within available equipment options, the smallest size necessary to meet the load.
2. Stand-by equipment may be installed if controls and devices are provided which allow redundant equipment to operate automatically only when the primary equipment is not operating.
3. Multiple units of the same equipment type, such as multiple chillers and boilers, with combined capacities exceeding the design load, or a single unit that is capable of modulating to a part-load capacity of 50 percent of the load or less may be specified to operate concurrently only if controls are provided that sequence or otherwise optimally control the operation of each unit based on load.
4. Installed space heating equipment output that does not exceed 10 Btu/h per square foot of gross conditioned floor area and installed space cooling equipment output that does not exceed 15 Btu/h per square foot of gross conditioned floor area. No additional safety factor is allowed.

1431.3 Hydronic System Design: All chilled water and condenser water piping shall be designed such that the design flow rate in each pipe segment shall not exceed the values listed in Table 14-3 for the appropriate total annual hours of operation. Pipe size selections for systems that operate under variable flow conditions (e.g. modulating 2-way control valves at coils) and that contain variable speed pump motors are allowed to be made from the "Variable Flow/Variable Speed" columns. All others shall be made from the "Other" columns. (Note: The flow rates listed here do not consider noise or erosion. Lower flow rates are often recommended for noise sensitive locations.)

EXCEPTION: Design flow rates exceeding the values in Table 14-3 are allowed in specific sections of pipe if the pipe in question is not in the critical circuit at design conditions and is not predicted to be in the critical circuit during more than 30% of operating hours.

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1432.2 Systems Temperature Reset Controls

1432.2.1 Air Systems for Multiple Zones: Systems supplying heated or cooled air to multiple zones shall include controls which automatically reset supply air temperatures by representative building loads. Temperature shall be reset by at least 25 percent of the design supply-air-to-room-air temperature difference. Interior zones without an exterior wall load impact and high occupancy areas (per Section 1413.3) shall have maximum airflow sized to meet typical cooling loads with the higher reset air temperature.

EXCEPTIONS:

1. Where specified humidity levels are required to satisfy process needs, such as computer rooms or museums.
2. Systems that prevent reheating, recooling, or mixing of heated and cooled air supply.
3. 75 percent of the energy for reheating is from site-recovered or site solar energy sources.
4. Zones with peak supply air quantities of 300 cfm or less.
5. Dedicated outdoor air systems less than 5,000 cfm with separate thermal controls.

1432.2.2 Hydronic Systems: Systems with a design capacity of 300,000 Btu/h or greater supplying heated or mechanically refrigerated water shall include controls which automatically reset supply water temperatures by representative building loads or by outside air temperature. Temperature shall be reset by at least 25 percent of the design supply-to-return water temperature differences.

EXCEPTIONS:

1. Steam boilers.
2. Systems that provide heating with 100°F or lower supply temperature (e.g., water source heat pump loops).

To limit the heat loss from the heat rejection device (cooling tower), for hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection (e.g., cooling tower):

a. If a closed-circuit tower (fluid cooler) is used, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower (for freeze protection), or low leakage positive closure dampers shall be provided.

b. If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower.

c. If an open-circuit tower is used in conjunction with a separate heat exchanger to isolate the tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

For hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection (e.g., cooling tower) and having a total pump system power 5 hp and greater ((~~exceeding~~ 10 hp)), each hydronic heat pump shall have:

a. A two-position two-way (but not three-way) valve, or

b. A variable head pressure two-way (water regulating) control valve or pump.

For the purposes of this section, pump system power is the sum of the nominal power demand (i.e., nameplate horsepower at nominal motor efficiency) of motors of all pumps that are required to operate at design conditions to supply fluid from the heating or cooling source to all heat transfer devices (e.g., coils, heat exchanger) and return it to the source. This converts the system into a variable flow system and, as such, the primary circulation pumps shall comply with the variable flow requirements in Section 1438.

***

1433 Economizers. Air economizers meeting the requirements of Section 1413 shall be provided on all ((~~new~~)) systems including those serving computer server rooms, electronic equipment, radio equipment, telephone switchgear, medical and laboratory equipment, and also on redundant equipment.

EXCEPTIONS:

1. a. Qualifying small equipment: This exception shall not be used for unitary cooling equipment installed outdoors or in a mechanical room adjacent to the outdoors. This exception is allowed to be used for other cooling units and split systems with a total cooling capacity rated in accordance with Section 1411.2 of less than 33,000 Btu/h (hereafter referred to as qualifying small systems) provided that these are high-efficiency cooling equipment with SEER and EER values more than 15% higher than minimum efficiencies listed in Tables 14-1A, 14-1B and 14-1D, in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all qualifying small equipment without economizers shall not exceed 72,000 Btu/h per building, or 5% of its air economizer capacity, whichever is greater. That portion of the equipment serving Group R Occupancy is not included in determining the total capacity of all units without economizers in a building. Redundant units are not included in determining the total capacity of all units without economizers in a building ((redundant-unit capacity limitations)). This exception shall not be used for the shell-and-core permit or for the initial tenant improvement (i.e. the first time that the space is occupied) or for RS-29 analysis.

b. Qualifying very-small very-high efficiency equipment: This exception shall not be used for unitary cooling equipment installed outdoors or in a mechanical room adjacent to the outdoors. This exception is allowed to be used for other cooling units and split systems with a total cooling capacity rated in accordance with Section 1411.2 of less than or equal to 24,000 Btu/h (hereafter referred to as "qualifying very small very-high efficiency equipment") provided that these are high-efficiency cooling equipment with SEER and EER values more than 64% higher than minimum efficiencies listed in Tables 14-1A, 14-1B and 14-1D, in the appropriate size category, using the same test procedures. If an HVAC unit is rated with an IPLV, IEER or SEER, then to eliminate the required economizer, the minimum cooling efficiency of the HVAC unit shall be increased by the percentage shown. If the HVAC unit is only rated with a full load metric like EER or COP cooling then these shall be increased by the percentage shown. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all qualifying very-small very-high efficiency equipment without economizers shall not exceed 24,000 Btu/h per tenant space. This exception shall not be used for the shell-and-core permit or for the initial tenant improvement or for RS-29 analysis.

Informative Note: Exception 1 is only applicable to HVAC equipment that complies with Section 1411.1 and is regulated in Tables 14-1A, 14-1B and 14-1D.

Section 1411.1 requires that "if a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program." As of the date of adoption of this Code, the AHRI program does satisfy those criteria. Therefore, products subject to the AHRI standards must be listed in the AHRI certification program.

In Tables 14-1A, 14-1B, and 14-1D, virtually all of the equipment efficiency ratings are required to be determined in accordance with an AHRI Standard (though some products are rated in accordance with ASHRAE Standard 127). Energy Code compliance is determined at standard conditions (not at project specific conditions). Compliance should be verified through the AHRI directory at www.ahridirectory.org. It is not acceptable for a manufacturer to submit its own calculations for AHRI standards.

Consequently, to use exception 1 to Section 1433, a product must both be within the scope of the specified AHRI standard and be included in the AHRI certification program (except for those products rated in accordance with ASHRAE Standard 127). Certain equipment used in computer server rooms is not within the scope of the standards listed in Tables 14-1A, 14-1B, and 14-1D and is not eligible for certification. Therefore, such equipment does not qualify to use exception 1 to Section 1433 (though it may qualify to use another exception).

Informative Note: The exceptions to Section 1433 generally are not equal-energy alternates to a system with air economizer. For example, the 15% higher efficiency cooling units allowed in Exception 1a do not come close to providing equivalence to air economizer.

However, in response to requests, ASHRAE has calculated the improvement in cooling equipment efficiency necessary to compensate for the lack of outside air cooling capability of an economizer. For western Washington, the cooling equipment efficiency improvement required is 64%. This is the basis for the criteria in Exception 1b. At the time this Code was adopted, it was not known whether there were equipment models on the market that could be shown to meet the criteria in Exception 1b.

2. Chilled water terminal units connected to systems with chilled water generation equipment with IPLV values more than 25% higher than minimum part load efficiencies listed in Table 14-1C, in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all systems without economizers shall not exceed ((480,000)) 72,000 Btu/h per building, or ((20%)) 5% of its air economizer capacity, whichever is greater. That portion of the equipment serving Group R Occupancy is not included in determining the total capacity of all units without economizers in a building. This exception shall not be used for the shell-and-core permit or for the initial tenant improvement or for RS-29 analysis.

3. Water-cooled refrigeration equipment (serving chilled beams and chilled ceilings space cooling systems only) which are provided with a water economizer meeting the requirements of Section 1413 and that serve only the following space cooling systems:

a. chilled floor slabs not covered with other material and having direct exposure to the space,

b. chilled beams,

c. chilled ceilings.

Water economizer capacity per building shall not exceed 500 tons. This exception shall not be used for RS-29 analysis.

Informative Note: This water economizer exception applies to equipment that only serves chilled floor slabs, chilled beams, and chilled ceilings space cooling systems. Chilled floor slabs, chilled beams, and chilled ceilings space cooling systems are often partnered with Direct Outside Air Supply (DOAS) systems. The DOAS system is not included in this exception and must comply with the air economizer requirements, unless it qualifies for one of the other exceptions.

4. Systems for which at least 75% of the annual energy used for mechanical cooling is provided from site-recovery or site-solar energy source.

5. Systems where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes an air economizer infeasible.

6. Systems with dehumidification that affect other systems so as to increase the overall building energy consumption. New humidification equipment shall comply with Section 1413.4.

7. Systems complying with all of the following criteria:

a. Consist of multiple water source heat pumps with a total cooling capacity for each water-source heat pump of less than 54,000 Btu/h that are connected to a common water loop;

b. Have a minimum of 60% air economizer complying with Section 1413 that is ducted in a fully enclosed path directly to every heat pump unit in each zone, except that ducts may terminate within 12 inches of the intake to an HVAC unit provided that they are physically fastened so that the outside air duct is directed into the unit intake;

c. Have water source heat pumps with an EER at least 15% higher for cooling and, for units serving perimeter zones with heating loads (e.g. zones with exterior walls, roofs, or floors), a COP at least 15% higher for heating than that specified in Section 1411;

d. Where provided with a dedicated boiler or furnace for that building, have a central boiler or furnace efficiency of 90 percent minimum; and

e. Provide heat recovery with a minimum 50% heat recovery effectiveness as defined in Section 1436 to preheat the outside air supply.

8. For Group R Occupancy, cooling units installed outdoors or in a mechanical room adjacent to outdoors with a total cooling capacity less than 20,000 Btu/h and other cooling units with a total cooling capacity less than 54,000 Btu/h provided that these are high-efficiency cooling equipment with SEER and EER values more than 15 percent higher than minimum efficiencies listed in Tables 14-1A, 14-1B and 14-1D, in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. For split systems, compliance is based on the cooling capacity of individual fan coil units.

Informative Note: Chillers with fan coil units do not qualify for this exception as chillers are not covered in Tables 14-1A, 14-1B, or 14-1D. Most variable refrigerant flow (VRF) systems are too large and also do not qualify for this exception, as AHRI 1230, the standard for rating the efficiency of VRF systems in Tables 14-1A(3)-(4), bases the capacity on the outside unit size.

9. Equipment used to cool any dedicated server room, electronic equipment room or telecom switch room provided that they completely comply with option 9a, 9b, ((or)) 9c, 9d, or 9e in the table below. The total capacity of all qualifying systems without economizers shall not exceed 240,000 Btu/h per building or 10 percent of its air economizer capacity, whichever is greater. This exception shall not be used for RS-29 analysis.

10. Variable refrigerant flow (VRF) systems, multiple-zone split-system heat pumps, consisting of multiple, individually metered indoor units with multi-speed fan motors, served on a single common refrigeration circuit with an exterior reverse-cycle heat pump with variable speed compressor(s) and variable speed condenser fan(s). These systems shall also be capable of providing simultaneous heating and cooling operation, where in all zones with VRF units recovered energy from the indoor units operating in one mode can be transferred to one or more indoor units operating in the other mode, and shall serve at least 20 percent internal (no perimeter wall within 12 feet ((??))) and 20 percent perimeter zones (as determined by conditioned floor area) and the outdoor unit shall be [illegible] 65,000 Btu/h in total capacity. Systems of 1 zone this exception shall have 50 percent heat recovery effectiveness on the outside air. For the purposes of this exception, dedicated server rooms, electronic equipment rooms or telecom switch rooms are not considered perimeter zones and shall not exceed 20% of the floor area served by the VRF system. This exception shall be limited to buildings of 60,000 square feet and less.

Procedural Requirement: The materials submitted with the permit application shall specify the gross conditioned floor area of the building.

11. Medical and laboratory equipment that is directly water-cooled and that is not dependent upon space air temperature.

	Equipment Type	Higher Equipment Efficiency	Part-Load Control	Economizer
Option 9a	Table 14-1A and Table 14-1B[a]	+ 15%[b]	Required over 85,000 Btu/h[c]	None required
Option 9b	Table 14-1A and Table 14-1B[a]	+ 5%[d]	Required over 85,000 Btu/h[c]	Dedicated Waterside economizer
Option 9c	ASHRAE Standard 127[f]	+ ((0)) 10%[g]	Required over 85,000 Btu/h[c]	Dedicated Waterside economizer
Option 9d	Table 14-1C[h]	+ 25%[i]	Required for all chillers[j]	None required
Option 9e	Table 14-1C[h]	+ 10/15%[k]	Required over 85,000 Btu/h[c]	Dedicated Waterside economizer

Footnotes to table

a. For a system where all of the cooling equipment is subject to the AHRI standards listed in Tables 14-1A and 14-1B, the system shall comply with all of the following (note that if the system contains any cooling equipment that exceeds the capacity limits in Table 14-1A or 14-1B, or if the system contains any cooling equipment that is not included in Table 14-1A or 14-1B, then the system is not allowed to use this option).

b. The cooling equipment shall have an SEER/EER value and an IEER/IPLV value that each is a minimum of 15 percent greater than the value listed in Tables 14-1A and 14-1B (1.15 x values in Tables 14-1A and 14-1B).

c. For units with a total cooling capacity over 85,000 Btu/h, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50 percent of the load or less that results in the compressor operating at the same or higher EER at part loads than at full load (e.g., minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, dual tandem scrolls, but hot gas bypass is not credited as a compressor unloading system).

d. The cooling equipment shall have an SEER/EER value and an IEER/IPLV value that each is a minimum of 5 percent greater than the value listed in Tables 14-1A and 14-1B (1.05 x values in Tables 14-1A and 14-1B).

e. The system shall include a water economizer in lieu of air economizer. Water economizers shall be capable of providing the total concurrent cooling load served by the connected terminal equipment lacking airside economizer, at outside air temperatures of 50°F dry-bulb/45°F wet-bulb and below. For this calculation, all factors including solar and internal load shall be the same as those used for peak load calculations, except for the outside temperatures. The equipment shall be served by a dedicated condenser water system ((unless a nondedicated condenser water system exists that can provide appropriate water temperatures during hours when waterside economizer cooling is available)).

f. For a system where all cooling equipment is subject to ASHRAE Standard 127-2007.

g. The cooling equipment subject to the ASHRAE Standard 127-2007 shall have ((an SCOP value and an IPLV)) a SCOP value that is ((equal to)) a minimum of 10 percent greater than the value listed in Tables 14-1A(2) (1.10 x values in Tables 14-1A(2)) ((and 14-1A)) when determined in accordance with the rating conditions in ASHRAE Standard 127-2007 (i.e., not the rating conditions in AHRI Standard 210/240 or 340/360). ((This)) Effective January 1, 2012, this information shall be provided by an independent third party.

h. For a system with chillers subject to the AHRI standards listed in Table 14-1C (e.g. a chilled water system with fan coil units).

i. The cooling equipment shall have an full-load EER value and an IPLV value that is a minimum of 25 percent greater than the value listed in Table 14-1C (1.25 x value in Table 14-1C), e.g. full load and IPLV kW/ton that is at least 25 percent lower than the value listed in Table 14-1C (0.75 x value in Table 14-1C).

j. For all chillers, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50 percent of the load or less and that result in the compressor operating at the same or higher EER at part loads than at full load (e.g., minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, dual tandem scrolls, but hot gas bypass is not a qualifying compressor unloading system).

k. For air-cooled chillers, the cooling equipment shall have an IPLV EER value that is a minimum of 10% greater than the IPLV EER value listed in Table 14-1C (1.10 x values in Table 14-1C). For water-cooled chillers, the cooling equipment shall have an IPLV kW/ton that is at least 15% lower than the IPLV kW/ton value listed in Table 14-1C (0.85 x values in Table 14-1C).

Informative Note: Options 9a and 9b are only applicable to HVAC equipment that complies with Section 1411.1 and is regulated in Tables 14-1A and 14-1B.

Section 1411.1 requires that "If a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program." As of the date of adoption of this Code, the AHRI program does satisfy these criteria. Therefore, products subject to the AHRI standards must be listed in the AHRI certification program.

In Tables 14-1A and 14-1B, virtually all of the equipment efficiency ratings are required to be determined in accordance with an AHRI Standard (though some products are rated in accordance with ASHRAE Standard 127). As specified in Section 1411.2, Energy Code compliance is determined at standard conditions (not at project specific conditions). Compliance should be verifiable through the AHRI directory at www.ahridirectory.org. It is not acceptable for a manufacturer to submit its own calculations for AHRI standards.

Equipment used in computer server rooms that is within the scope of ASHRAE Standard 127, Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners is also eligible to use exception 9 option 9c to Section 1433.

Informative Note: For hydronic systems over 300,000 Btu/h, see Section 1432.2.2.

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1435 Simultaneous heating and cooling. Systems which provide heating and cooling simultaneously to a zone are prohibited. Zone thermostatic and humidistatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the zone. Such controls shall prevent:

a. Reheating for temperature control.

b. Recooling for temperature control.

c. Mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by economizer systems, ((ground water)) ground-coupled hydronic loops, or by mechanical refrigeration.

d. Other simultaneous operation of heating and cooling systems to the same zone.

e. Reheating for humidity control.

EXCEPTIONS:

1. Variable air volume (VAV) systems which, during periods of occupancy, are designed and controlled:

1.1 To reduce the primary air supply to each zone to a minimum air volume when the zone temperature is in a 5°F (3°C) zone temperature dead band after cooling is no longer required and before reheating, recooling or mixing takes place. This minimum volume shall be no greater than the larger of the following:

1.1.1 Twenty percent of the peak supply volume; or

1.1.2 The volume of outdoor air required to meet zone ventilation requirements, unless increasing the volume to critical zones (zones with the highest ratio of outside air to total supply air) beyond the minimum ventilation requirements results in a decrease in overall outside air required by the HVAC system. An increase beyond minimum ventilation rates shall not be applied to more than 20 percent of the zones with reheat on any one system excluding zones equipped with ventilation controls for high occupancy areas required by Section 1513.2.2.

1.2 So the volume of air that is reheated, recooled, or mixed in peak heating demand shall be less than 50 percent of the zone design peak supply rate.

1.3 So the airflow between dead band and full heating or full cooling shall be modulated.

1.4 So the control logic of each system shall have means preventing changes in setpoint(s) from inducting simultaneous heating and cooling (including economizer cooling) except for humidity control or zone controls operating as described under exception 1.1.

2. Zones where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical, such as some areas of hospitals and laboratories. Systems which use this exception and supply heated or cooled air to multiple zones shall include:

2.1 Controls that automatically reset supply air temperatures by representative building loads or by outside air temperature unless it can be shown that supply air temperature reset increases overall building annual energy costs. In all cases, these controls shall comply with the requirements in Section 1432.2.

2.2 Variable speed drives for supply, ((and)) return and exhaust fans, modulating pressure independent zone dampers on all zones (supply, return, and exhaust (as where applicable)), specified occupied and unoccupied or low occupancy airflows, and have controls which reduce airflow in response to changes in occupancy levels.

3. Zones where at least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered (including condenser heat) or site solar energy source.

4. Zones where specific humidity levels are required to satisfy process needs, such as ((computer rooms,)) museums, surgical suites, and buildings with refrigerating systems, such as supermarkets, refrigerated warehouses, and ice arenas. This exception does not apply to computer rooms.

5. Zones with a peak supply air quantity of 300 cfm (142 L/s) or less.

6. Three deck multizone systems that mix economizer cooled outside air with heated or cooled air where the temperature of the economizer cooled air is reset based on weighted zone heating or cooling loads and zone airflow is reduced to a minimum of 20% design airflow or the volume of outdoor air required to meet zone ventilation requirements before mixing is allowed.

1436 ((Heat)) Energy Recovery.

Informative Note: As indicated in Section 1120, the Energy Code applies to industrial facilities, as well as commercial and industrial processes. Thus, the energy recovery requirements apply to industrial facilities, as well as systems and equipment used in commercial and industrial processes.

1436.1 Fan Systems: Fan systems which have a minimum outdoor air capacity of 5,000 cfm or greater shall have an ((heat)) energy recovery system that is designed for, and operates during, both the heating and the cooling seasons, with at least 50 percent heat recovery effectiveness. For the purposes of sizing the energy recovery system, the applicant shall submit calculations demonstrating that the system will provide at least 50% heat recovery effectiveness. Fifty percent heat recovery effectiveness shall mean an increase in the outside air supply temperature at design heating conditions of one half the difference between the outdoor design air temperature and 65°F. Provision shall be made to bypass or control the ((heat)) energy recovery system to permit air economizer operation as required by Section 1433. ((Heat)) Energy recovery energy may be provided from any site-recovered or site-solar source. Where a single room or space is supplied by multiple units, the aggregate ventilation (cfm) of those units shall be used in applying this requirement. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F.

Informative Note: In Seattle, the outdoor design air temperature is 24°F as specified in Table 3-1. The difference between 24°F and 65°F is 41 degrees. One-half of 41 degrees is 20.5 degrees. Therefore, to provide 50% heat recovery effectiveness in Seattle, the heat recovery system shall raise the outside supply air temperature to a minimum of 44.5°F (24°F + 20.5°F) at the outdoor design conditions.

EXCEPTIONS: These exceptions only apply to the particular exhaust subsystems. The remaining cfm of the main supply system is subject to the energy recovery requirements.

1. ((Laboratory systems equipped with both variable air volume supply and variable air volume or two-speed exhaust fume hoods provided that an instruction label is placed on the face of the hood that provides the information in Table 14-3)) Reserved.

((Table 14-3

INSTRUCTIONS TO OPERATOR

To be in compliance with the Energy Code, this fume hood is designed to operate as variable air volume (VAV) by adjusting the sash or controller. Maintain sash in the minimum position during use and close totally when the fume hood is not in use.

))

2. Systems serving spaces heated to less than 60 degrees F.

3. Systems which can be shown to use as much energy with the addition of heat recovery equipment as without it.

4. Systems exhausting toxic, flammable, paint exhaust or corrosive fumes making the installation of heat recovery equipment impractical.

5. Type I commercial kitchen hoods.

6. Systems that only provide cooling.

7. Cooling only air handling units or air conditioning units where the minimum outdoor air is less than 70 percent of total supply air.

Laboratory systems shall also comply with Section 1439.2.

1436.2 Condensate Systems: ((On-site steam h))Heating systems with on-site steam generation shall have condensate water recovery. On site includes a system that is located within or adjacent to one or more buildings within the boundary of a contiguous area or campus under one ownership and which serves one or more of those buildings.

Buildings using steam generated off-site with steam heating systems which do not have condensate water recovery shall have condensate water recovery.

1436.3 Heat Recovery for Service Water Heating: Condenser water heat recovery systems shall be installed for heating or preheating of service hot water provided all of the following are true:

a. The facility operates 24 hours a day.

b. The total installed heat rejection capacity of the water-cooled systems exceeds 1,500,000 Btu/h of heat rejection.

c. The capacity of service water heating equipment exceeds 250,000 Btu/h.

The required heat recovery system shall have the capacity to provide the smaller of:

a. 60 percent of the peak heat rejection load at design conditions; or

b. Preheat of the peak service hot water draw to 85°F; or

c. 50 percent of the service water heating load.

EXCEPTIONS:

1. Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.

2. Facilities that provide 60 percent of their service water heating from site solar or site recovered energy or from other sources.

Informative Note: This requirement typically applies to hotels, dormitories, mixed-use retail/residential projects, commercial kitchens, and institutions such as prisons and hospitals according to the ASHRAE/IESNA Standard 90.1 User's Manual, page 6-76.

1436.4 Condenser Heat Recovery: Facilities having food service, meat or deli departments and having 500,000 Btu/h or greater of remote refrigeration condensers shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for service water heating, space heating or for dehumidification reheat. Facilities having a gross conditioned floor area of 40,000 ft² or greater and 1,000,000 Btu/h or greater of remote refrigeration shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for service water heating, and either for space heating or for dehumidification reheat for maintaining low space humidity. The required heat recovery system shall have the capacity to provide the smaller of:

a. 60 percent of the peak heat rejection load at design conditions; or

b. 50 percent of the sum of the service water heating load plus space heating load.

1437 Electric motor efficiency. Design A & B squirrel cage, T frame induction permanently wired polyphase motors of 1 hp or more having synchronous speeds of 3,600, 1,800 and 1,200 rpm shall have a nominal full-load motor efficiency no less than the corresponding values for energy efficient motors provided in Table 14-4.

EXCEPTIONS:

1. Motors used in systems designed to use more than one speed of a multi-speed motor.

2. Motors used as a component of the equipment meeting the minimum equipment efficiency requirements of Section 1411 and Tables 14-1A through 14-1G provided that the motor input is included when determining the equipment efficiency.

3. Motors that are an integral part of specialized process equipment.

4. Where the motor is integral to a listed piece of equipment for which no complying motor has been approved.

Fan motors less than 1 hp in series terminal units and in fan-coil units shall be electronically commutated motors, or shall have a minimum motor efficiency of 65% when rated in accordance with NEMA Standard MG-1 at full load rating conditions.

Informative Note: As indicated in Section 1120, the Energy Code applies to industrial facilities, as well as commercial and industrial processes. Thus, the motor efficiency requirements apply to industrial facilities, as well as systems and equipment used in commercial and industrial processes.

1438 System Criteria. For fans and pumps ((7.5)) 5 horsepower and greater including custom and packaged air handlers serving variable air volume fan systems, constant volume fans, parking garage ventilation fans, heating and cooling hydronic pumping systems, pool and service water pumping systems, domestic water pressure boosting systems, cooling tower fan, and other pumps or fans where variable flows are required, there shall be:

a. Variable speed drives, or

b. Other controls and devices that will result in fan and pump motor demand of no more than 30% of design wattage at 50% of design air volume for fans when static pressure set point equals 1/3 the total design static pressure, and 50% of design water flow for pumps, based on manufacturer's certified test data. Variable inlet vanes, throttling valves (dampers), scroll dampers or bypass circuits shall not be allowed.

Informative Note: At the time this Code was adopted, very few technologies could be shown to meet the criteria in option b.

EXCEPTION: Variable speed devices are not required for motors that serve:

1. Fans or pumps in packaged equipment where variable speed drives are not available as a factory option from the equipment manufacturer.

2. Fans or pumps that are required to operate only for emergency fire-life-safety events (e.g., stairwell pressurization fans, elevator pressurization fans, fire pumps, etc.).

See the Seattle Building Code, Section 3016.15, for energy efficiency requirements for ventilation fan systems in elevators.

Informative Note: As indicated in Section 1120, the Energy Code applies to industrial facilities, as well as commercial and industrial processes. Thus, the variable speed drive requirement applies to industrial facilities, as well as systems and equipment used in commercial and industrial processes.

1438.1 Heat Rejection Equipment: The requirements of this section apply to heat rejection equipment used in comfort cooling systems such as air-cooled condensers, open cooling towers, closed-circuit cooling towers, and evaporative condensers.

EXCEPTION: Heat rejection devices included as an integral part of equipment listed in Tables 14-1A through 14-1D.

Heat rejection equipment shall have a minimum efficiency performance not less than values specified in Table 14-1G. These requirements apply to all propeller, axial fan and centrifugal fan cooling towers. Table 14-1G specifies requirements for air-cooled condensers that are within rating conditions specified within the table.

1438.1.1 Variable flow controls: Cooling tower fans ((7.5)) 5 hp and greater shall have control devices that vary flow by controlling leaving fluid temperature or condenser temperature/pressure of the heat rejection device.

1438.1.2 Limitation on centrifugal fan cooling towers: Open cooling towers with a combined rated capacity of 1,100 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet bulb temperature shall meet the energy efficiency requirement for axial fan open circuit cooling towers.

EXCEPTION: Heat rejection devices included as an integral part of equipment listed in Tables 14-1A through 14-1D.

Heat rejection equipment shall have a minimum efficiency performance not less than values specified in Table 14-1G. These requirements apply to all propeller, axial fan and centrifugal fan cooling towers. Table 14-1G specifies requirements for air cooled condensers that are within rating conditions specified within the table.

1438.1.1 Variable flow controls: Cooling tower fans ((7.5)) 5 hp and greater shall have control devices that vary flow by controlling leaving fluid temperature or condenser temperature/pressure of the heat rejection device.

1438.1.2 Limitation on centrifugal fan cooling towers: Open cooling towers with a combined total capacity of 1,100 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet bulb temperature shall meet the energy efficiency requirement for axial fan open circuit cooling towers.

EXCEPTION: Open circuit cooling towers that are ducted (inlet or discharge) ((or have external sound attenuation)) that require((s)) external static pressure capability or open circuit cooling towers that have external sound attenuation.

1438.2 Hot gas bypass limitation: Cooling equipment with direct expansion coils rated at greater than 95,000 Btu/h total cooling capacity shall have a minimum of 2 stages of cooling capacity or capacity modulation other than hot gas bypass that is capable of reducing input and output by at least 50%.

1438.3 Large volume fan systems: Single or multiple fan systems serving a zone or adjacent zones without separating walls with total air flow over 10,000 cfm (3,540 L/s) are required to reduce air flow based on space thermostat heating and cooling demand. A variable speed drive shall reduce airflow to a maximum 75% of peak airflow or minimum ventilation air requirement as required by Section 403 of the IMC, whichever is greater.

EXCEPTIONS:

1. Systems where the function of the supply air is for purposes other than temperature control, such as maintaining specific humidity levels or supplying an exhaust system.
2. Dedicated outdoor air supply unit(s) with heat recovery where airflow is equal to the minimum ventilation requirements and other fans cycle off unless heating or cooling is required.
3. An area served by multiple units where designated ventilation units have 50% or less of total area airflow and nonventilation unit fans cycle off when heating or cooling is not required.

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1439.2 Laboratory Exhaust Systems: Buildings with laboratory exhaust systems having a total exhaust rate greater than 5,000 cfm (2,360 L/s) shall include heat recovery systems to precondition((ed)) makeup air from laboratory exhaust. The heat recovery system shall be capable of increasing the outside air supply temperature at design heating conditions by 25°F (13.9°C) in Climate Zone 1 and 35°F (19.4°C) in Climate Zone 2. A provision shall be made to bypass or control the heat recovery system to permit air economizer operation as required by Section 1433.

EXCEPTIONS:

1. Variable air volume laboratory exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50% or less of design values; or
2. Direct make-up (auxiliary) air supply equal to at least 75% of the exhaust rate, heated no warmer than 2°F (1.1°C) below room set point, cooled to no cooler than 3°F (1.7°C) above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control; or
3. Combined Energy Reduction Method: VAV exhaust and room supply system capable of reducing exhaust and makeup air volumes and a heat recovery system to precondition makeup air from laboratory exhaust that when combined will produce the same energy reduction as achieved by a heat recovery system with a 50% sensible recovery effectiveness as required above. For calculation purposes, the heat recovery component can be assumed to include the maximum design supply airflow rate at design conditions. The combined energy reduction (QER) shall meet the following:

QER ≥ QMIN

QMIN = CFMS · (TR-TO) · 1.1 · 0.6

QER = CFMS · (TR-TO) · 1.1(A+B)/100

Where:

QMIN = Energy recovery at 60% sensible effectiveness (Btu/h)

QER = Combined energy reduction (Btu/h)

CFMS = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute

TR = Space return air dry bulb at winter design conditions

TO = Outdoor air dry bulb at winter design conditions

A = Percentage that the exhaust and makeup air volumes can be reduced from design conditions

B = Percentage sensible heat recovery effectiveness

Laboratory systems shall also comply with Section 1436.1.

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1444 Conservation of Water and Pumping Energy. Pumps for all domestic water systems shall comply with Section 1438.

In addition, domestic water pressure booster systems shall be designed such that:

a. One or more pressure sensors shall be used to vary pump speed or to start and stop pumps, or for both purposes. Either the sensor(s) shall be located near the critical fixture(s) that determine the pressure required, or logic shall be employed that adjusts the setpoint to simulate operation of remote sensor(s).
b. No device(s) shall be installed for the purpose of reducing the pressure of all of the water supplied by any booster system pump or booster system, except for safety devices.
c. No booster system pumps shall operate when there is no service water flow.

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1452 Pool Water Heaters: Pool water heaters using electric resistance heating as the primary source of heat are prohibited for pools over 2,000 gallons. Heat pump pool heaters shall have a minimum COP of 4.0 at 50.0°F db, 44.2°F wb, outdoor air and 80.0°F entering water, determined in accordance with AHRI Standard 1160, Performance Rating of Heat Pump Pool Heaters((ASHRAE Standard 146, Method of Testing for Rating Pool Heaters)). Other pool heating equipment shall comply with the applicable efficiencies in Tables 14-1A through 14-1G.

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1470 Compressed Air and Vacuum Air.

EXCEPTIONS: If used for medical purposes, compressed air and vacuum air are exempt from this section.

1470.1 Air Compressors (50-150 PSI), General: Air compressors operating at 50-150 PSI shall comply with the following:

a. All water drains shall be "no loss" drains.
b. Timed or heated desiccant air driers shall not be allowed.

1470.2 Rotary Screw Air Compressors over 10 hp (50-150 PSI): Rotary screw air compressors over 10 hp operating at 50-150 PSI shall not rely on modulation control and shall have one of the following:

a. Receiver capacity greater than three gallon per cfm to allow efficient load/unload control,
b. Variable speed drive controlled air compressor, or
c. Multiple air compressors using a smaller trim air compressor to trim. The trim compressor shall use variable speed drive control, or shall use load/unload control with greater than three gallon receiver capacity per cfm for the trim air compressor.

Informative Note: As indicated in Section 1420, the Energy Code applies to industrial facilities, as well as commercial and industrial processes. Thus, the air compressor requirements apply to industrial facilities, as well as systems and equipment used in commercial and industrial processes.

1475 Commercial Food Service. The following types of equipment within the scope of the applicable Energy Star program shall comply with the energy-efficiency and water-efficiency criteria required to achieve the Energy Star label:

a. Commercial fryers: Energy Star Program Requirements for Commercial Fryers.
b. Commercial hot food holding cabinets: Energy Star Program Requirements for Hot Food Holding Cabinets.
c. Commercial steam cookers: Energy Star Program Requirements for Commercial Steam Cookers.
d. Commercial dishwashers: Energy Star Program Requirements for Commercial Dishwashers.

Informative Note: Energy Star requirements are posted on the Energy Star website at: http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs

TABLE 14-1A(1)

Unitary Air Conditioners and Condensing Units, Electrically Operated, Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air conditioners, air cooled	< 65,000 Btu/h[d]		Split System and Single Package	13.0 SEER	AHRI 210/240
	≥65,000 Btu/h and < 135,000 Btu/h		Split System and Single Package	11.2 EER[c] 11.4 IEER[c]	AHRI 340/360
	≥135,000 Btu/h and <240,000 Btu/h		Split System and Single Package	11.0 EER[c] 11.2 IEER[c]	
	≥240,000 Btu/h and < 760,000 Btu/h		Split System and Single Package	10.0 EER[c] 10.1 IEER[c]	
	≥ 760,000 Btu/h		Split System and Single Package	9.7 EER[c] 9.8 IEER[c]	
Through-the-wall, air-cooled	≤ 30,000 Btu/h[d]		Split System and Single Package	12.0 SEER	AHRI 210/240
Small-duct high-velocity, air-cooled	< 65,000 Btu/h[d]		Split System	10.0 SEER	AHRI 210/240
Air conditioners, water ((and evaporatively)) cooled	< 65,000 Btu/h	A	Split System and Single Package	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.5 EER (before 6/1/2011) 12.1 EER (as of 6/1/2011) 11.7 IEER (before 6/1/2011) 12.3 IEER (as of 6/1/2011)	AHRI 340/360
		All other	Split System and Single Package	11.3 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.5 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.5 EER (as of 6/1/2011) 11.2 IEER (before 6/1/2011) 12.7 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.3 EER (as of 6/1/2011) 11.0 IEER (before 6/1/2011) 12.5 IEER (as of 6/1/2011)	
	≥240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 12.6 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 12.4 IEER (as of 6/1/2011)	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 12.4 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 12.2 IEER (as of 6/1/2011)	
Air conditioners, evaporatively cooled	< 65,000 Btu/h	A	Split System and Single Package	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.5 EER (before 6/1/2011) 12.1 EER (as of 6/1/2011) 11.7 IEER (before 6/1/2011) 12.3 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	11.3 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.5 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011) 11.2 IEER (before 6/1/2011) 12.2 IEER (as of 6/1/2011)	AHRI 340/360
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 11.8 EER (as of 6/1/2011) 11.0 IEER (before 6/1/2011) 12.0 IEER (as of 6/1/2011)	
	≥240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 11.9 IEER (as of 6/1/2011)	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 11.7 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 11.9 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 11.5 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 11.7 IEER (as of 6/1/2011)	
Condensing units, air cooled	≥ 135,000 Btu/h	–		10.1 EER (before 6/1/2011) 10.5 EER (as of 6/1/2011) ((11.2 IPLV)) 11.4 IEER (before 6/1/2011) 11.8 IEER (as of 6/1/2011)	AHRI 365
Condensing units, water ((or evaporatively)) cooled	≥ 135,000 Btu/h	–		13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) ((13.1 IPLV)) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	
Condensing units, evaporatively cooled	≥ 135,000 Btu/h	–		13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) ((13.1 IPLV)) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	

a Reserved.

b IPLVs are only applicable to equipment with capacity modulation.

c Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

d Applies to all units, including single-phase and three-phase. For single-phase air-cooled air-conditioners < 65,000 Btu/h, SEER values are those set by NAECA.

e Reserved.

TABLE 14-1A(2)

Air Conditioners and Condensing Units Serving Computers Rooms

Minimum Efficiency Requirements

Equipment Type	Net Sensible Cooling Capacity[a]	Minimum SCOP-127[b] Efficiency Downflow units / Upflow units	Test Procedure
Air conditioners, air cooled	<65,000 Btu/h (<19 kW)	2.20 / 2.09	ANSI/ASHRAE 127
	>= 65,000 Btu/h and < 240,000 Btu/h (>=19 kW and < 70 kW)	2.10 / 1.99	
	>= 240,000 Btu/h (>= 70 kW)	1.90 / 1.79	
Air conditioners, water cooled	<65,000 Btu/h (< 19 kW)	2.60 / 2.49	ANSI/ASHRAE 127
	>= 65,000 Btu/h and < 240,000 Btu/h (>=19kW and < 70 kW)	2.50 / 2.39	
	>= 240,000 Btu/h (>= 70 kW)	2.40 / 2.29	
Air conditioners, water cooled with fluid economizer	<65,000 Btu/h (<19 kW)	2.55 / 2.44	ANSI/ASHRAE 127
	>= 65,000 Btu/h and < 240,000 Btu/h (>=19kW and < 70 kW)	2.45 / 2.34	
	>= 240,000 Btu/h (>= 70 kW)	2.35 / 2.24	
Air conditioners, glycol cooled (rated at 40% propylene glycol)	<65,000 Btu/h (<19 kW)	2.50 / 2.39	ANSI/ASHRAE 127
	>= 65,000 Btu/h and < 240,000 Btu/h (>=19kW and < 70 kW)	2.15 / 2.04	
	>= 240,000 Btu/h (>= 70 kW)	2.10 / 1.99	
Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer	<65,000 Btu/h (<19 kW)	2.45 / 2.34	ANSI/ASHRAE 127
	>= 65,000 Btu/h and < 240,000 Btu/h (>=19kW and < 70 kW)	2.10 / 1.99	
	>= 240,000 Btu/h (>= 70 kW)	2.05 / 1.94	

a Net sensible cooling capacity. The total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power)

b Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.

TABLE 14-1A(3)

Electrically Operated Variable Refrigerant Flow Air Conditioners

Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure
VRF Air Conditioners, Air Cooled	<65,000 Btu/h	All	VRF Multi-split System	13.0 SEER	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	11.2 EER 12.5 IEER 13.1 IEER (as of 7/1/2012)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	11.0 EER 12.3 IEER 12.9 IEER (as of 7/1/2012)	
	≥240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	10.0 EER 11.1 IEER 11.6 IEER (as of 7/1/2012)	

TABLE 14-1A(4)

Electrically Operated Variable Refrigerant Flow Air to Air and Applied Heat Pumps

Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure
VRF Air Cooled, (cooling mode)	<65,000 Btu/h	All	VRF Multi-split System	13.0 SEER	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	11.0 EER 12.3 IEER 12.9 IEER (as of 7/1/2012)	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System with Heat Recovery	10.8 EER 12.1 IEER 12.7 IEER (as of 7/1/2012)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	10.6 EER 11.8 IEER 12.3 IEER (as of 7/1/2012)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System with Heat Recovery	10.4 EER 11.6 IEER 12.1 IEER (as of 7/1/2012)	
	≥240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System	9.5 EER 10.6 IEER 11.0 IEER (as of 7/1/2012)	
	≥240,000 Btu/h	Electric Resistance (or none)	VRF Multi-split System with Heat Recovery	9.3 EER 10.4 IEER 10.9 IEER (as of 7/1/2012)	
VRF Water source (cooling mode)	<65,000 Btu/h	All	VRF Multi-split systems 86°F entering water	12.0 EER	AHRI 1230
	<65,000 Btu/h	All	VRF Multi-split systems with Heat Recovery 86°F entering water	11.8 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	VRF Multi-split System 86°F entering water	12.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	VRF Multi-split System with Heat Recovery 86°F entering water	11.8 EER	
	≥135,000 Btu/h	All	VRF Multi-split System 86°F entering water	10.0 EER	
	≥135,000 Btu/h	All	VRF Multi-split System with Heat Recovery 86°F entering water	9.8 EER	
VRF Groundwater source (cooling mode)	<135,000 Btu/h	All	VRF Multi-split System 59°F entering water	16.2 EER	AHRI 1230
	<135,000 Btu/h	All	VRF Multi-split System with Heat Recovery 59°F entering water	16.0 EER	
	≥135,000 Btu/h	All	VRF Multi-split System 59°F entering water	13.8 EER	
	≥135,000 Btu/h	All	VRF Multi-split System with Heat Recovery 59°F entering water	13.6 EER	
VRF Ground source (cooling mode)	<135,000 Btu/h	All	VRF Multi-split System 77°F entering water	13.4 EER	AHRI 1230
	<135,000 Btu/h	All	VRF Multi-split System with Heat Recovery 77°F entering water	13.2 EER	
	≥135,000 Btu/h	All	VRF Multi-split System 77°F entering water	11.0 EER	
	≥135,000 Btu/h	All	VRF Multi-split System with Heat Recovery 77°F entering water	10.8 EER	
VRF Air Cooled (heating mode)	<65,000 Btu/h (cooling capacity)	---	VRF Multi-split System	7.7 HSPF	AHRI 1230
	≥65,000 Btu/h and <135,000 Btu/h (cooling capacity)	---	VRF Multi-split system 47°F db/43°F wb outdoor air	3.3 COP	
			17°F db/15°F wb outdoor air	2.25 COP	
	≥135,000 Btu/h (cooling capacity)		VRF Multi-split System 47°F db/43°F wb outdoor air	3.2 COP	
			17°F db/15°F wb outdoor air	2.05 COP	
VRF Water source (heating mode)	<135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68°F entering water	4.2 COP	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 68°F entering water	3.9 COP	
VRF Groundwater source (heating mode)	<135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 50°F entering water	3.6 COP	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	---	VRF Multi-split System 50°F entering water	3.3 COP	
VRF Ground source (heating mode)	<135,000 Btu/h (cooling capacity)		VRF Multi-split System 32°F entering water	3.1 COP	AHRI 1230
	≥135,000 Btu/h (cooling capacity)	—	VRF Multi-split System 32°F entering water	2.8 COP	

TABLE 14-1B

UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED,

MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[a]
Air Cooled, (Cooling Mode)	<65,000 Btu/h[d]	Split System	13.0 SEER	AHRI 210/240
		Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Split System and Single Package	11.0 EER[c] 11.2 IEER[c]	AHRI 340/360
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	10.6 EER[c] 10.7 IEER[c]	
	≥240,000 Btu/h	Split System and Single Package	9.5 EER[c] 9.6 IEER[c]	
Through-the-Wall (Air Cooled, Cooling Mode)	≤30,000 Btu/h[d]	Split System	12.0 SEER	AHRI 210/240
		Single Package	12.0 SEER	
Water-Source (Cooling Mode)	<17,000 Btu/h	86°F Entering Water	11.2 EER	AHRI/ISO-13256-1
	≥17,000 Btu/h and <65,000 Btu/h	86°F Entering Water	12.0 EER	AHRI/ISO-13256-1
	≥65,000 Btu/h and <135,000 Btu/h	86°F Entering Water	12.0 EER	AHRI/ISO-13256-1
Groundwater-Source (Cooling Mode)	<135,000 Btu/h	59°F Entering Water	16.2 EER	AHRI/ISO-13256-1
Ground Source (Cooling Mode)	<135,000 Btu/h	77°F Entering Water	13.4 EER	AHRI/ISO 13256-1
Air Cooled (Heating Mode)	<65,000 Btu/h[d] (Cooling Capacity)	Split System	7.7 HSPF	AHRI 210/240
		Single Package	7.7 HSPF	
	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.3 COP	AHRI 340/360
		17°F db/15°F wb Outdoor Air	2.25 COP	
	≥135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.2 COP	
		17°F db/15°F wb Outdoor Air	2.05 COP	
Through-the-Wall (Air Cooled, Heating Mode)	≤30,000 Btu/h[d]	Split System	7.4 HSPF	AHRI 210/240
		Single Package	7.4 HSPF	
Water-Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)	68°F Entering Water	4.2 COP	AHRI/ISO-13256-1
Groundwater-Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)	50°F Entering Water	3.6 COP	AHRI/ISO-13256-1
Ground Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)	32°F Entering Water	3.1 COP	AHRI/ISO-13256-1
Water-Source Water-to-Water (Cooling Mode)	<135,000 Btu/h	86°F Entering Water	10.6 EER	AHRI/ISO-13256-2
Groundwater-Source Water-to-Water (Cooling Mode)	<135,000 Btu/h	59°F Entering Water	16.3 EER	AHRI/ISO-13256-2
Ground Source Brine-to-Water (Cooling Mode)	<135,000 Btu/h	77°F Entering Water	12.1 EER	AHRI/ISO-13256-2
Water-Source Water-to-Water (Heating Mode)	<135,000 Btu/h (Cooling Capacity)	68°F Entering Water	4.2 COP	AHRI/ISO-13256-2
Groundwater-Source Water-to-Water (Heating Mode)	<135,000 Btu/h (Cooling Capacity)	50°F Entering Water	3.5 COP	AHRI/ISO-13256-2
Ground Source Brine-to-Water (Heating Mode)	<135,000 Btu/h (Cooling Capacity)	32°F Entering Water	3.1 COP	AHRI/ISO-13256-2

[a] Reserved.

[b] IPLVs and part load rating conditions are only applicable to equipment with capacity modulation.

[c] Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

[d] Applies to all units, including single phase and three phase. For single phase air-cooled heat pumps <65,000 Btu/h, SEER and HSPF values are those set by NAECA.

[e] Reserved.

TABLE 14-1C

WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS[a]

Equipment Type	Size Category	Units	PATH A[b] Full Load	PATH A[b] IPLV	PATH B[b] Full Load	PATH B[b] IPLV	Test Procedure[c]
Air Cooled Chillers	<150 tons	EER	≥9.562	≥12.500	NA[a]	NA[a]	AHRI 550/590-03
	≥150 tons	EER	≥9.562	≥12.750	NA[a]	NA[a]	
Air-Cooled Without Condenser, Electrically Operated[f]	All Capacities	Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements					
Water-Cooled, Electrically Operated, Reciprocating	All Capacities	Reciprocating units must comply with water cooled positive displacement efficiency requirements					
Water-Cooled, Electrically Operated, Positive Displacement and Heat Recovery Chillers	<75 tons (larger sizes to comply with centrifugal requirements)	kW/ton	≤0.780[f]	≤0.630	≤0.800[f]	≤0.600	
	~~((≥75 tons and <150 tons~~	~~kW/ton~~	~~≤0.775~~	~~≤0.615~~	~~≤0.790~~	≤0.586	
	~~≥150 tons and <300 tons~~	kW/ton	≤0.680	≤0.580	≤0.718	≤0.540	
	≥300 tons	kW/ton	≤0.620	≤0.5[illegible]0	≤0.639	≤0.[illegible]	
Water Cooled, Electrically Operated, Centrifugal	<150 tons	kW/ton	≤0.634[f]	≤0.596	≤0.639	≤0.450	
	≥150 tons and <300 tons	kW/ton	≤0.634[f]	≤0.596	≤0.639[f]	≤0.450	
	≥300 tons and <600 tons	kW/ton	≤0.576[f]	≤0.549	≤0.600[f]	≤0.400	
	≥600 tons	kW/ton	≤0.570[f]	≤0.539	≤0.590[f]	≤0.400	

Air-Cooled Absorption Single Effect	All Capacities	COP	≥0.600	NR[d]	NA[e]	NA[e]	ARI 560
Water-Cooled Absorption Single Effect	All Capacities	COP	≥0.700	NR[d]	NA[e]	NA[e]	ARI 560
Absorption Double Effect	All Capacities	COP	≥1.000	≥1.050	NA[e]	NA[e]	
Absorption Double Effect Direct Fired	All Capacities	COP	≥1.000	≥1.000	NA[e]	NA[e]	

[a] The shell-and-tube equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is <38°F.

[b] Compliance with this standard can be obtained by meeting the minimum requirements of Path A or Path B. However, both the A and IPLV must be met to fulfill the requirements of Path A or Path B.

[c] NA means that this requirement is not applicable and cannot be used for compliance.

[d] NR means that there are no minimum requirements for this category.

[e] Chilled water plants and buildings with more than 300 tons total capacity shall not have more than 100 tons provided by air-cooled chillers.

[f] Path A and efficiency requirements do not apply to positive displacement chillers used in condenser water heat recovery systems.

TABLE 14-10

PACKAGED TERMINAL AIR CONDITIONERS,

PACKAGED TERMINAL HEAT PUMPS, ROOM AIR CONDITIONERS,

AND ROOM AIR CONDITIONER HEAT PUMPS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY

REQUIREMENTS

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[c]
PTAC (Cooling Mode) Standard Size	All Capacities	95°F db Outdoor Air	12.5 - (0.213 x Cap/1000)[f] EER (before 10/08/2012) 13.8 - (0.300 x Cap/1000)[f] EER (as of 10/08/2012)	AHRI 310/380
		82°F db Outdoor Air	16.7 - (0.213 x Cap/1000)[f] EER	
PTAC (Cooling Mode) Nonstandard Size[g]	All Capacities	95°F db Outdoor Air	10.8 - (0.213 x Cap/1000)[f] EER	
		82°F db Outdoor Air	13.1 - (0.213 x Cap/1000)[f] EER	
PTHP (Cooling Mode) Standard Size	All Capacities	95°F db Outdoor Air	12.3 - (0.213 x Cap/1000)[f] EER (before 10/08/2012) 14.0 - (0.300 x Cap/1000)[f] EER (as of 10/08/2012)	
		82°F db Outdoor Air	14.5 - (0.213 x Cap/1000)[f] EER	
PTHP (Cooling Mode) Nonstandard Size[g]	All Capacities	95°F db Outdoor Air	10.8 - (0.213 x Cap/1000)[f] EER	
		82°F db Outdoor Air	13.0 - (0.213 x Cap/1000)[f] EER	
Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[c]
PTHP (Heating Mode) Standard Size	All Capacities		3.3 - (0.026 x Cap/1000)[f] COP (before 10/08/2012) 3.7 - (0.052 x Cap/1000)[f] COP (as of 10/08/2012)	
PTHP (Heating Mode) Nonstandard Size[g]	All Capacities		2.9 - (0.026 x Cap/1000)[f] COP	
SPVAC (Cooling Mode)	< 65,000 Btu/h	95°F db/75°F wb Outdoor Air	9.0 EER	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/75°F wb Outdoor Air	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/75°F wb Outdoor Air	8.6 EER	
SPVHP (Cooling Mode)	< 65,000 Btu/h	95°F db/75°F wb Outdoor Air	9.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/75°F wb Outdoor Air	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/75°F wb Outdoor Air	8.6 EER	
SPVAC (Heating Mode)	< 65,000 Btu/h	47°F db/43°F wb Outdoor Air	3.0 COP	
Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[c]
	≥ 65,000 Btu/h and < 135,000 Btu/h	47°F db/43°F wb Outdoor Air	3.0 COP	
	≥ 135,000 Btu/h and < 240,000 Btu/h	47°F db/43°F wb Outdoor Air	2.9 COP	
Room Air Conditioners, with Louvered Sides	< 6,000 Btu/h		9.7 EER	ANSI/ AHAM/ RAC-1
	≥ 6,000 Btu/h and < 8,000 Btu/h		9.7 EER	
	≥ 8,000 Btu/h and < 14,000 Btu/h		9.8 EER	
	≥ 14,000 Btu/h and < 20,000 Btu/h		9.7 EER	
	≥ 20,000 Btu/h		8.5 EER	
Room Air Conditioners, without Louvered Sides	< 8,000 Btu/h		9.0 EER	
	≥ 8,000 Btu/h and < 20,000 Btu/h		8.5 EER	
	≥ 20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps with Louvered Sides	< 20,000 Btu/h		9.0 EER	
	≥ 20,000 Btu/h		8.5 EER	

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[c]
Room Air Conditioner Heat Pumps without Louvered Sides	< 14,000 Btu/h		8.5 EER	ANSI/ AHAM/ RAC-1
	≥ 14,000 Btu/h		8.0 EER	
Room Air Conditioner, Casement Only	All Capacities		8.7 EER	
Room Air Conditioner, Casement–Slider	All Capacities		9.5 EER	

[a] Reserved.

[b] Cop means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the units capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

[c] Non-standard size units must be factory labeled as follows: "MANUFACTURED FOR NONSTANDARD SIZE APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Nonstandard size efficiencies apply only to units being installed in existing sleeves having an external wall opening of less than 16-in. high or less than 42-in. wide and having a cross-sectional area less than 670 in².

[d] Casement-only and casement-slider air conditioners are not separate product classes in the current minimum efficiency criteria.

[e] New room air conditioner standards, enacted by NAECA, became effective October 1, 2000.

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Table 14-1G

Performance Requirements for Heat Rejection Equipment

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[c]
Propeller or Axial Fan Open-Circuit Cooling Towers	All propeller or axial fan, PLUS centrifugal fan ≥ 1100 gpm	95°F (35°C) Entering Water 85°F (29°C) Leaving Water 75°F (24°C) wb Outdoor Air	18.2 gpm/hp (5.23 L/s-kW)	CTI ATC-105 and CTI STD-201
Centrifugal Fan Open-Circuit Cooling Towers[d]	≤ 1100 gpm (larger sizes must comply with propeller/axial fan requirements) (All)	95°F (35°C) Entering Water 85°F (29°C) Leaving Water 75°F (24°C) wb Outdoor Air	20.0 gpm/hp (1.7 L/s-kW)	CTI ATC-105 and CTI STD-201
Propeller or Axial Fan Closed-Circuit Cooling Towers	All	102°F (29°C) Entering Water 90°F (32°C) Leaving Water 75°F (24°C) wb Outdoor Air	14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal Fan Closed-Circuit Cooling Towers	All	102°F (39°C) Entering Water 92°F (32°C) Leaving Water 75°F (24°C) wb Outdoor Air	7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Air Cooled Condensers	All	125°F (52°C) Condensing Temperature R22 Test Fluid 190°F (88°C) Entering Gas Temperature 15°F (8°C) Subcooling 95°F (35°C) Entering Drybulb	176,000 Btu/hp 09 COP[e]	AHRI 460

[a] For purposes of this table, open-circuit cooling tower performance is defined as the process water flow rating of tower at thermal rating conditions listed in this table divided by the fan nameplate rated motor power.

[b] For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of tower at thermal conditions listed in this table divided by the sum of fan motor nameplate power.

[c] For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.

[d] Centrifugal fan open-circuit cooling towers with a combined rated capacity of 1,000 gpm or greater at 95°F condenser water return, 85°F condenser water supply, and 75°F entering air wet-bulb temperature shall comply with the energy efficiency requirement for axial fan open-circuit cooling towers listed in Table 14-1G except for those that comply with the exception listed in Section 1438.1.2.

***

TABLE 11-3 (((SUPERSEDED))

PIPING SYSTEM DESIGN MAXIMUM FLOW RATE IN GPM[1]

Pipe Size (in)	≤ 2500 hours/year		>2500 and ≤4400 hours/year		> 4400 hours/year	
	Other	Variable Flow/ Variable Speed	Other	Variable Flow/ Variable Speed	Other	Variable Flow/ Variable Speed
2.5	120	180	85	130	58	110
3	180	270	140	210	110	170
4	350	530	260	420	210	320
5	510	820	330	470	250	370
6	740	1100	570	860	440	680
8	1200	1800	900	1400	700	1100
10	1800	2700	1300	2000	1000	1600
12	2500	3800	1900	2900	1500	2300

1. There are no requirements for pipe sizes smaller than the minimum shown in the table or larger than the maximum shown in the table.

***

TABLE 14-6

MINIMUM PIPE INSULATION THICKNESS[1]

Fluid Design Operating Temp Range (°F)	Insulating Conductivity		Nominal Pipe or Tube Size (in.)				
	Conductivity Btu in/(h·ft²·°F)	Mean Rating Temp, °F	<1	1 to <1-1/2	1-1/2 to <4	4 to <8	≥8

Heating and Hot Water Systems (Steam, Steam Condensate, ((and)) Hot Water Heating and Domestic Water Systems)[a]

>350	0.32-0.34	250	4.5 (3.5)	5.0 (3.5)	5.0 ((3.5))	5.0 ((4.5))	5.0 ((4.5))
251-350	0.29-0.32	200	3.0 (2.5)	4.0 (3.5)	4.5 (3.5)	4.5 (3.5)	4.5 (3.5)
201-250	0.27-0.30	150	2.5 ((1.5))	2.5 ((1.5))	3.0	3.0 ((2.5))	3.0 ((2.5))
141-200	0.25-0.29	125	1.5	1.5	2.0 ((1.5))	2.0	2.0
105-140	0.22-0.28	100	1.0	1.0	1.0	1.5	1.5

((Domestic and Boys on Hot Water Systems

105	0.22-0.28	100	1.0	1.0	1.5	1.5	1.5))

Cooling Systems (Chilled Water, Brine and Refrigerant)

40-60	0.23-0.28	150	1.0	1.0	1.5	1.5	1.5
<40	0.23-0.28	100	1.0	1.0	1.5	1.0	1.0

[a] For installation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:

$T = r\{(t/r + 1)^{(K/k)} - 1\}$

where

T = minimum insulation thickness (in.),

r = actual outside radius of pipe (in),

t = insulation thickness listed in this table for applicable fluid temperature and pipe size,

K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature, Btu·in/(h·ft²·°F), and

k = the upper value of the conductivity range listed in this table for the applicable fluid temperature.

Piping insulation is not required between the control valve and coil on systems when the control valve is located within 4 feet of the coil and the pipe size is 1 inch or less.

Section 14. The following sections of Chapter 15 of the 2009 Washington State Energy Code are amended, and new sections are added to that Chapter, as follows:

***

Section 1510 General Requirements: Lighting and motors shall comply with Sections 1511 through 1514. Lighting systems shall comply with one of the following paths:

a. Prescriptive Lighting Option:
Interior Section 1521, or
Exterior Section 1522.

b. Lighting Power Allowance Option:
Interior Section 1531, or
Exterior Section 1532.

c. Systems Analysis. See Section 1141.4.

The compliance path selected for interior and exterior lighting need not be the same. However, interior and exterior lighting cannot be traded. In addition, parking garage lighting cannot be traded with other interior lighting or with exterior lighting. See the Seattle Building Code, Section 3016.15, for energy efficiency requirements for lighting in elevators.

Transformers shall comply with Section 1540.

1511 Electric Motors: All permanently wired polyphase motors of 1 hp or more, which are not part of an HVAC system, shall comply with Section 1437.

EXCEPTIONS: 1. Motors that are an integral part of specialized process equipment.

2. Where the motor is integral to a listed piece of equipment for which no compliant motor has been approved.

Informative Note: As indicated in Section 1120, the Energy Code applies to industrial facilities, as well as commercial and industrial processes. Thus, the motor efficiency requirements apply to industrial facilities, as well as systems and equipment used in commercial and industrial processes, unless a motor qualifies for one of the exceptions.

***

1513.1 Local Control and Accessibility: Each space, enclosed by walls or ceiling-height partitions, shall be provided with lighting controls located within that space. The lighting controls, whether one or more, shall be capable of turning off all lights within the space. The controls shall be readily accessible, at the point of entry/exit, to personnel occupying or using the space.

EXCEPTIONS: The following lighting controls may be combined with other locations:

1. Lighting controls for spaces which must be used as a whole.
2. Automatic controls, when provided in addition to manual controls.
3. Controls requiring trained operators.
4. Controls for safety hazards and security.

***

1513.3 Daylight Zone Control: All daylighted zones, as defined in Chapter 2, both under skylights((overhead-glazing)) and adjacent to vertical fenestration((glazing)), shall be provided with individual controls, or daylight-or occupant-sensing automatic controls, which control the lights independent of general area lighting.

In all areas with skylights, monitors or other fenestration at or above ceiling level and in all areas with windows and all areas in parking garages with façade openings, all permanent luminaires in the daylighted zone shall be controlled by automatic daylight sensing controls. The primary daylighted zone shall be controlled separately from the secondary daylighted zone.

Automatic daylight sensing controls shall:

a. Be capable of reducing the light output of the controlled luminaires while maintaining a uniform level of illuminance by either:
1. Continuous dimming to at least 20% light output; or
2. Step switching of each lamp in individual luminaires (noncontinuous dimming devices shall have adjustable separation (deadband) of on and off points to prevent short cycling) and provide an automatic OFF control, switching alternate luminaires is not permitted except with single lamp luminaires); or
3. Step dimming by reducing the output of all of the lamps in individual luminaires by at least 50% and provide an automatic OFF control.

b. Control only luminaires within the daylighted area.

c. Incorporate time-delay circuits to prevent cycling of light level changes of less than five minutes.

Any switching devices installed to override the automatic daylighting control shall comply with the criteria in Section 1513.6.2 items a through c.

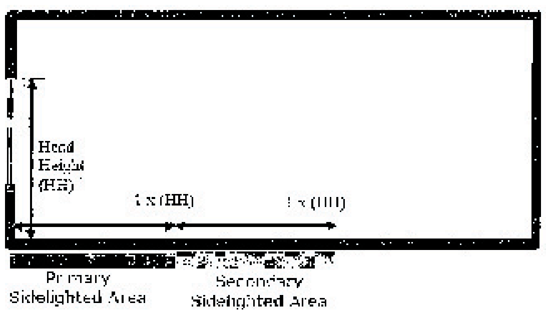
Contiguous daylight zones adjacent to vertical fenestration((glazing)) are allowed to be controlled by a single controlling device serving no more than eight fixtures or 60 linear feet of façade whichever is less provided that they do not include zones facing more than two adjacent cardinal orientations (i.e., north, east, south, west). Daylight zones under skylights((overhead-glazing)) shall be controlled separately from daylight zones adjacent to vertical fenestration((glazing)).

EXCEPTION: The following are exempt from the requirements for automatic daylighting controls in Section 1513.3, if they have separate control of the lights in the daylight zone, which control is independent of general area lighting:

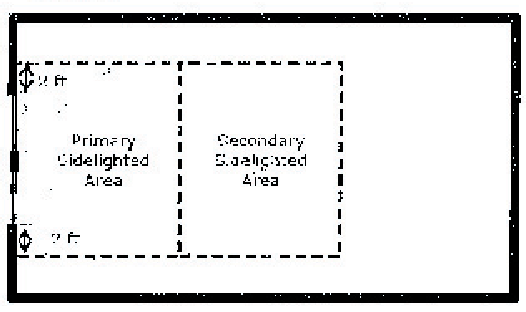
1. Retail and restaurant spaces adjacent to vertical fenestration((glazing)) (retail and restaurant spaces under skylights ((overhead glazing)) are not exempt).
2. Lighting exempted by Section 1512
3. Display, exhibition and specialty lighting complying with Section 1513.4.
4. The following spaces are exempt from the requirements for automatic daylighting controls in Section 1513.3 provided that they have occupancy sensor controls that comply with Section 1513.6.1:
   a. Small spaces in the daylighted zone that are normally unoccupied (such as a storage room with a window or restrooms);
   b. Rooms less than 250 square feet; and
   c. Conference rooms 300 square feet and larger that have a lighting control system with at least four scene options and an occupancy sensor control that complies with Section 1513.6.1.
5. HID lamps with automatic controls that are capable of reducing the power consumption by at least 50%.
6. HID lamps 150 watts or less.

Informative Note: The following graphics from addendum ac to RS-6 provide a visual representation of the primary and secondary daylighting zones adjacent to vertical fenestration.

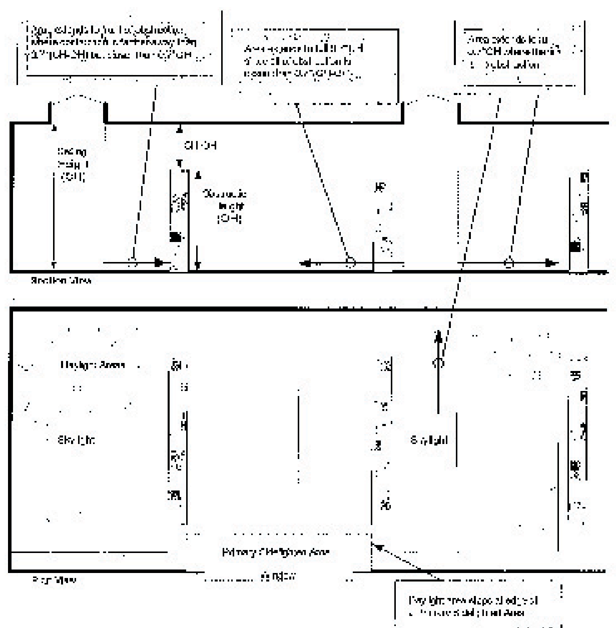
a) Section View

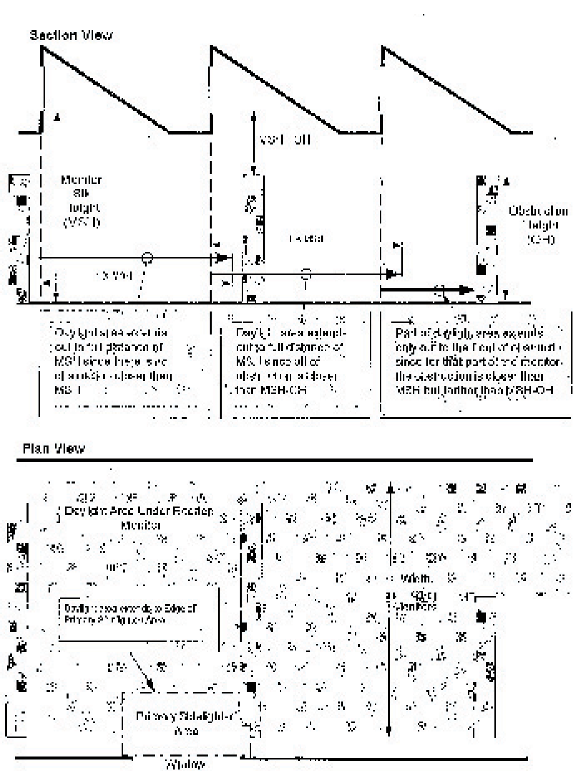


b) Plan View



Informative Note: The following graphics from addendum ac to RS-6 provide a visual representation of daylighting zones under skylights and under high vertical fenestration.





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1513.5 Automatic Reduction and Shut-off Controls, Exterior: Lighting for exterior applications not exempted in Section 1512 shall comply with the following requirements:

a. Lighting shall be controlled by a device that automatically turns off the lighting when sufficient daylight is available by either:
   i. A combination of a photosensor and a time switch; or
   ii. An astronomical time switch.
b. All building façade lighting shall be automatically shut off between midnight or business/facility closing, whichever is later, and 6 am or business/facility opening, whichever comes first.
c. Lighting not specified in paragraph b above, including advertising signage, shall be controlled by a device that automatically reduces the connected lighting power, on a system-wide basis, by at least 30% for at least one of the following conditions:
   1. from 12 midnight or one hour after the end of business/facility operations, if any, whichever is later, until 6am or business/facility opening, whichever is earlier; or
   2. during any period when no activity has been detected for a time of no longer than 15 minutes.

((Lighting for all exterior applications shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours. Lighting not designated for dusk to dawn operation shall be controlled by either:

a. A combination of a photosensor and a time switch; or
b. An astronomical time switch.

Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor.)) All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

EXCEPTION: Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

1513.6 Automatic Reduction and Shut-Off Controls, Interior: All buildings shall be equipped with separate automatic controls to shut off the lighting in all spaces during unoccupied hours, including lighting with dual functionality as normal and emergency lighting.

Within these buildings, the following spaces shall be equipped with occupancy sensors that comply with Section 1513.6.1:

a. all office areas less than 300 ft² enclosed by walls or ceiling-height partitions, and
b. all meeting and conference rooms, and training rooms,
c. all ((school)) classrooms and lecture halls,
d. all employee lunch and break rooms,
e. all rooms used for document copying and printing,
f. all restrooms,
g. all dressing, locker, and fitting rooms, and
h. warehouse and storage spaces greater than 50 ft² ((shall be equipped with occupancy sensors that comply with Section 1513.6.1))

In addition, lighting in stairwells and parking garages shall have one or more control devices to automatically reduce lighting power in any one controlled zone by at least 50% within 30 minutes of all occupants leaving that controlled zone. Lighting zones for occupancy sensors in parking garages shall be no larger than 3,600 ft².

For all other spaces not specifically mentioned above, automatic controls may be an occupancy sensor, time switch, or other device capable of automatically shutting off lighting. (For hotel and motel guestrooms, see Section 1513.7.)

EXCEPTIONS:

1. Areas that must be continuously illuminated (e.g., 24-hour convenience stores), or illuminated in a manner requiring manual operation of the lighting.
2. Emergency lighting and means of egress illumination as required by code that are automatically off during normal building operation.
3. Switching for industrial or manufacturing process facilities as may be required for production.
4. 24-hour occupancy areas in hospitals and laboratory spaces.
5. Areas in which medical or dental tasks are performed are exempt from the occupancy sensor requirement.
6. Dwelling units.

1513.6.1 Occupancy Sensors: Occupancy sensors shall be capable of automatically turning off all the lights in an area, no more than 30 minutes after the area has been vacated. Light fixtures controlled by occupancy sensors shall have a wall-mounted, manual switch capable of turning off lights when the space is occupied. Occupancy sensors either shall be manual ON or shall be controlled to automatically turn the lighting on to no more than 50% power.

EXCEPTIONS:

1. Occupancy sensors in stairwells are allowed to have two-step lighting (high-light and low-light) provided the control fails in the high-light position.
2. Stairwells and parking garages are not permitted to have a wall-mounted manual switch.
3. Restrooms, warehouses, stairwells, and parking garages are allowed to use automatic ON to bring the lighting to 100% power.

1513.6.2 Automatic Time Switches: Automatic time switches shall have a minimum 7-day clock and be capable of being set for 7 different day types per week and incorporate an automatic holiday "shut-off" feature, which turns off all loads for at least 24 hours and then resumes normally scheduled operations. Automatic time switches shall also have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted.

Automatic time switches shall incorporate an over-ride switching device which:

a. Is readily accessible;
b. Is located so that a person using the device can see the lights or the areas controlled by the switch, or so that the area being illuminated is annunciated; and
c. Is manually operated;
d. Allows the lighting to remain on for no more than two hours when an over-ride is initiated; and
e. Controls an area not exceeding ((5,000)) 2,500 square feet or 5 percent of footprint for footprints over 100,000 square feet, whichever is greater.

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1513.8 Commissioning Requirements: For lighting controls which include daylight or occupant sensing automatic controls, automatic shut-off controls, occupancy sensors, or automatic time switches, the lighting controls shall be tested to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications.

When occupant sensors, time switches, or photosensors are used, the following functionality testing shall be performed:

a. Confirm that the sensitivity and time-out adjustments for occupant sensors yield acceptable performance (i.e. lights turn off only after space is vacated). At initial installation, occupancy sensor controls shall be set to turn lights off at 15 minutes unless other thresholds are specifically mentioned in the approved permit.
b. Confirm that the time switches are programmed to turn the lights off.
c. Confirm that photosensor controls reduce electric light levels based on the amount of usable daylight in the space as specified. At initial installation, automatic daylighting sensor setpoints shall be set at 30 footcandles or not more than 110% of the footcandle level specified on the drawings in the approved permit.

The construction documents for the electrical permit shall state the party who will conduct and certify the functional testing. The party responsible for the functional testing shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria. Certification shall be specific enough to verify conformance.

See Section 1416 for complete requirements. Optional examples of test methods and forms are provided in Reference Standard 34.

1521 Prescriptive Interior Lighting Requirements: Spaces for which the Unit Lighting Power Allowance in Table 15-1 is 0.80 W/ft² or greater may use unlimited numbers of lighting fixtures and lighting energy, provided that the installed lighting fixtures comply with all ((four)) three of the following criteria:

a. one-lamp ((or two-lamp (but not three-))) (but not two- or more lamps);

((b. luminaires have a reflector or louver assembly to direct the light (bare lamp strip or industrial fixtures do not comply with this section);))

b. ((c.)) fitted with type T-1, T-2, T-4, T-5, T-8 or compact fluorescent lamps from 5 to 60 watts (but not T-10 or T-12 lamps); and

c. ((d.)) hard-wired fluorescent electronic dimming ballasts with photocell or programmable dimming control for all lamps in all zones (nondimming electronic ballasts and electronic ballasts that screw into medium base sockets do not comply with this section).

Track lighting ((is)) and bare lamp strip or industrial fixtures are not allowed under this path

EXCEPTIONS:

1. Up to a total of 5% of installed lighting fixtures may use any type of ballasted lamp and do not require dimming controls.
2. Clear safety lenses are allowed in food prep and serving areas and patient care areas in otherwise compliant fixtures.
3. LED lights.
4. Metal halide lighting which complies with all three of the following criteria:
   i. Luminaires or fixtures which have a reflector or louver assembly to direct the light,
   ii. fixtures are fitted with ceramic metal halide lamps not exceeding 150 watts, and
   iii. electronic ballasts.

1531 Interior Lighting Power Allowance: The interior lighting power allowance shall be calculated by multiplying the gross interior floor area, in square feet, by the appropriate unit lighting power allowance, in watts per square foot, for the use as specified in Table 15-1. Accessory uses, including corridors, lobbies and toilet facilities shall be included with the primary use.

The lighting power allowance for each use shall be separately calculated and summed to obtain the interior lighting power allowance.

In cases where a lighting plan for only a portion of a building is submitted, the interior lighting power allowance shall be based on the gross interior floor area covered by the plan. Plans submitted for common areas only, including corridors, lobbies and toilet facilities shall use the lighting power allowance for common areas in Table 15-1.

When insufficient information is known about the specific use of the space, the allowance shall be based on the apparent intended use of the space.

Compliance shall be demonstrated separately for covered parking.

Informative Note: Section 1515 prohibits trading between interior and exterior lighting, and prohibits trading between parking garage lighting and other interior lighting or exterior lighting.

1532 Exterior lighting power allowance. All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lm/W unless the luminaire is controlled by a motion sensor or qualifies for one of the following exceptions.

The total exterior lighting power allowance for all exterior building applications is the sum of the base site allowance plus the individual allowances for areas that are designated on the buildings plans to be illuminated and are permitted in Table 15-2B for the applicable lighting zone. Trade-offs are allowed only among exterior lighting applications listed in the Table 15-2B "Tradable Surfaces" section. The lighting zone for building exterior is determined from Table 15-2A((, unless otherwise specified by the local jurisdiction)).

EXCEPTION: Lighting used for the following exterior applications is exempt when equipped with a control device independent of the control of the nonexempt lighting:

a. Specialized signal, directional, and marker lighting associated with transportation.
b. ((Lighting integral to)) Internally-illuminated signs
c. Lighting integral to equipment or instrumentation and installed by its manufacturer
d. Lighting for theatrical purposes, including performance, stage, film production, and video production.
e. Lighting for athletic playing areas
f. Temporary lighting.
g. Lighting for industrial production.
h. Theme elements in theme/amusement parks.
i. Lighting used to highlight features of public monuments.
j. Group U Occupancy accessory to Group R-3 or R-4 Occupancy.

For open parking and outdoor areas and roadways, luminaires mounted more than 15 feet above the ground shall be Full Cutoff Luminaires. (Full Cutoff means a luminaire light distribution where zero candela intensity occurs at an angle of 90 degrees above nadir, and all greater angles from nadir.)

Section 1540 Transformers: ((The minimum efficiency of a low voltage dry type distribution transformer shall be the Class I Efficiency Levels for distribution transformers specified in Table 4-2 of the "Guide for Determining Energy Efficiency for Distribution Transformers" published by the National Electrical Manufacturers Association (NEMA TP-1-2002).)) Low voltage dry-type transformers shall comply with the provisions of the Energy Policy Act of 2005 where applicable, as shown in Table 15-3. Transformers that are not included in the scope of the Energy Policy Act of 2005 have no performance requirements in this section, and are listed for ease of reference below as exceptions.

Exceptions: Transformers that meet the Energy Policy Act of 2005 exclusions based on NEMA TP-1 definition:

1. special purpose applications.
2. not likely to be used in general purpose applications.
3. transformers with multiple voltage taps where the highest tap is at least 20% more than the lowest tap.

Products meeting these criteria and exempted from Section 1540 include the following: drive transformer, rectifier transformer, auto-transformer, uninterruptible power system transformer, impedance transformer, regulating transformer, sealed and nonventilating transformer, machine tool transformer, welding transformer, grounding transformer, or testing transformer.

TABLE 15-1
UNIT LIGHTING POWER ALLOWANCE (LPA)

Use[1]	LPA[2] (W/ft²)
Automotive facility and aircraft maintenance	((0.82)) 0.82
Convention center	((1.15)) 1.08
Courthouse	((1.05)) 1.05
Cafeterias, fast food establishments[3], restaurants/bars[3]	((1.20)) 0.95
Dormitory	((0.55)) 0.5
Dwelling unit	1.00
Exercise center	((0.95)) 0.88
Gymnasium((5)), assembly spaces((5))	0.95

Health care clinic	((1.00)) 0.87
Hospitals, physicians, nursing homes, and other Group I-1 and I-2 Occupancies	1.20
Hotel/motel	1.00
Laboratory spaces (all spaces not classified "laboratory" shall meet office and other appropriate categories)	1.62
Laundries	1.20
Libraries[5]	((1.20)) 1.18
Manufacturing facility	((1.20)) 1.11
Museum	1.00
Office buildings, office/administrative areas in facilities of other use types (including but not limited to schools, hospitals, institutions, museums, banks, churches)[5]((5,7,11))	((0.94)) 0.90
Parking garages	0.20
Penitentiary and other Group I-3 Occupancies	0.90
Police and fire stations	0.90
Post office	((1.20)) 0.87
Retail[10], retail banking, mall concourses, wholesale stores (pallet rack shelving)	1.34
School buildings (Group E Occupancy only), school classrooms, day care centers	((1.20)) 0.99
Theater, motion picture	((0.97)) 0.82
Theater, performance arts	1.25
Transportation	((0.90)) 0.77
Warehouses	0.50
Workshop	1.20
Plans Submitted for Common Areas Only(([7]))	
Main floor building lobbies[3] (except mall concourses)	1.10
All building common areas, corridors, toilet facilities and washrooms, elevator lobbies, including Group R-1 and R-2 Occupancies	0.80

Footnotes for Table 15-1

1. In cases in which a general use and a specific use are listed, the specific use shall apply. In cases in which a use is not mentioned specifically, the *Unit Lighting Power Allowance* shall be determined by the building official. This determination shall be based upon the most comparable use specified in the table. See Section 1512 for exempt areas.

2. The watts per square foot may be increased, by 2% per foot of ceiling height above 20 feet, unless specifically directed otherwise by subsequent footnotes.

3. The watts per square foot of room may be increased by 2% per foot of ceiling height above 12 feet.

4. ((For all other spaces, such as seating and common areas, use the *Unit Lighting Power Allowance* for assembly.)) Reserved.

5. The watts per square foot of room may be increased by 2% per foot of ceiling height above 9 feet.

6. Reserved.

7. ~~((For conference rooms and offices less than 150 ft² with full height partitions, a Unit Lighting Power Allowance of 1.1 w/ft² may be used.))~~ Reserved.

8. Reserved.

9. ((For indoor sport tournament courts with adjacent spectator seating over 5,000, the *Unit Lighting Power Allowance* for the court area is 2.60 W/ft².)) Reserved.

10. Display window illumination installed within 2 feet of the window, provided that the display window is separated from the retail space by walls or at least three-quarter-height partitions (transparent or opaque) and lighting for free-standing display where the lighting moves with the display are exempt.

An additional lighting power allowance is allowed for merchandise display luminaires installed in retail sales areas that are specifically designed and directed to highlight merchandise. The following additional wattages apply:

i. ((0.6)) 0.4 watts per square foot of sales floor area not listed in ii or iii below.

ii. ((1.4)) 0.9 watts per square foot of furniture, clothing, cosmetics or artwork floor area, or

iii. ((2.5)) 1.5 watts per square foot of jewelry, crystal, or china floor area.

The specified floor area for i, ii, or iii above, and the adjoining circulation paths shall be identified and specified on building plans. Calculate the additional power allowance by multiplying the above LPDs by the sales floor area for each department excluding major circulation paths. The total additional lighting power allowance is the sum of allowances for sales categories i, ii, or iii plus an additional 1,000 watts for each separate tenant larger than 250 square feet in area.

The additional wattage is allowed only if the merchandise display luminaires comply with all of the following:

a. located on ceiling-mounted track or directly on or recessed into the ceiling itself (not on the wall),

b. adjustable in both the horizontal and vertical axes (vertical axis only is acceptable for fluorescent and other fixtures with two points of track attachment),

This additional lighting power is allowed only if the specified lighting is actually installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose.

11. ((Provided that a floor plan, indicating rack location and height, is submitted, the square footage for a ~~warehouse may be defined, for computing the interior *Unit Lighting Power Allowance*, as the floor area not covered by racks plus the vertical face area (access side only) of the racks. The height allowance defined in~~ footnote 2 applies only to the floor area not covered by racks.)) Reserved.

TABLE 15-2A

EXTERIOR LIGHTING ZONES

Lighting Zone	Description
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High-activity commercial districts in major metropolitan areas as designated by the local jurisdiction

TABLE 15-2B

LIGHTING POWER DENSITIES FOR BUILDING EXTERIORS

	Specific area description	Zone 1	Zone 2	Zone 3 and Zone 4	((Zone 4))
Base site allowance[1]		500 W	600 W	750 W	((1300 W))
Tradable Surfaces[2]					
Uncovered Parking Areas	Parking areas and drives	0.04 W/ft²	0.06 W/ft²	0.10 W/ft²	((0.13 W/ft²))
Building Grounds	Walkways less than 10 feet wide	0.70 W/linear foot	0.70 W/linear foot	0.80 W/linear foot	((1.0 W/linear foot))
	Walkways 10 feet wide or greater, Plaza areas, Special feature areas	0.14 W/ft²	0.14 W/ft²	0.16 W/ft²	((0.2 W/ft²))
	Stairways	0.75 W/ft²	1.00 W/ft²	1.00 W/ft²	((1.0 W/ft²))
	Pedestrian tunnel	0.15 W/ft²	0.15 W/ft²	0.20 W/ft²	((0.3 W/ft²))
	Landscaping	0.04 W/ft²	0.05 W/ft²	0.05 W/ft²	((0.05 W/ft²))
Building Entrances and Exits	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	((30 W/linear foot of door width))
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	((20 W/linear foot of door width))
	Entry canopies	0.25 W/ft²	0.25 W/ft²	0.40 W/ft²	((0.4 W/ft²))
Sales Canopies	Free standing and attached	0.60 W/ft²	0.60 W/ft²	0.80 W/ft²	((1.0 W/ft²))
Outdoor Sales	Open areas[3]	0.25 W/ft²	0.25 W/ft²	0.50 W/ft²	((0.7 W/ft²))
	Street frontage for vehicle sales lots in addition to "open area" allowance	No Allowance	10 W/linear foot	20 W/linear foot	((30 W/linear foot))
Nontradable Surfaces[4]					
Building Facades and Signs		No Allowance	0.10 W/ft² for each illuminated wall or surface[5]	0.15 W/ft² for each illuminated wall or surface[6]	((0.2 W/ft² for each illuminated wall or surface[7]))
Automated Teller Machines and Night Depositories		270 W per location[8]	270 W per location[8]	270 W per location[8]	((270 W per location[8]))
Entrances and Gatehouse Inspection Stations at Guarded Facilities		0.75 W/ft² of covered and uncovered area	0.75 W/ft² of covered and uncovered area	0.75 W/ft² of covered and uncovered area	((0.75 W/ft² of covered and uncovered area))
Loading Areas for Law Enforcement, Fire, Ambulance and Other Emergency Service Vehicles		0.50 W/ft² of covered and uncovered area	0.50 W/ft² of covered and uncovered area	0.50 W/ft² of covered and uncovered area	((0.5 W/ft² of covered and uncovered area))
Material Handling and Associated Storage		No Allowance	No Allowance	0.50 W/ft²	((0.5 W/ft²))
Drive-up Windows and Doors		400 W per drive-through	400 W per drive-through	400 W per drive-through	((400 W per drive-through))
Parking Near 24-hour Retail Entrances		800 W per main entry	800 W per main entry	800 W per main entry	((800 W per main entry))

FOOTNOTES FOR TABLE 15-2B

1. Base site allowance may be used in tradable or nontradable surfaces.

2. Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.

3. Including vehicle sales lots.

4. Lighting power density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.

5. May alternately use 2.5 watts per linear foot for each wall or surface length.

6. May alternately use 3.75 watts per linear foot for each wall or surface length.

7. May alternately use 5 watts per linear foot for each wall or surface length.

8. An additional 90 watts is allowed per additional ATM location.

TABLE 15-3

MINIMUM NOMINAL EFFICIENCY LEVELS FOR

NEMA CLASS I LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS[a]

Single Phase Transformers		Three Phase Transformers	
KVA[b]	Efficiency (%)[c]	KVA[b]	Efficiency (%)[c]
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

a. A low voltage distribution transformer is a transformer that is air-cooled, does not use oil as a coolant, has an input voltage <= 600 Volts, and is rated for operation at a frequency of 60 Hertz.

b. kiloVolt-Amperes.

c. Nominal efficiencies shall be established in accordance with the NEMA TP-1-2002 test procedure for low voltage dry-type transformers. Class I Low Voltage Dry-Type is a National Electrical Manufacturers Association (NEMA) design class designation.

Section 15. A new Chapter 16 of the Seattle Energy Code is enacted, as follows:

CHAPTER 16
ON-SITE RENEWABLE ENERGY SYSTEMS

1601 Scope. Effective Date: This chapter covers the requirements for on-site renewable energy systems or additional energy savings by other means. This chapter applies to new buildings and additions of more than 5,000 ft² to existing buildings.

This Chapter 16 shall take effect on the effective date of a rule adopted under Section 1631 that provides alternate means of compliance. Prior to that date, references in this Code to Chapter 16 are not effective.

1610 General Requirements: The building shall include on-site renewable energy systems or shall comply with another option as indicated in Figure 16A:

a. Prescriptive. See Section 1621.

b. Alternate Means of Compliance. See Section 1631.

c. Systems Analysis. See Section 1141.4.

FIGURE 16A
ON-SITE RENEWABLE ENERGY SYSTEMS COMPLIANCE OPTIONS

Section Number	Subject	Prescriptive Option	DR with Alternate Means of Compliance	Systems Analysis Option
1610	General Requirements	X	X	X
1620	Prescriptive Option	X		
1621	Annual Production	X		
1630	Alternate Means of Compliance		X	
1631	Director's Rule		X	
RS-29	Systems Analysis			X

1620 Prescriptive Option for On-Site Renewable Energy Systems.

1621 Annual Production of On-site Renewable Energy Systems. Building projects shall contain on-site renewable energy systems that provide the annual energy production equivalent to 500 Btu/ft² of gross conditioned floor area. The annual energy production shall be the combined sum of all on-site renewable energy systems.

1630 Alternate Means of Compliance.

1631 Development by Director's Rule. The Director of DPD shall develop and adopt by rule one or more alternate means of compliance for this Chapter. Each alternate means of compliance shall be designed to achieve energy savings that are at least as great as the energy production achieved over the expected life of the building through compliance with Section 1621. Alternate means allowed by rule may include, without limitation, payments or contributions related to off-site renewable energy production.

On-site renewable energy systems are preferred. This section is intended to ensure that a feasible alternative is available when the nature of a site or project makes on-site renewable energy systems impracticable, without requiring a determination as to practicality in each case. This section is not intended to authorize any financially more attractive means of compliance for a typical project than compliance with Section 1621, taking into account expected costs and benefits of each option over the expected life of the building, and without regard to any subsidies that may be available for on-site renewable energy systems.

Informative Note: The 2030 Challenge specifies a set of total building energy consumption thresholds that gradually reduce over time to reach net zero energy consumption in new buildings by 2030. (A rough rule-of-thumb from those working on net-zero energy buildings in the Northwest is that net-zero energy buildings would be achieved by a combination of a 75% reduction in building energy load with the remaining 25% being provided by on-site renewable energy.)

The 2010 threshold is for new buildings to use at least 60% less energy than the average existing building. Taking office buildings as an example, the maximum energy use for new office buildings in Seattle is approximately 32,400 Btu/ft²-yr (as the baseline for the average existing office building is 81,000 btu/ft²-yr).

The value of 500 Btu/ft² of gross conditioned floor area is approximately 1.5% of the total energy consumption of a new office building complying with the 2030 Challenge and consuming 32,400 Btu/ft²-yr. As service water heating loads in office buildings are often in the range of 1% - 3% of total energy consumption, this means that a solar water heating system could be an option for complying with the prescriptive on-site renewable energy system option (as an alternative to photovoltaics).

For photovoltaic (PV) systems, local conservative rules of thumb are 1000 kWh and 100 ft² per kW of DC rated PV capacity. In practice, performance in any given year may be 1200 kWh/kW or higher, based on metered data from customer systems in the Seattle City Light service area (approximately 235 systems as of early 2010). Some newer crystalline modules are rated at 12 - 17 W/ft².

See DPD's Client Assistance Memo 420, Solar Energy Systems, for discussion of permit requirements, land use requirements, design and installation considerations, interconnection and net metering requirements, financial incentives, and sources for further information.

Section 16. The following sections or subsections of Reference Standard 29 of the 2009 Washington State Energy Code are amended as follows:

((APPENDIX))

REFERENCE STANDARD 29

(RS-29)

NONRESIDENTIAL AND MULTIFAMILY RESIDENTIAL BUILDING DESIGN

BY SYSTEMS ANALYSIS

***

REFERENCE STANDARD 29

NONRESIDENTIAL AND MULTIFAMILY RESIDENTIAL BUILDING DESIGN BY SYSTEMS ANALYSIS

NOTE: ((Washington State))Seattle Energy Code Reference Standard 29 (RS-29) is a modified version of Appendix G from ASHRAE/IESNA Standard 90.1-2007.

RS-29 has been completely rewritten from the 2006 edition.

***

1.1 General: This Standard establishes design criteria in terms of total energy consumption of a building, including all of its systems.

The building permit application for projects utilizing this Standard shall include in one submittal all building and mechanical drawings and all information necessary to verify that the building envelope and mechanical design for the project corresponds with the annual energy analysis. If credit is proposed to be taken for lighting energy savings, then an electrical permit application shall also be submitted and approved prior to the issuance of the building permit. If credit is proposed to be taken for energy savings from other components, then the corresponding permit application (e.g., plumbing, boiler, etc.) shall also be submitted and approved prior to the building permit application. Otherwise, components of the project that would not be approved as part of a building permit application shall be modeled the same in both the proposed building and the baseline

building and shall comply with the requirements of the ((Washington State)) Seattle Energy Code.

1.2 Performance Rating. This performance rating method requires conformance with the following provisions:

All requirements of Sections 1201 through ((1202)) 1204, 1310 through 1314, 1410 through 1416, 1440 through 1446, 1450 through 1455, 1460 through 1465, 1510 through 1514, and 1540 are met. These sections contain the mandatory provisions of the standard and are prerequisites for this rating method. The proposed design shall not vary from those requirements in Sections 1320 through 1334, 1420 through 1439, 1470, 1475, 1520 through 1532, and 1620 through 1621 except to the extent those variations have been accurately and completely modeled. Where variations are not specifically analyzed, the proposed design shall comply with the requirements of the sections referred to in the preceding sentence.

The improved performance of the proposed building design is calculated in accordance with provisions of this ((appendix))standard using the following formula:

Percentage improvement = 100 x (Baseline building performance - Proposed building performance) / Baseline building performance

A "proposed building" designed in accordance with this standard will be deemed as complying with this Code, if the calculated annual energy consumption is 5% less than that of a corresponding "baseline building."

Notes: 1. Both the proposed building performance and the baseline building performance shall include all end-use load components, such as receptacle and process loads.

2. Neither the proposed building performance nor the baseline building performance are predictions of actual energy consumption or costs for the proposed design after construction. Actual experience will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, energy use not covered by this procedure, changes in energy rates between design of the building and occupancy, and the precision of the calculation tool.

1.3 Trade-Off Limits. When the proposed modifications apply to less than the whole building, only parameters related to the systems to be modified shall be allowed to vary. Parameters relating to unmodified existing conditions or to future building components shall be identical for determining both the baseline building performance and the proposed building performance. Future building components shall meet the requirements of Sections 1320 through 1334, 1420 through 1439, 1470, 1475, ((and)) 1530 through 1532, and 1620 through 1631.

1.4 Documentation Requirements: Simulated performance shall be documented, and documentation shall be submitted to the building official in accordance with the Reporting Format in Section 5 of RS-29. The information submitted shall include the material specified in Section 5 of RS-29 as well as the following:

a. Calculated values for the baseline building performance, the proposed building performance, and the percentage improvement.

b. A list of the energy-related features that are included in the design and on which the performance rating is based. This list shall document all energy features that differ between the models used in the baseline building performance and proposed building performance calculations.

c. Input and output report(s) from the simulation program or compliance software including a breakdown of energy usage by at least the following components: Lights, internal equipment loads, service water heating equipment, space heating equipment, space cooling and heat rejection equipment, fans, and other HVAC equipment (such as pumps). The output reports shall also show the amount of time any loads are not met by the HVAC system for both the proposed design and baseline building design.

d. An explanation of any error messages noted in the simulation program output.

***

2.3 Climatic Data: The simulation program shall perform the simulation using hourly values of climatic data, such as temperature and humidity from representative climatic data, for the site in which the proposed design is to be located. For cities or urban regions with several climatic data entries, and for locations where weather data are not available, the designer shall select available weather data that best represent the climate at the construction site. The selected weather data shall be approved by the building official.

Exterior design conditions are 24°F dry bulb for heating and 82°F dry bulb/66°F wet bulb for cooling.

For ground temperatures for below-grade wall and basement floor heat loss calculations, it is acceptable to use an annual average ground temperature of 53°F. If monthly temperatures are desired, the following values are acceptable: J - 49°F, F - 48°F, M - 49°F, A - 51°F, M - 53°F, J - 55°F, J - 57°F, A - 58°F, S - 57°F, O - 55°F, N - 53°F, D - 51°F.

For water main temperatures, it is acceptable to use an annual water main supply temperature of 53°F. If monthly temperatures are desired, the following values are acceptable: J - 44°F, F - 44°F, M - 46°F, A - 51°F, M - 56°F, J - 61°F, J - 65°F, A - 66°F, S - 59°F, O - 50°F, N - 49°F, D - 45°F (based on 14-year average from Seattle Water Department).

2.4 Energy Conversion: The comparison between the baseline building and proposed design shall be expressed as kBtu input per square foot of conditioned floor area per year at the building site. Buildings which use electricity as the only fuel source, comparisons may be expressed in kWh. When converting electricity in kWh to kBtu a multiplier of 3.413 kWh/kBtu shall be used.

EXCEPTION: On-site renewable energy sources or site recovered energy shall not be considered to be consumed energy and shall not be included in the proposed building performance. When Chapter 16 of this Code applies, baseline building performance shall exclude from consumed energy the amount that is or would be provided by on-site renewable energy sources to comply with the prescriptive option in Section 1621. ((Where)) To the extent that on-site renewable or site-recovered sources are used and would not be required to satisfy Section 1621, the baseline building performance shall be based on the energy source used as the backup energy source or on the use of electricity if no backup energy source has been specified.

2.5 Exceptional Calculation Methods. Where no simulation program is available that adequately models a design, material, or device, the building official may approve an exceptional calculation method to demonstrate above-standard performance using this method.

Applications for approval of an exceptional method shall include documentation of the calculations performed and theoretical and/or empirical information supporting the accuracy of the method.

If there are multiple designs, materials or devices that the simulation program does not model, each shall be calculated separately and energy savings from the exceptional method determined for each. Unless otherwise approved by the building official, at no time shall the total energy savings from the exceptional method constitute more than one-half of the difference between the baseline building performance and the proposed building performance. All applications for approval of an exceptional method shall include:

a. step-by-step documentation of the exceptional calculation method performed detailed enough to enable the reader to reproduce the results;

b. copies of all spreadsheets used to perform the calculations;

c. a sensitivity analysis of energy consumption when each of the input parameters is varied from half to double the value assumed;

d. calculations performed on a time step basis consistent with the simulation program used;

e. the percentage improvement calculated with and without the exceptional calculation method.

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3.1 Building Performance Calculations. The simulation model for calculating the proposed and baseline building performance shall be developed in accordance with the requirements in Table 3.1. The specifications of the proposed design used in the analysis shall be as similar as is reasonably practical to those in the plans submitted for a permit. In all cases, the baseline building shall comply with Sections 1320 through 1334, 1420 through 1439, 1470, 1475, 1520 through 1532, and 1620 through 1631. Where this Code does not contain requirements, the specifications and operations of the standard design and of the proposed design shall be identical. Where assumptions are not specified in this Code, the values shall be based on accepted engineering practice and are subject to the review and approval of the building official.

For the baseline building and the proposed building, shading by permanent structures and terrain shall be taken into account for computing energy consumption whether or not these features are located on the building site. A permanent fixture is one that is likely to remain for the life of the proposed design.

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3.1.2.2 Equipment Capacities. The equipment capacities for the baseline building design shall be based on sizing runs for each orientation (per Table 3.1, No. 5c) and shall be oversized by 15% for cooling and 25% for heating, i.e., the ratio between the capacities used in the annual simulations and the capacities determined by the sizing runs shall be 1.15 for cooling and 1.25 for heating. Unmet load hours for the proposed design or baseline building designs shall not exceed 300 (of the 8760 hours simulated), and unmet load hours for the proposed design shall not exceed the number of unmet load hours for the baseline building design ((by more than 50)). ((If unmet load hours in the proposed design exceed the unmet load hours in the baseline building by more than 50, simulated capacities in the baseline building shall be decreased incrementally and the building resimulated until the unmet load hours are within 50 of the unmet load hours of the proposed design.)) If unmet load hours for the proposed design or baseline building design exceed 300, simulated capacities shall be increased incrementally, and the building with unmet loads resimulated until unmet load hours are reduced to 300 or less. Alternatively, unmet load hours exceeding these limits may be accepted at the discretion of the building official provided that sufficient justification is given indicating that the accuracy of the simulation is not significantly compromised by these unmet loads.

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3.1.2.9 System Fan Power. System fan electrical power for supply, return, exhaust, and relief (excluding power to fan-powered VAV boxes) shall be calculated using the following formulas:

For Systems 1 and 2,

$P_{fan} = CFMS \times 0.3$,

For Systems 3 through 8,

$P_{fan} = bhp \times 746/\text{Fan Motor Efficiency}$.

Where:

P_{fan}	=	Electric power to fan motor (watts) and
bhp	=	Brake horsepower of baseline fan motor from Table 3.1.2.9. Single zone variable-air-volume systems shall comply with the constant volume fan power limitation.
Fan Motor Efficiency	=	The efficiency from Table 14-4 for the next motor size greater than the bhp using the enclosed motor at 1800 rpm.
CFMS	=	The baseline system maximum design supply fan airflow rate in cfm

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TABLE 3.1

Modeling Requirements for Calculating Proposed and Baseline Building Performance

No. Proposed Building Performance	Baseline Building Performance
1. Design Model	
a. The simulation model of the proposed design shall be consistent with the design documents, including proper accounting of fenestration and opaque envelope types and areas; interior lighting power and controls; HVAC system types, sizes, and controls; and service water heating systems and controls. All end-use load components within and associated with the building shall be modeled, including, but not limited to, exhaust fans, parking garage ventilation fans, snow-melt and freeze-protection equipment, facade lighting, swimming pool heaters and pumps, elevators and escalators, refrigeration, and cooking. Where the simulation program does not specifically model the functionality of the installed system, spreadsheets or other documentation of the assumptions shall be used to generate the power demand and operating schedule of the systems.	The baseline building design shall be modeled with the same number of floors and identical conditioned floor area as the proposed design.
b. All conditioned spaces in the proposed design shall be simulated as being both heated and cooled even if no heating or cooling system is to be installed, and temperature and humidity control setpoints and schedules shall be the same for proposed and baseline building designs. Unless otherwise expressly permitted by the building official based on the needs of a particular use, space temperature controls shall be set at 70°F for space heating and 75°F for space cooling, with a deadband in accordance with Section 1412.2.	

No. Proposed Building Performance	Baseline Building Performance
The system shall be OFF during off hours according to the appropriate schedule in Table 3.3, except that the heating system shall cycle ON if any space should drop below the night setback temperature of 55°F and the cooling system shall cycle ON if any space should rise above the setup temperature of 90°F.	
c. When the performance rating method is applied to buildings in which energy-related features have not yet been designed (e.g., a lighting system), those yet-to-be-designed features shall be described in the proposed design exactly as they are defined in the baseline building design. Where the space classification for a space is not known, the space shall be categorized as an office space.	
2. Additions and Alterations	

No. Proposed Building Performance	Baseline Building Performance
It is acceptable to predict performance using building models that exclude parts of the existing building provided that all of the following conditions are met: a. Work to be performed in excluded parts of the building shall meet the requirements of Chapters 11 through ((14)) 16. b. Excluded parts of the building are served by HVAC systems that are entirely separate from those serving parts of the building that are included in the building model.	Same as Proposed Design
c. Design space temperature and HVAC system operating setpoints and schedules on either side of the boundary between included and excluded parts of the building are essentially the same.	
d. If a declining block or similar utility rate is being used in the analysis and the excluded and included parts of the building are on the same utility meter, the rate shall reflect the utility block or rate for the building plus the addition.	
3. Space Use Classification	

No. Proposed Building Performance	Baseline Building Performance
Usage for each space shall be specified using the ((building type or space type)) lighting classifications in accordance with Sections 1530 through 1531. ((The user shall specify the space use classifications using either the building type or space type categories but shall not combine the two types of categories. More than one building type category may be used in a building if it is a mixed-use facility. If space type categories are used, the user may simplify the placement of the various space types within the building model, provided that building-total areas for each space type are accurate.))	Same as Proposed Design
4. Schedules	

No. Proposed Building Performance	Baseline Building Performance
Schedules capable of modeling hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation shall be used. The schedules shall be typical of the proposed building type as determined by the designer and approved by the building official. Default schedules are included in Tables 3.3A through 3.3I. HVAC Fan Schedules. Schedules for HVAC fans that provide outdoor air for ventilation shall run continuously whenever spaces are occupied and shall be cycled on and off to meet heating and cooling loads during unoccupied hours. Exceptions: a. Where no heating and/or cooling system is to be installed and a heating or cooling system is being simulated only to meet the requirements described in this table, heating and/or cooling system fans shall not be simulated as running continuously during occupied hours but shall be cycled on and off to meet heating and cooling loads during all hours. b. HVAC fans shall remain on during occupied and unoccupied hours in spaces that have health and safety mandated minimum ventilation requirements during unoccupied hours.	Same as Proposed Design. Exception: Schedules may be allowed to differ between proposed design and baseline building design when necessary to model nonstandard efficiency measures, provided that the revised schedules have the approval of the building official. Measures that may warrant use of different schedules include, but are not limited to, lighting controls, ((natural ventilation,)) demand control ventilation, and measures that reduce service water heating loads.
5. Building Envelope	

No. Proposed Building Performance	Baseline Building Performance
All components of the building envelope in the proposed design shall be modeled as shown on architectural drawings or as built for existing building envelopes. Exceptions: The following building elements are permitted to differ from architectural drawings: a. All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate floor slabs, concrete floor beams over parking garages, roof parapet) shall be separately modeled using either of the following techniques: 1. Separate model of each of these assemblies within the energy simulation model. 2. Separate calculation of the U-factor for each of these assemblies. The U-factors of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average U-factor is modeled within the energy simulation model. Infiltration. For a design where a total door and leakage rate... [illegible]	Equivalent dimensions shall be assumed for each exterior envelope component type as in the proposed design; i.e., the total gross area of exterior walls shall be the same in the proposed and baseline building designs. The same shall be true for the areas of roofs, floors, and doors, and the exposed perimeters of concrete slabs on grade shall also be the same in the proposed and baseline building designs. The following additional requirements shall apply to the modeling of the baseline building design: a. Orientation. The baseline building performance shall be generated by simulating the building with its actual orientation and again after rotating the entire building 90, 180, and 270 degrees, then averaging the results. The building shall be modeled so that it does not shade itself. b. Opaque Assemblies. Opaque assemblies used for new buildings or additions shall conform with the following common, lightweight assembly types and shall match the appropriate

Infiltration. For a design where the air leakage rate has not been determined, the leakage is 0.3% when the building fan system is off and 0.25% when the building fan system is on, unless otherwise approved by the building official for unusually pressurized buildings. Per PNNL Report 18898, Infiltration Modeling Guidelines for Commercial Building Energy Analysis, the building air leakage rates as determined in accordance with Section 1314.6.2 at 0.30 in. w.g. (75 Pa) shall be converted for modeling in annual energy analysis programs by being multiplied by 0.112 unless other multipliers are approved by the building official (e.g., a tested air leakage of 0.40 cfm/ft² of building envelope area at 0.30 in. w.g. (75 Pa) would be modeled at 0.045 cfm/ft² of building envelope area). The Proposed Building air leakage rate shall be the same as the Standard Design. The Proposed building shall comply with Section 1314.6.2.

Any other envelope assembly that covers less than 5% of the total area of that assembly

No. Proposed Building Performance	Baseline Building Performance
	c. Vertical Fenestration. Vertical fenestration areas for new buildings and additions shall equal that in the proposed design or 40% of gross above-grade wall area, whichever is smaller, and shall be distributed on each face of the building in the same proportions in the proposed design. Fenestration U-factors and SHGC shall match the appropriate requirements in Tables 13-1 and 13-2. All vertical glazing shall be assumed to be flush with the exterior wall, and no shading projections shall be modeled. Manual window shading devices such as blinds or shades shall not be modeled. The fenestration areas for envelope alterations shall reflect the limitations on area, U-factor, and SHGC as described in Section 1132.1.

No. Proposed Building Performance	Baseline Building Performance
	d. Skylights and Glazed Smoke Vents. Skylight area shall be equal to that in the proposed building design or 5% of the gross roof area that is part of the building envelope, whichever is smaller. If the skylight area of the proposed building

No. Proposed Building Performance	Baseline Building Performance
	design is greater than 5% of the gross roof area, baseline skylight area shall be decreased by an identical percentage in all roof components in which skylights are located to reach the 5% skylight-to-roof ratio. Skylight orientation and tilt shall be the same as in the proposed building design. Skylight U-factor and SHGC properties shall match the appropriate requirements in Tables 13-1 and 13-2.
	c. Roof albedo. All roof surfaces shall be modeled with a reflectivity of 0.30.

No. Proposed Building Performance	Baseline Building Performance
	f. Existing Buildings. For existing building envelopes, the baseline building design shall reflect existing conditions prior to any revisions that are part of the scope of work being evaluated.
	g. Air leakage. The baseline building air leakage rate shall match the value determined according to Section 1314.6.2. The air leakage rates at standard test conditions shall be converted for energy modeling purposes as described under "Proposed Building Performance" in this table. The air leakage rate as modeled for hours when the fan system is off and the air leakage percentage modeled for hours when the fan system is on shall be the same as the Proposed Building.

6. Lighting

No. Proposed Building Performance	Baseline Building Performance
Lighting power in the proposed design shall be determined as follows: a. Where a complete lighting system exists, the actual lighting power for each thermal block shall be used in the model. b. Where a lighting system has been designed, lighting power shall be determined in accordance with Chapter 15. c. Where lighting neither exists nor is specified, lighting power shall be determined in accordance with the building area method for the appropriate building type. d. Lighting system power shall include all lighting system components shown or provided for on the plans (including lamps and ballasts and task and furniture mounted fixtures). Exception: For multifamily dwelling units, hotel/motel guest rooms, and other spaces in	Lighting power in the baseline building design shall be determined using the same categorization procedure and categories as the proposed design with lighting power set equal to the maximum allowed for the corresponding method and category in Chapter 15. Automatic lighting controls (e.g., programmable controls or automatic controls for daylight utilization) shall be modeled in the baseline building design as required by Section 1513.

No. Proposed Building Performance	Baseline Building Performance
which lighting systems are connected via receptacles and are not shown or provided for on building plans, assume identical lighting power for the proposed and baseline building designs in the simulations. e. Lighting power for parking garages and building facades shall be modeled. f. Credit may be taken for the use of automatic controls for daylight utilization not otherwise required by Section 1513 but only if their operation is either modeled directly in the building simulation or modeled in the building simulation through schedule adjustments determined by a separate daylighting analysis approved by the building official. g. For automatic lighting controls in addition to those required for minimum code compliance under Section 1513, credit may be taken for automatically controlled systems by reducing the connected lighting power by the applicable percentages listed in Table 15-2. Alternatively, credit may be taken for these devices by modifying the lighting schedules used for the proposed design, provided that credible technical documentation for the modifications are provided to the building official.	
Informative Note: Per Section 1510, interior and exterior lighting cannot be traded. In addition, parking garage lighting cannot be traded with other interior lighting or with exterior lighting.	

No. Proposed Building Performance	Baseline Building Performance
7. Thermal Blocks–HVAC Zones Designed	
Where HVAC zones are defined on HVAC design drawings, each HVAC zone shall be modeled as a separate thermal block. Exception: Different HVAC zones may be combined to create a single thermal block or identical thermal blocks to which multipliers are applied, provided that all of the following conditions are met: a. The space use classification is the same throughout the thermal block. b. All HVAC zones in the thermal block that are adjacent to glazed exterior walls face the same orientation or their orientations vary by less than 45 degrees. c. All of the zones are served by the same HVAC system or by the same kind of HVAC system.	Same as Proposed Design
8. Thermal Blocks–HVAC Zones Not Designed	
Where the HVAC zones and systems have not yet been designed, thermal blocks shall be defined based on similar internal load densities, occupancy, lighting, thermal and space temperature schedules, and in combination with the following guidelines:	Same as Proposed Design.

No. Proposed Building Performance	Baseline Building Performance
a. Separate thermal blocks shall be assumed for interior and perimeter spaces. Interior spaces shall be those located greater than 15 ft from an exterior wall. Perimeter spaces shall be those located within 15 ft of an exterior wall.	
b. Separate thermal blocks shall be assumed for spaces adjacent to glazed exterior walls; a separate zone shall be provided for each orientation, except that orientations that differ by less than 45 degrees may be considered to be the same orientation. Each zone shall include all floor area that is 15 ft or less from a glazed perimeter wall, except that floor area within 15 ft of glazed perimeter walls having more than one orientation shall be divided proportionately between zones. c. Separate thermal blocks shall be assumed for spaces having floors that are in contact with the ground or exposed to ambient conditions from zones that do not share these features. d. Separate thermal blocks shall be assumed for spaces having exterior ceiling or roof assemblies from zones that do not share these features.	
9. Thermal Blocks–Multifamily Residential Buildings	
Residential spaces shall be modeled using at least one thermal block per dwelling unit, except that those units facing the same orientations may be combined into one thermal block. Corner units and units with roof or floor loads shall only be combined with units sharing these features.	Same as Proposed Design.

No. Proposed Building Performance	Baseline Building Performance
10. HVAC Systems	
The HVAC system type and all related performance parameters in the proposed design, such as equipment capacities and efficiencies, shall be determined as follows: a. Where a complete HVAC system exists, the model shall reflect the actual system type using actual component capacities and efficiencies. b. Where an HVAC system has been designed, the HVAC model shall be consistent with design documents. Mechanical equipment efficiencies shall be adjusted from actual design conditions to the standard rating conditions specified in Section 1411 if required by the simulation model. c. Where no heating system exists or no heating system has been specified, the heating system classification shall be assumed to be electric, and the system characteristics shall be identical to the system modeled in the baseline building design. d. Where no cooling system exists or no cooling system has been specified, the cooling system shall be identical to the system modeled in the baseline building design.	The HVAC system(s) in the baseline building design shall be of the type and description specified in Section 3.1.1, shall meet the general HVAC system requirements specified in Section 3.1.2, and shall meet any system-specific requirements in Section 3.1.3 that are applicable to the baseline HVAC system type(s).

11. Service Hot-Water Systems

No. Proposed Building Performance	Baseline Building Performance
The service hot-water system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design shall be determined as follows:	The service hot-water system in the baseline building design shall use the same energy source as the corresponding system in the proposed design and shall conform with the following conditions:
a. Where a complete service hot-water system exists, the proposed design shall reflect the actual system type using actual component capacities and efficiencies.	a. Where the complete service hot-water system exists, the baseline building design shall reflect the actual system type using actual component capacities and efficiencies.
b. Where a service hot-water system has been specified, the service hot-water model shall be consistent with design documents.	b. Where a new service hot water system has been specified, the system shall be sized using the same methods and values as the proposed design and the equipment shall match the minimum efficiency requirements in Chapter 14. Where the energy source is electricity, the heating method shall be electrical resistance.

No. Proposed Building Performance	Baseline Building Performance
c. Where no service hot-water system exists or has been specified, but the building will have service hot-water loads, a service hot-water system shall be modeled that matches the system in the baseline building design and serves the same hot-water loads.	c. Where no service hot-water system exists or has been specified but the building will have service hot-water loads, a service water system(s) using electric-resistance heat and matching minimum efficiency requirements of Chapter 14 shall be assumed and modeled identically in the proposed and baseline building designs.
d. For buildings that will have no service hot water loads, no service hot water system shall be modeled.	d. For buildings that will have no service hot water loads, no service hot water heating shall be modeled. e. Where a combined system has been specified to meet both space heating and service water heating loads, the baseline building system shall use separate systems meeting the minimum efficiency requirements applicable to each system

No. Proposed Building Performance	Baseline Building Performance
	f. For large, 24-hour-per-day facilities that meet the prescriptive criteria for use of condenser heat recovery systems described in Section 1436.3, a system meeting the requirements of that section shall be included in the baseline building design regardless of the exceptions to Section 1436.3. Exception: If a condenser heat recovery system meeting the requirements described in Section 1436.3 cannot be modeled, the requirement for including such a system in the actual building shall be met as a prescriptive requirement in accordance with Section 1436.3, and no heat-recovery system shall be included in the proposed or baseline building designs.

No. Proposed Building Performance	Baseline Building Performance
	g. Service hot-water energy consumption shall be calculated explicitly based upon the volume of service hot water required and the entering makeup water and the leaving service hot-water temperatures. Entering water temperatures shall be estimated based upon the location. Leaving temperatures shall be based on the end-use requirements. h. Where recirculation pumps are used to ensure prompt availability of service hot water at the end use, the energy consumption of such pumps shall be calculated explicitly. i. Service water loads and usage shall be the same for both the baseline building design and the proposed design and shall be documented by the calculation procedures described in the manufacturer's specifications or generally accepted engineering methods.

No. Proposed Building Performance	Baseline Building Performance
	Exceptions: 1. Appliances that are not built-in (e.g., washing machines) and plumbing fixtures (e.g., faucets and low-flow showerheads) shall be modeled the same for both the baseline building design and the proposed design. Other service hot-water usage can be demonstrated to be reduced by documented water conservation measures that reduce the physical volume of service water required. Such reduction shall be demonstrated by calculations.

No. Proposed Building Performance	Baseline Building Performance
	2. Service hot-water energy consumption can be demonstrated to be reduced by reducing the required temperature of service mixed water, by increasing the temperature, or by increasing the temperature of the entering makeup water. Examples include alternative sanitizing technologies for dishwashing and heat recovery to entering makeup water. Such reduction shall be demonstrated by calculations. 3. Service hot-water usage can be demonstrated to be reduced by reducing the hot fraction of mixed water to achieve required operational temperature. Examples include shower or laundry heat recovery to incoming cold-water supply, reducing the hot-water fraction required to meet required mixed water temperature. Such reduction shall be demonstrated by calculations.
12. Receptacle and Other Loads	

No. Proposed Building Performance	Baseline Building Performance
Receptacle and process loads where not otherwise covered by this Code, such as those for office and other equipment, shall be estimated based on the building type or space type category and shall be assumed to be identical in the proposed and baseline building designs. These loads shall be included in simulations of the building and shall be included when calculating the baseline building performance and proposed building performance. Default process loads are included in Table 3-4.1.	Other systems, such as motors covered by Sections 1437, 1438 and 1511, and miscellaneous loads shall be modeled as identical to those in the proposed design including schedules of operation and control of the equipment. Where there are specific efficiency requirements in Sections 1437, 1438 and 1511, these systems or components shall be modeled as having the lowest efficiency allowed by those requirements. Where no efficiency requirements exist, power and energy rating or capacity of the equipment shall be identical between the baseline building and the proposed design with the following exception: Variations of the power requirements, schedules, or control sequences of the equipment modeled in the baseline building from those in the proposed design may be allowed by the building official based upon documentation that the equipment installed in the proposed design represents a significant verifiable departure from documented conventional practice. The burden of this documentation is to demonstrate that accepted conventional

No. Proposed Building Performance	Baseline Building Performance
13. Modeling Limitations to the Simulation Program	
If the simulation program cannot model a component or system included in the proposed design explicitly, substitute a thermodynamically similar component model that can approximate the expected performance of the component that cannot be modeled explicitly.	Same as Proposed Design.

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TABLE 3.3A

Assembly Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting[2]/Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0
6 (5-6 am)	0	0	0	5	5	5	On	Off	Off	0	0	0	0	0	0
7 (6-7 am)	0	0	0	15/40	5	5	On	On	On	0	0	0	0	0	0
8 (7-8 am)	0	0	0	15/40	30	30	On	On	On	0	0	0	0	0	0
9 (8-9 am)	20	20	10	15/40	30	30	On	On	On	0	0	0	0	0	0
10 (9-10 am)	20	20	10	65/75	40/50	30	On	On	On	5	5	5	0	0	0
11 (10-11 am)	20	20	10	65/75	40/50	30	On	On	On	5	5	5	0	0	0
12 (11-12 pm)	80	60	10	65/75	40/50	30	On	On	On	35	20	10	0	0	0
13 (12-1 pm)	80	60	10	65/75	40/50	55/65	On	On	On	5	0	0	0	0	0
14 (1-2 pm)	80	60	70	65/75	40/50	55/65	On	On	On	5	0	0	0	0	0
15 (2-3 pm)	80	60	70	65/75	40/50	55/65	On	On	On	5	0	0	0	0	0
16 (3-4 pm)	80	60	70	65/75	40/50	55/65	On	On	On	5	0	0	0	0	0
17 (4-5 pm)	80	60	70	65/75	40/50	55/65	On	On	On	5	0	0	0	0	0
18 (5-6 pm)	80	60	70	65/75	40/50	55/65	On	On	On	0	0	0	0	0	0
19 (6-7 pm)	20	60	70	65/75	40/50	55/65	On	On	On	0	0	0	0	0	0
20 (7-8 pm)	20	60	70	65/75	40/50	55/65	On	On	On	0	65	65	0	0	0
21 (8-9 pm)	20	60	70	65/75	40/50	55/65	On	On	On	0	30	30	0	0	0
22 (9-10 pm)	20	60	70	65/75	40/50	55/65	On	On	On	0	0	0	0	0	0
23 (10-11 pm)	10	0	20	35	40/50	5	On	On	On	0	0	0	0	0	0
24 (11-12 am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0
Total/Day	[illegible]	750	700	1020/1135	660/800	715/845	1900	1700	1700	70	175	115	0	0	0
Total/Week	[illegible] hours			65.55/74.30 hours			134 hours			5.0 hours			0 hours		
Total/Year	[illegible] hours			3355/3869 hours			6968 hours			300 hours			0 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6

TABLE 3.3B

Health Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting[2]/Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
2 (1-2 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
3 (2-3 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
4 (3-4 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
5 (4-5 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
6 (5-6 am)	0	0	0	10	10	5	On	On	On	1	1		0	0	0
7 (6-7 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
8 (7-8 am)	10	10	0	45/50	20	5	On	On	On	17		1	2	2	0
9 (8-9 am)	50	40	5	80/90	35/40	10	On	On	On	58	20	1	75	46	2
10 (9-10 am)	80	40	5	80/90	35/40	10	On	On	On	66	28	1	100	70	2
11 (10-11 am)	80	40	5	80/90	35/40	10	On	On	On	78	30	1	100	70	2
12 (11-12 pm)	80	40	5	80/90	35/40	10	On	On	On	82	30	1	100	75	2
13 (12-1 pm)	80	40	5	80/90	35/40	10	On	On	On	71	24	1	75	51	2
14 (1-2 pm)	80	10	5	80/90	35/40	10	On	On	On	82	24	1	100	51	2
15 (2-3 pm)	80	10	5	80/90	35/40	10	On	On	On	78	22	1	100	51	2
16 (3-4 pm)	80	10	5	80/90	35/40	10	On	On	On	74	20	1	100	51	2
17 (4-5 pm)	80	10	0	20	35/40	5	On	On	On	63	20	1	100	51	0
18 (5-6 pm)	50	10	0	20	35/40	5	On	On	On	41	10	1	100	25	0
19 (6-7 pm)	30	10	0	30	10	5	On	On	On	5	1		52	2	0
20 (7-8 pm)	30	0	0	30	10	5	On	On	On	12	1	1	52	0	0
21 (8-9 pm)	30	0	0	30	10	5	On	On	On	18	1	1	52	0	0
22 (9-10 pm)	20	0	0	30	10	5	On	On	On	18	1	1	28	0	0
23 (10-11 pm)	0	0	0	30	10	5	On	On	On	1	1	1	0	0	0
24 (11-12 am)	0	0	0	10	10	5	On	On	On	1	1	1	0	0	0
Total/Day	550	380	40	935/1060	500/550	150	2400	2400	2400	782	249	24	1130	545	16
Total/Week	[illegible] hours			55.35/60.10 hours			168 hours			41.88 hours			57.36 hours		
Total/Year	2135 hours			2375/3134 hours			8760 hours			2148 hours			3213 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

TABLE 3.3C

Hotel/Motel Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)	90	90	70	20	20	30	On	On	On	20	20	25	40	44	55
2 (1-2 am)	90	90	70	15	20	20	On	On	On	15	15	20	33	33	55
3 (2-3 am)	90	90	70	10	15	20	On	On	On	15	15	20	33	33	43
4 (3-4 am)	90	90	70	10	10	20	On	On	On	15	15	20	33	35	43
5 (4-5 am)	90	90	70	10	10	20	On	On	On	20	20	20	33	35	43
6 (5-6 am)	90	90	70	20	10	20	On	On	On	25	25	30	33	35	43
7 (6-7 am)	70	70	70	40	30	20	On	On	On	50	40	50	42	40	52
8 (7-8 am)	40	50	60	50	30	40	On	On	On	60	50	50	42	[illegible]	52
9 (8-9 am)	20	30	50	40	40	40	On	On	On	55	50	50	32	43	63
10 (9-10 am)	20	30	50	40	40	30	On	On	On	45	50	55	32	45	63
11 (10-11 am)	20	30	50	25	30	30	On	On	On	40	45	50	41	42	55
12 (11-12 pm)	20	30	50	25	25	30	On	On	On	45	50	50	51	60	60
13 (12-1 pm)	20	30	30	25	25	30	On	On	On	40	50	40	51	65	53
14 (1-2 pm)	20	30	20	25	25	20	On	On	On	35	45	40	51	65	53
15 (2-3 pm)	20	30	20	25	25	20	On	On	On	30	40	30	51	65	50
16 (3-4 pm)	30	30	20	25	25	20	On	On	On	30	40	30	[illegible]	65	44
17 (4-5 pm)	50	30	30	25	25	20	On	On	On	30	35	30	63	65	64
18 (5-6 pm)	50	50	40	25	25	20	On	On	On	40	40	40	80	75	62
19 (6-7 pm)	50	60	40	60	60	50	On	On	On	55	55	50	86	91	[illegible]
20 (7-8 pm)	70	60	60	80	70	70	On	On	On	60	55	50	70	80	65
21 (8-9 pm)	70	60	60	90	70	80	On	On	On	50	50	40	70	73	65
22 (9-10 pm)	80	70	60	90	70	60	On	On	On	55	55	50	50	75	65
23 (10-11 pm)	90	70	70	80	60	50	On	On	On	45	40	40	43	55	[illegible]
24 (11-12 am)	90	70	70	30	30	30	On	On	On	25	30	20	45	55	40
Total/Day	1590	1350	1300	855	755	810	2400	2400	2400	915	530	500	217	1303	1287
Total/Week	95.40 hours			58.70 hours			168.0 hours			54.05 hours			86.75 hours		
Total/Year	[illegible] hours			3061 hours			8760 hours			2840 hours			4523 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.

TABLE 3.3D

Light Manufacturing Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting[2]/Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
6 (5-6 am)	0	0	0	10	5	5	Off	Off	Off	8	8	7	0	0	0
7 (6-7 am)	10	10	5	20	10	5	On	On	Off	7	7	1	0	0	0
8 (7-8 am)	20	10	5	20	10	5	On	On	Off	19	11	4	35	16	0
9 (8-9 am)	95	30	5	85/90	30	5	On	On	Off	35	15	4	69	14	0
10 (9-10 am)	95	30	5	85/90	30	5	On	On	Off	38	21	4	43	21	0
11 (10-11 am)	95	30	5	85/90	30	5	On	On	Off	39	19	4	37	18	0
12 (11-12 pm)	95	30	5	85/90	30	5	On	On	Off	47	23	6	43	25	0
13 (12-1 pm)	50	10	5	75/80	15	5	On	On	Off	57	20	6	58	21	0
14 (1-2 pm)	95	10	5	85/90	15	5	On	On	Off	54	15	9	48	13	0
15 (2-3 pm)	95	10	5	85/90	15	5	On	On	Off	34	15	5	37	8	0
16 (3-4 pm)	95	10	5	85/90	15	5	On	On	Off	33	12	4	37	4	0
17 (4-5 pm)	95	10	5	85/90	15	5	On	On	Off	44	14	4	46	5	0
18 (5-6 pm)	30	5	5	50	5	5	On	On	Off	26	7	1	62	6	0
19 (6-7 pm)	10	5	0	30	5	5	On	Off	Off	21	7	4	20	0	0
20 (7-8 pm)	10	0	0	30	5	5	On	Off	Off	15	7	4	2	0	0
21 (8-9 pm)	10	0	0	20	5	5	On	Off	Off	7	7	4	4	0	0
22 (9-10 pm)	10	0	0	20	5	5	On	Off	Off	8	9	7	4	0	0
23 (10-11 pm)	5	0	0	10	5	5	Off	Off	Off	5	5	4	0	0	0
24 (11-12 am)	5	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
Total/Day	920	200	60	955/1040	230	120	1600	1200	0	537	256	113	555	151	0
Total/Week	49.60 hours			53.05/55.30 hours			92.00 hours			20.51 hours			29.26 hours		
Total/Year	2584 hours			2765/2920 hours			4797 hours			592 hours			1525 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

TABLE 3.3E

Office Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting[2]/Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
6 (5-6 am)	0	0	0	10	5	5	Off	Off	Off	8	8	7	0	0	0
7 (6-7 am)	10	10	5	10	10	5	On	On	Off	7	7	1	0	0	0
8 (7-8 am)	20	10	5	20	10	5	On	On	Off	19	11	4	35	16	0
9 (8-9 am)	95	30	5	65/90	30	5	On	On	Off	35	15	4	69	14	0
10 (9-10 am)	95	30	5	65/90	30	5	On	On	Off	38	21	4	43	21	0
11 (10-11 am)	95	30	5	65/90	30	5	On	On	Off	39	19	4	37	18	0
12 (11-12 pm)	95	30	5	65/90	30	5	On	On	Off	47	23	6	43	25	0
13 (12-1 pm)	50	10	5	55/80	15	5	On	On	Off	57	20	6	58	21	0
14 (1-2 pm)	95	10	5	65/90	15	5	On	On	Off	54	19	9	48	13	0
15 (2-3 pm)	95	10	5	65/90	15	5	On	On	Off	34	15	6	37	8	0
16 (3-4 pm)	95	10	5	65/90	15	5	On	On	Off	33	12		37	4	0
17 (4-5 pm)	95	10	5	65/90	15	5	On	On	Off	44	14	4	46	5	0
18 (5-6 pm)	30	5	5	35/50	5	5	On	On	Off	26	7	4	62	6	0
19 (6-7 pm)	10	5	0	30	5	5	On	Off	Off	21	7	4	20	0	0
20 (7-8 pm)	10	5	0	30	5	5	On	Off	Off	15	7	4	12	0	0
21 (8-9 pm)	10	0	0	20	5	5	On	Off	Off	7	7	4	4	0	0
22 (9-10 pm)	10	0	0	20	5	5	On	Off	Off	7	9	7	4	0	0
23 (10-11 pm)	5	0	0	10	5	5	Off	Off	Off	5	5	4	0	0	0
24 (11-12 am)	5	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
Total/Day	920	200	60	855/1040	250	120	1600	1200	0	537	256	113	555	151	0
Total/Week	48.50 hours			44.00/55.30 hours			92.00 hours			30.51 hours			29.26 hours		
Total/Year	2534 hours			2288/2920 hours			4797 hours			592 hours			1526 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

TABLE 3.3F

Parking Garage Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting[2]/Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)				50/100	50/100	50/100									
2 (1-2 am)				50/100	50/100	50/100									
3 (2-3 am)				50/100	50/100	50/100									
4 (3-4 am)				50/100	50/100	50/100									
5 (4-5 am)				50/100	50/100	50/100									
6 (5-6 am)				50/100	50/100	50/100									
7 (6-7 am)				100	100	50/100									
8 (7-8 am)				100	100	50/100									
9 (8-9 am)				100	100	50/100									
10 (9-10 am)				100	100	50/100									
11 (10-11 am)				100	100	50/100	Based on						Included with		
12 (11-12 pm)	NA			100	100	50/100	likely use			NA			other occupancies		
13 (12-1 pm)				100	100	50/100									
14 (1-2 pm)				100	100	50/100									
15 (2-3 pm)				100	100	50/100									
16 (3-4 pm)				100	100	50/100									
17 (4-5 pm)				100	100	50/100									
18 (5-6 pm)				100	50/100	50/100									
19 (6-7 pm)				100	50/100	50/100									
20 (7-8 pm)				100	50/100	50/100									
21 (8-9 pm)				100	50/100	50/100									
22 (9-10 pm)				100	50/100	50/100									
23 (10-11 pm)				50/100	50/100	50/100									
24 (11-12 am)				50/100	50/100	50/100									
Total/Day				2000/2400	1700/2400	1200/2400									
Total/Week				125.35/168 hours											
Total/Year				[illegible]/8760 hours											

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6. For parking garage lighting, the schedule has been revised to accompany the office schedule; the lighting in the parking garage is set to be on at 100% for all hours when the building occupancy is 10% or greater, but reduced to 50% (per Section 1513.6) for all hours when the building occupancy is less than 10%. For parking garage serving a use other than office, it is acceptable to modify the parking garage schedule to parallel that use.

TABLE 3.3G

Restaurant Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Lighting[2]/Receptacle, Percent of Maximum Load: Wk	Sat	Sun	Schedule for HVAC System: Wk	Sat	Sun	Schedule for Service Hot Water, Percent of Maximum Load: Wk	Sat	Sun	Schedule for Elevator, Percent of Maximum Load: Wk	Sat	Sun
1 (12-1 am)	15	30	20	15	20	20	On	On	On	20	20	25	0	0	0
2 (1-2 am)	15	25	20	15	15	15	On	On	On	15	15	20	0	0	0
3 (2-3 am)	5	5	5	15	15	15	On	On	On	15	15	20	0	0	0
4 (3-4 am)	0	0	0	15	15	15	Off	Off	Off	0	0	0	0	0	0
5 (4-5 am)	0	0	0	15	15	15	Off	Off	Off	0	0	0	0	0	0
6 (5-6 am)	0	0	0	20	15	15	Off	Off	Off	0	0	0	0	0	0
7 (6-7 am)	0	0	0	35/40	30	30	Off	Off	Off	0	0	0	0	0	0
8 (7-8 am)	5	0	0	35/40	30	30	On	Off	Off	60	0	0	0	0	0
9 (8-9 am)	5	0	0	55/60	55/60	45/50	On	Off	Off	55	0	0	0	0	0
10 (9-10 am)	5	5	0	55/60	55/60	45/50	On	On	Off	45	50	0	0	0	0
11 (10-11 am)	20	20	10	85/90	75/80	65/70	On	On	On	40	45	50	0	0	0
12 (11-12 pm)	50	45	50	85/90	75/80	65/70	On	On	On	45	50	50	0	0	0
13 (12-1 pm)	80	50	35	85/90	75/80	65/70	On	On	On	40	50	40	0	0	0
14 (1-2 pm)	70	50	35	85/90	75/80	65/70	On	On	On	35	45	40	0	0	0
15 (2-3 pm)	40	35	15	85/90	75/80	55/60	On	On	On	30	40	40	0	0	0
16 (3-4 pm)	20	30	20	85/90	75/80	65/70	On	On	On	30	40	40	1	0	0

	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
17 (4-5 pm)	25	30	25	85/90	75/80	55/60	On	On	On	50	35	50	0	0	0
18 (5-6 pm)	50	30	25	85/90	85/80	55/60	On	On	On	40	40	40	0	0	0
19 (6-7 pm)	80	70	25	85/90	55/90	55/60	On	On	On	35	55	50	0	0	0
20 (7-8 pm)	80	90	65	85/90	85/90	55/60	On	On	On	60	55	50	0	0	0
21 (8-9 pm)	80	70	70	85/90	85/90	55/60	On	On	On	50	50	40	0	0	0
22 (9-10 pm)	50	65	35	55/00	85/90	55/60	On	On	On	55	55	50	0	0	0
23 (10-11 pm)	35	55	20	45/50	45/50	45/60	On	On	On	45	40	40	0	0	0
24 (11-12 am)	20	35	20	40	30	40	On	On	On	35	30	30	0	0	0
Total/Day	750	740	455	1370/ 1433	1280/ 1365	1040/ 1115	2000	2000	1900	790	750	723	0	0	0
Total/Week	19.75 hours			91.6/97.33 hours			133 hours			53.03 hours			0 hours		
Total/Year	2594 hours			4774/5086 hours			7059 hours			2765 hours			0 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. **These values may be used only if actual schedules are not known.**
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

TABLE 3.3H

Retail Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy Percent of Maximum Load			Schedule for Lighting[2]/Receptacle Percent of Maximum Load			Schedule for HVAC System			Schedule for Service Hot Water Percent of Maximum Load			Schedule for Elevator Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	4	11	7	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	5	10	7	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	5	8	7	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	4	6	6	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	4	6	5	0	0	0
6 (5-6 am)	0	0	0	5	5	5	Off	Off	Off	4	6	6	0	0	0
7 (6-7 am)	0	0	0	5	5	5	On	On	Off	4	7	7	0	0	0
8 (7-8 am)	10	10	0	20	10	5	On	On	Off	15	20	0	12	0	0
9 (8-9 am)	20	20	0	50	30	10	On	On	On	23	24	12	22	0	0
10 (9-10 am)	50	50	0	85/90	55/60	10	On	On	On	32	35	14	44	56	0
11 (10-11 am)	50	60	20	85/90	85/90	40	On	On	On	41	42	29	54	66	12
12 (11-12 pm)	70	80	70	85/90	85/90	40	On	On	On	57	54	31	68	68	35
13 (12-1 pm)	70	80	40	85/90	85/90	55/60	On	On	On	62	59	36	68	68	37
14 (1-2 pm)	70	80	40	85/90	85/90	55/60	On	On	On	61	60	26	71	59	37
15 (2-3 pm)	70	80	40	85/90	85/90	55/60	On	On	On	50	49	34	72	70	39
16 (3-4 pm)	80	80	40	85/90	85/90	55/60	On	On	On	45	48	35	72	70	41
17 (4-5 pm)	70	80	40	85/90	85/90	55/60	On	On	On	46	47	37	73	72	39
18 (5-6 pm)	50	60	20	85/90	85/90	40	On	On	Off	47	46	34	63	58	34
19 (6-7 pm)	50	20	10	55/60	50	20	On	On	Off	42	41	25	63	47	0
20 (7-8 pm)	30	20	0	55/60	30	5	On	On	Off	34	35	27	58	43	0
21 (8-9 pm)	30	20	0	50	30	5	On	On	Off	33	27	21	54	42	0
22 (9-10 pm)	0	10	0	30	10	5	Off	On	Off	23	22	16	0	0	0
23 (10-11 pm)	0	0	0	5	5	5	Off	Off	Off	13	16	10	0	0	0
24 (11-12 am)	0	0	0	5	5	5	Off	Off	Off	8	13	6	0	0	0
Total/Day	720	750	360	1060/ 1115	940/ 985	500/ 525	1300	1600	500	662	690	430	844	761	355
Total/Week	16.39 hours			67.40/70.85 hours			100 hours			15.59 hours			52.69 hours		
Total/Year	2410 hours			3505/3684 hours			5214 hours			2125 hours			2717 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used only if actual **schedules are not known.**
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

TABLE 3.3I

School Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy Percent of Maximum Load			Schedule for Lighting[2]/Receptacle Percent of Maximum Load			Schedule for HVAC System			Schedule for Service Hot Water Percent of Maximum Load			Schedule for Elevator Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
6 (5-6 am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0
7 (6-7 am)	0	0	0	5	5	5	Off	Off	Off	5	3	2	0	0	0
8 (7-8 am)	5	0	0	30	5	5	On	Off	Off	10	3	2	0	0	0
9 (8-9 am)	75	10	0	85/95	15	5	On	On	Off	34	3	5	30	0	0
10 (9-10 am)	90	10	0	95/95	15	5	On	On	Off	60	5	5	30	0	0
11 (10-11 am)	90	10	0	95/95	15	5	On	On	Off	63	5	5	30	0	0
12 (11-12 pm)	80	10	0	95/95	5	5	On	On	Off	72	5	5	30	0	0
13 (12-1 pm)	80	10	0	80/80	15	5	On	On	Off	79	5	5	30	0	0
14 (1-2 pm)	80	0	0	80/90	5	5	On	Off	Off	73	5	5	30	0	0
15 (2-3 pm)	80	0	0	80/90	5	5	On	Off	Off	65	5	5	30	0	0
16 (3-4 pm)	45	0	0	80/70	5	5	On	Off	Off	63	5	3	15	0	0
17 (4-5 pm)	15	0	0	50/70	5	5	On	Off	Off	10	3	3	0	0	0
18 (5-6 pm)	5	0	0	35/50	5	5	On	Off	Off	10	3	3	0	0	0
19 (6-7 pm)	15	0	0	35	5	5	On	Off	Off	19	3	3	0	0	0
20 (7-8 pm)	20	0	0	35	5	5	On	Off	Off	25	3	3	0	0	0
21 (8-9 pm)	20	0	0	35	5	5	On	Off	Off	22	3	3	0	0	0
22 (9-10 pm)	10	0	0	30	5	5	On	Off	Off	22	3	3	0	0	0
23 (10-11 pm)	0	0	0	5	5	5	Off	Off	Off	13	3	3	0	0	0
24 (11-12 am)	0	0	0	5	5	5	Off	Off	Off	8	3	3	0	0	0
Total/Day	710	50	0	750/ 950	170	120	1200	500	0	670	80	80	235	0	0

Total/Week	35.30 hours	40.10/52.40 hours	80.00 hours	36.19 hours	14.25 hours
Total/Year	1877 hours	2300/2732 hours	4171 hours	1882 hours	540 hours

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. **These values may be used only if actual schedules are not known.**
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

TABLE 3.3J

Warehouse Occupancy[1]

Hour of Day (Time)	Schedule for Occupancy Percent of Maximum Load			Schedule for Lighting[2]/Receptacle Percent of Maximum Load			Schedule for HVAC System			Schedule for Service Hot Water Percent of Maximum Load			Schedule for Elevator Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12-1 am)	0	0	0	5	5	5	Off	Off	Off	2	2	2	0	0	0
2 (1-2 am)	0	0	0	5	5	5	Off	Off	Off	2	2	2	0	0	0
3 (2-3 am)	0	0	0	5	5	5	Off	Off	Off	2	2	2	0	0	0
4 (3-4 am)	0	0	0	5	5	5	Off	Off	Off	2	2	2	0	0	0
5 (4-5 am)	0	0	0	5	5	5	Off	Off	Off	5	2	2	0	0	0
6 (5-6 am)	0	0	0	5	5	5	Off	Off	Off	7	2	2	0	0	0
7 (6-7 am)	0	0	0	5	5	5	Off	Off	Off	7	2	2	0	0	0
8 (7-8 am)	15	0	0	25/40	5	5	On	Off	Off	0	2	2	0	0	0
9 (8-9 am)	70	20	0	65/70	8	5	On	On	Off	20	6	2	0	0	0
10 (9-10 am)	90	20	0	55/90	24	5	On	On	Off	30	12	3	0	0	0
11 (10-11 am)	90	20	0	55/90	24	5	On	On	Off	30	12	3	40	0	0
12 (11-12 pm)	90	20	0	55/90	24	5	On	On	Off	46	17	2	0	0	0
13 (12-1 pm)	50	10	0	50/80	5	5	On	On	Off	57	4	4	0	0	0
14 (1-2 pm)	85	10	0	55/90	5	5	On	On	Off	43	4	4	0	0	0
15 (2-3 pm)	85	10	0	55/90	5	5	On	On	Off	35	2	2	0	0	0
16 (3-4 pm)	85	10	0	55/90	5	5	On	On	Off	40	2	2	40	0	0
17 (4-5 pm)	20	0	0	55/80	5	5	On	Off	Off	30	2	2	0	0	0
18 (5-6 pm)	0	0	0	30	5	5	Off	Off	Off	18	2	2	0	0	0
19 (6-7 pm)	0	0	0	5	5	5	Off	Off	Off	3	2	2	0	0	0
20 (7-8 pm)	0	0	0	5	5	5	Off	Off	Off	5	2	2	0	0	0
21 (8-9 pm)	0	0	0	5	5	5	Off	Off	Off	4	2	2	0	0	0
22 (9-10 pm)	0	0	0	5	5	5	Off	Off	Off	4	2	2	0	0	0
23 (10-11 pm)	0	0	0	5	5	5	Off	Off	Off	3	2	2	0	0	0
24 (11-12 am)	0	0	0	5	5	5	Off	Off	Off	3	2	2	0	0	0
Total/Day	680	120	0	685/ 913	180	120	1000	500	0	479	91	73	80	0	0
Total/Week	34.90 hours			45.00/48.73 hours			55.00 hours			25.55 hours			5.20 hours		
Total/Year	1835 hours			2160/2541 hours			4094 hours			1192 hours			182 hours		

Wk = Weekday

1. Schedules for occupancy, lighting, receptacle, HVAC system, and service hot water are from ASHRAE Standard 90.1-1989 and addendums, except that 5% emergency lighting has been added for all off hours. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques except changed to 0% when occupancy is 0%. These values may be used **only** if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in Section 1513.6.

***

Section 5 – Reporting Format.

The reporting format has been developed to guide both staff and applicants through the energy analysis process. The report (three copies are to be submitted) begins with a text summary including project description, methodology description, and a discussion of the estimated energy consumption differences. These are accompanied by an appendix which has summary forms, calculations to support the inputs, and copies of the computer inputs and outputs (all with numbered pages).

The text and summary forms are among the most important parts of the submittal. This information is read prior to any review of the computer inputs and outputs to give an overall orientation to the project. The first evaluation of the project is based on a review of the text and summary forms. These indicate what the key energy-efficiency strategies are and form the basis for a more-detailed review of the drawings and of the computer analysis. Information for statistical summaries or other evaluations is drawn from the text and summary forms. While these may be the last items completed by the applicant prior to submittal, the importance of having them complete and accurate cannot be overemphasized.

REPORTING FORMAT OUTLINE

I. Executive Summary

II. Project Description

III. Methodology Description

IV. Discussion of Estimated Energy Consumption Differences

Appendices (Supporting Material)

A. Energy Analysis Summary Form
   1. Energy Consumption by End-use portion
   2. Design Parameter Comparison portion
B. General Information
   1. Site Plan
   2. HVAC Zoning Diagram
C. Building Envelope
   1. Fenestration, NFRC Certification Authorization Report (CAR) or Simulation Report for U-factor and SHGC or Manufacturer's Specifications for Shading Coefficient
   2. Opaque Elements: Cross-sections and U-factor Calculations
   3. Shading Diagrams
D. Lighting System
   1. Lighting for Interior
   2. Lighting for Parking and Outdoor Areas
   3. Lighting for Facade
E. Space Heating and Space Cooling
   1. Equipment Efficiency – Manufacturer's Specifications
F. Ventilation
G. Interior Exhaust Fans
H. Parking Ventilation Fans
I. Service Water Heating
J. Other End-uses
   1. Office Equipment
   2. Elevators and Escalators
   3. Refrigeration
   4. Cooking
   5. Other
K. Computer Printout of Inputs and Outputs

I. Executive Summary

The executive summary is the condensed version of the text. This is usually several paragraphs long, never more than one page, and includes:

1. A brief description of the project with name, address, number of stories, and total square footage, as well as a listing of the various uses and the square footage of each use.
2. An explanation about why the systems analysis compliance option was chosen (i.e. what elements of the Proposed Design do not comply with the prescriptive option).
3. A listing of the key energy efficiency features that are being used to compensate for the elements that do not comply.
4. The total energy consumption on a Btu-per-conditioned-square-foot-per-year basis for both the Standard Design and the Proposed Design, and the percentage ratio of the Proposed Design to the Standard Design (i.e. what the energy efficiency improvement has been).

II. Project Description

The project description is a detailed summary of the project. First is the name and the street address as well as adjacent cross-streets or streets on all four sides of the building if it is a full-block development. Indicate the number of stories and total square footage. A listing of the various uses and square footage of each use should be done on a floor-by-floor or a system-by-system basis. Thus, for mixed-use floors, specify how much is office and how much is retail, or how much is office and how much is lab. Include parking garage number of floors and area in the listing.

The description should also include information on the energy efficiency of the Proposed Design systems.

1. For the building envelope: indicate the glazing area, and how the fenestration U-factor and SHGC compare with the Standard Design requirements; and point out any opaque component U-factors or R-values which are better than the Standard Design requirements.
2. For each HVAC system: provide an explanation of the system including area served, key features, economizer percentage, control strategies, etc. Indicate any differences between the Standard Design and the Proposed Design, such as equipment efficiency.
3. For the lighting: indicate whether any tradeoffs are included in this analysis, and, if so, what they are.
4. For other end-uses: indicate any differences between the Standard Design and the Proposed Design.

It is intended that the material in this section be descriptive, supporting calculations are to be included in the appendices.

III. Methodology Description

The methodology description is an explanation of any aspects of the modeling which are unusual or not perfectly clear. (The algorithms in approved analysis programs are generally acceptable and do not need to be explained.) For example:

1. Explain what shading by adjacent buildings has been included in the analysis and how it has been modeled (e.g. either using the program capabilities or as a north-facing wall, etc.).
2. If there are below grade walls and floors, explain how the heat loss has been modeled for these (e.g. either as an exterior wall with a limited ground temperature variation or as a constant negative load to a zone, etc.)
3. If a program cannot model a system exactly, explain why the modeling assumptions used are the best representation of that system.

It is intended that the material in this section provide a heads-up for anything unusual. Again, it is intended that the material in this section be descriptive, supporting calculations are to be included in the appendices.

IV. Discussion of Estimated Energy Consumption Differences

The discussion of estimated energy consumption differences is a summary and explanation of the energy savings.

1. First, list the total energy consumption on a Btu-per-conditioned-square-foot-per-year basis for both the Standard Design and the Proposed Design, and the percentage ratio of the Proposed Design to the Standard Design (i.e. what the energy efficiency improvement would be).
2. Then, review the energy savings by end-use, starting with the end-use which has the largest difference as a percent of the Standard Design total. Attempt to correlate the differences by end-use with the strategies used. While some changes will have a simple, direct correlation with consumption, other end-use differences may have a more complex explanation due to interactive effects. For example:
   - Changes in exterior lighting will have a simple, direct correlation with consumption.
   - Differences in space heating and space cooling are likely due to a combination of

building envelope and HVAC system strategies. (Lacking any better information, the following procedure can provide a rough-cut disaggregation. First, determine the ratio of the design heating load of the Proposed Design to the design heating load of the Standard Design. Multiply the space heating energy consumption of the Standard Design by this ratio and assume that the resulting figure is what the space heating energy consumption would have been for the Proposed Design if only the building envelope had changed. This difference is what could be attributed to the building envelope. Second, determine the ratio of the average equipment efficiency of the Proposed Design to the average equipment efficiency of the Standard Design. Multiply the space heating energy consumption from the first step by this ratio and assume that the resulting figure is what the space heating energy consumption would have been for the Proposed Design if only the building envelope and equipment efficiency had changed. This second difference is what could be attributed to changes in equipment efficiency. Finally, assume that whatever energy consumption differences remain are due to other HVAC system strategies. Follow this same process for space cooling, starting with a comparison of loads, then equipment efficiency, then system type. Differences in economizer cycle, however, add another layer of complexity.)

This section should, at a minimum, provide confirmation that the results of the analysis are reasonable.

Appendices (Supporting Materials)

A. Energy Analysis Summary Form (required)

1. Complete the Energy Consumption by End-use portion of the form for each project. Where a project has multiple buildings which are individually analyzed, complete the form for each building as well as for the overall project. (An automated electronic spreadsheet version of this page is on the DPD Seattle Energy Code website at: www.seattle.gov/dpd/energy.)
2. Complete the Design Parameter Comparison portion of the form for each project. Where a project has multiple HVAC systems, complete the HVAC information for each system. (An electronic version of these pages is on the DPD Seattle Energy Code website at: www.seattle.gov/dpd/energy.)

B. General Information

1. Site Plan (required) – provide site plan (8½ x 11 preferred) showing location and height, in feet or stories, of all adjacent buildings and also any other buildings and topography which would provide significant shading of the proposed building.
2. HVAC zoning diagram used in the modeling process (required) – provide zoning diagram indicating zone lines and with zones labeled to match the modeling. (Providing takeoff sheets with area inputs will simplify review.)

C. Building Envelope

1. Glazing and opaque doors, including windows, skylights, sliding/swinging/rollup doors, glass block (required):
   a. for U-factor,
      i. provide NFRC Certification Authorization Report (CAR) from NFRC-licensed Inspection Agency for the overall fenestration product including the frame OR
      ii. copy of simulation by NFRC-accredited simulation laboratory for the overall fenestration product including the frame OR
      iii. manufacturer's specifications where default U-factors from Chapter 10 have been used;
   b. for Solar Heat Gain Coefficient (SHGC),
      i. provide NFRC Certification Authorization Report (CAR) from NFRC-licensed Inspection Agency for the overall fenestration product including the frame OR
      ii. copy of simulation by NFRC-accredited simulation laboratory for the overall fenestration product including the frame OR
      iii. manufacturer's specifications where shading coefficient of the glass alone has been used.

   (Note products claiming NFRC values shall be labeled. For site-assembled products, the NFRC Label Certificate shall be on job site prior to installation of first fenestration product. See CAM 403 for more information.)
2. Opaque roof, wall, floor (required):
   a. provide cross-sections and U-factor calculations for each different assembly where default U-factors from Chapter 10 have not been used;
   b. if multiple elements (e.g., three wall types) are combined into one value for modeling purposes, provide calculations used to determine weighted-average value.
3. Shading diagrams (required):
   a. provide information on how shading by adjacent buildings and topography has been modeled,
   b. provide wall and roof sections showing overhangs and setbacks for glazing to justify the shading modeled.
4. Building air leakage:
   a. provide specific statement of the proposed building air leakage test rate when tested in accordance with the procedure in Section 1314.6.2,
   b. provide calculation showing how the building air leakage test rate at the standard rating conditions in Section 1314.6.2 has been converted to an air leakage test rate appropriate for the energy modeling using the conversion factors as specified in RS-29, Table 3.1, #5 Building Envelope, Proposed Design,
   c. for modeling, as specified in RS-29, Table 3.1, #5 Building Envelope, Proposed Design, indicate:
      i. what percentage of air leakage is modeled for the hours when the building fan system is off and
      ii. what percentage of air leakage is modeled for the hours when the building fan system is on.

D. Lighting

1. Interior lighting (as applicable):
   a. explain any special assumptions about interior lighting,
   b. discuss lighting inputs to account for any exempt lighting (e.g. retail, kitchen).
2. Parking/outdoor areas lighting (as applicable):
   a. provide calculation of areas for parking garages, then multiply by allowed Watts/square foot; provide calculation of areas for surface parking, and other lighted outdoor areas, then multiply by allowed Watts/square foot to obtain Standard Design;
   b. provide supporting information for Proposed only if different from Standard Design;
   c. if program does not list parking/outdoor area lighting energy consumption separately, then provide calculation of annual energy consumption for this end-use.
3. Facade lighting (required):
   a. provide calculation of building facade, then multiply by allowed Watts/square foot to obtain Standard Design;
   b. provide supporting information for Proposed only if different from Standard Design;
   c. if program does not list facade lighting energy consumption separately, then provide calculation of annual energy consumption for this end-use.

E. Space Heating and Space Cooling Equipment and Plant

1. provide manufacturer's specifications for equipment efficiency,
2. provide calculations per AHRI standards for COP, EER, IPLV,
3. provide list of equipment and size and calculations to justify if Proposed Design includes multiple pieces of equipment and a weighted average equipment efficiency is used in the energy analysis,
4. provide calculations to justify the equipment size for the Standard Design
   a. provide calculations of ratio of Proposed Design equipment size to Proposed Design design heating load and design cooling load,
   b. provide calculations of ratio of Standard Design equipment size to Standard Design design heating load and design cooling load.

F. Ventilation - interior (required):

1. provide W/CFM calculations for the ventilation system for the Proposed Design and for the Standard Design to justify inputs for the Standard Design,
2. if program does not list energy consumption for interior ventilation separately in the output, then provide calculation of annual energy consumption for this end-use.

G. Interior Exhaust Fans (as applicable):

1. where multiple toilet exhaust and relief fans are to be installed, provide listing of capacity for each and total for the interior exhaust fans,
2. if program does not list energy consumption for interior exhaust fans separately in the output, then provide calculation of annual energy consumption for this end-use.

H. Parking Garage Fans (as applicable):

1. where multiple parking garage fans are to be installed, provide listing of capacity for each and total for the parking garage fans,
2. if program does not list energy consumption for parking garage fans separately in the output, then provide calculation of annual energy consumption for this end-use.

I. Service Water Heating (required):

1. provide calculations used to size equipment (see RS-29 Table 3.1.4 for default assumptions for service hot water quantities in Btuh per person),
2. if program does not list energy consumption for service water heating separately in the output, then provide calculation of annual energy consumption for this end-use.

J. Other End-uses

1. Office/miscellaneous equipment (as applicable):
   a. if program requires an input of total equipment capacity rather than capacity on a square foot basis, then provide calculations used to size equipment (see RS-29 Table 3.1.4 for default assumptions for service hot water quantities in Watts/square foot),
   b. if program does not list energy consumption for office/miscellaneous equipment separately in the output, then provide calculation of annual energy consumption for this end-use.
2. Elevators and escalators (as applicable):
   a. where multiple elevators and escalators are to be installed, provide listing of capacity for each and total for the system,
   b. if program does not list energy consumption for elevators and escalators separately in the output, then provide calculation of annual energy consumption for this end-use.
3. Refrigeration - food, etc. (as applicable):
   a. where multiple units are to be installed for refrigeration other than for comfort cooling, provide listing of capacity for each and total for the system,
   b. if program does not list energy consumption for refrigeration other than for comfort cooling separately in the output, then provide calculation of annual energy consumption for this end-use.
4. Cooking (as applicable):
   a. where multiple units are to be installed for cooking, provide listing of capacity for each and total for the system,
   b. if program does not list energy consumption for cooking separately in the output, then provide calculation of annual energy consumption for this end-use.
5. Other (as applicable):
   a. provide supporting data for other end-uses (e.g. commercial washers and dryers, etc.),
   b. if program does not list energy consumption for other end-uses separately in the output, then provide calculation of annual energy consumption for these end-uses.

K. Computer Printout of Inputs and Outputs

Provide inputs and outputs with pages numbered so cross-references can be made to the Energy Analysis Summary Form.

ENERGY ANALYSIS SUMMARY FORM

PROJECT INFORMATION

DPD Project Address: ______ DPD Project Number: ______

Project Name: ______ Date of this submittal:

Building Use	Conditioned Space: Office	Group R	Retail	Subtotal	Unconditioned Space: Parking	Subtotal	Total
Area							
(sq.ft):							

ENERGY CONSUMPTION BY END-USE

END-USE	FUEL SOURCE	STANDARD DESIGN: Total Energy Use Estimate	BTU/Cond. Sq.Ft.-Year	% of Standard Design Total	PROPOSED DESIGN: Total Energy Use Estimate	BTU/Cond. Sq.Ft.-Year	% of Proposed Design Total	DIFFERENCES: Total Energy Use Estimate	BTU/Cond. Sq.Ft.-Year	% of Standard Design Total
Lighting - interior				%			%			%
Lighting - parking				%			%			%
Lighting - facade				%			%			%
Space Heating (1)				%			%			%
Space Heating (2)				%			%			%
Space Cooling				%			%			%
Fans - interior ventilation				%			%			%
Fans - interior exhaust				%			%			%
Fans - parking garage				%			%			%
Service water heating				%			%			%
Office equipment				%			%			%
Elevators & escalators				%			%			%
Refrigeration (food, etc)				%			%			%
Cooking (commercial)				%			%			%
				%			%			%
				%			%			%
Total				100.0%			100.0 %			
Percent of Standard Design:			100.0 %			%			%	

INSTRUCTIONS:

Electronic Version:

A spreadsheet version is available on the Seattle Energy Code website at: www.seattle.gov/dpd/energy

Project Information:

Enter DPD address, project number, and date of this Energy End-use Summary Form.

Enter the space uses in the building and the gross square footage of each.

(Add/revise headings as necessary.) Spreadsheet automatically calculates subtotals and total.

Energy Consumption by End-use:

Enter fuel source for each end-use (e.g. electric, gas, oil, steam, etc.).

Enter total energy consumption in BTU for each end-use for both the Standard Design and Proposed Design.

(Spreadsheet calculates the BTU/conditioned square foot-year, percentages, and differences.)

DESIGN PARAMETER COMPARISON

Element:	Standard Design Value	(Page)	Proposed Design Value	(Page)
Building Envelope				
Space heat type (electric resistance vs. other):				
Glazing: total vertical + overhead area (sq. feet):				
Glazing area as a percentage of gross wall (%):				
Overhead: total area (square feet):				
Overhead U-factor (weighted-average):				
Overhead SHGC (weighted-average):				
Vertical: total area (square feet):				
Vertical U-factor (weighted-average):				
Vertical SHGC (weighted-average):				
Roof total area (square feet):				
Opaque roof: net area (square feet):				
Opaque roof U-factor (weighted-average):				
Wall: total above-grade area (square feet):				
Opaque above-grade wall: net area (square feet):				
Above-grade wall U-factor (weighted-average):				
Below-grade wall net area (square feet):				
Below-grade wall U-factor (weighted-average):				
Opaque door: area (sq. feet):				
Opaque door U-factor (weighted-average):				
Floor over unconditioned space: area (sq. feet):				
Floor U-factor (weighted-average):				
Slab-on-grade floor: perimeter (lineal feet):				
Slab-on-grade F-factor (weighted-average):				
Below-grade slab floor: net area (square feet):				
Below-grade floor U-factor (weighted-average):				

Infiltration rate:				
Design heating load:				
Design cooling load:				
Lighting				
Interior				
Watts/sq.ft.: Office				
Watts/sq.ft.: Retail				
Watts/sq.ft.:				
Watts/sq.ft.:				
Parking/outdoor: total area (square feet)				
Watts/square foot:				
Facade: total area (square feet)				
Watts/square foot				

Element	Standard Design Value	(Page)	Proposed Design Value	(Page)

DESIGN PARAMETER COMPARISON (cont.)

Element	Standard Design Value	(Page)	Proposed Design Value	(Page)
Space Heating and Space Cooling System				
Space Heating: system type:				
Peak equipment efficiency:				
Output capacity:				
Percent of design heating load:				
Other features:				
Space Cooling: system type:				
Peak equipment efficiency:				
Output capacity:				
Percent of design cooling load:				
Other features:				
Ventilation				
Interior ventilation fans				
Economizer type (air or water):				
Economizer percentage:				
Supply fan: total CFM:				
Fan KW:				

Element	Standard Design Value	(Page)	Proposed Design Value	(Page)
Return fan: total CFM:				
Fan KW:				
Exhaust fan: total CFM:				
Fan KW:				
System Watts/CFM:				
Other features:				
Other features:				
Service Water Heating				
Capacity:				
Other End-uses				
Fans – toilet and other exhaust, capacity (KW):				
Fans – parking garage, capacity (KW):				
Elevator and escalator capacity				
Refrigeration capacity				
Cooking, capacity				
______: capacity				
______: capacity				
______: capacity				

Section 17. A new Reference Standard 35 to the Seattle Energy Code is adopted, as follows:

REFERENCE STANDARD - 35

ADVANCED CRITERIA FOR OTHER PROGRAMS

Reference Standard (RS)-35 contains advanced criteria for energy efficiency and energy conservation beyond the requirements of the Seattle Energy Code. The goal of these criteria is to achieve compliance with the 2030 Challenge. This RS-35 is adopted for incorporation in programs, agreements, or initiatives toward that goal.

PRESCRIPTIVE COMPLIANCE OPTION

Comply with the 2009 Seattle Energy Code with the following modifications and additions:

Section 901, Additional Residential Energy Efficiency Requirements: Achieve a minimum of five credits (instead of one credit) from Table 9-1 or, if using the exception, achieve 30 percent less (instead of 16 percent less) than the target building energy use in Chapter 4.

Section 1314.6.2.1, Testing of Overall Building Air Leakage: Tested air leakage of 0.25 cfm/ft^2 maximum for all buildings (instead of 0.40 cfm/ft^2).

Sections 1320-1323, Prescriptive Building Envelope Option: Compliance to be based on Table A13-1 Advanced Criteria (instead of Table 13-1). See below.

Sections 1330-1334, Component Performance Building Envelope Option: Compliance to be based on Table A13-1 Advanced Criteria (instead of Table 13-1).

Table 13-1: Opaque envelope and fenestration to comply with Table A13-1 Advanced Criteria (instead of Table 13-1):

Table A13-1
Advanced Criteria

Opaque Elements	Nonresidential Assembly Max. U-factor	Nonresidential Insulation Min. R-Value	Residential, Other than Single Family Assembly Max. U-factor	Residential, Other than Single Family Insulation Min. R-Value
Roofs				
Insulation entirely above deck	U-0.025	R-40 c.i.	U-0.025	R-40 c.i.
Metal building	U-0.024	R-30 + R-11 + R-11 Ls	U-0.024	R-30 + R-11 + R-11 Ls
Single-rafter	U-0.025	R-42	U-0.025	R-42
Attic and other	U-0.025	R-45 adv or R-50	U-0.025	R-49 adv or R-65
Walls, Above Grade				
Mass	U-0.051 for exterior and integral insulation; U-0.050 for interior insulation	Exterior and integral insulation: a. R-18 c.i. Interior insulation: b. R-13 cavity insulation + R-8 c.i. wood studs; or c. R-13 cavity insulation + R-12 c.i. metal studs; or d. R-25.0 insulation held solely by 1-in metal clips	U-0.045 for exterior and integral insulation; U-0.045 for interior insulation	Exterior and integral insulation: a. R-20 c.i. Interior insulation: b. R-13 cavity insulation + R-10 c.i. wood studs; or c. R-13 cavity insulation + R-14 c.i. metal studs; or d. R-28 insulation held solely by 1-in metal clips
Metal building	U-0.046	R-13 + R-13.5 c.i.	U-0.042	R-13 + R-19 c.i.
Steel framed	U-0.039	R-13 + R-12.5 c.i.	U-0.043	R-13 + R-15 c.i.
Wood framed and other	U-0.045	R-13 + R-10 c.i.	U-0.040	R-13 + R-12.5 c.i.
Walls, Below Grade				
Below grade wall	U-0.070	Exterior insulation: a. R-10 c.i. Interior insulation: b. R-19 cavity insulation wood studs; or c. R-15 cavity insulation + R-3 c.i. metal studs; or d. R-16.8 insulation held solely by 1-in metal clips	U-0.070	Exterior insulation: a. R-10 c.i. Interior insulation: a. R-19 cavity insulation wood studs; or c. R-13 cavity insulation + R-6 c.i. metal studs; or d. R-16.8 insulation held solely by 1-in metal clips
Floors				
Mass	U-0.027	R-35 c.i.	U-0.027	R-35 c.i.
Steel joist	U-0.027	R-38 + R-6 c.i.	U-0.027	R-38 + R-6 c.i.
Wood framed and other	U-0.025	R-38	U-0.025	R-38
Slab-on-Grade Floors				
Unheated	F-0.520	R-15 for 24 in (with thermal break)	F-0.520	R-15 for 24 in (with thermal break)
Heated	F-0.360	R-15 c.i. (with thermal break)	F-0.360	R-15 c.i. (with thermal break)
Opaque Doors				
Swinging	U-0.370		U-0.370	
Non-swinging	U-0.390		U-0.400	
Fenestration	Assembly Max. U-Factor NFRC-certified or per 1006	Assembly Max. SHGC NFRC-certified or per 1312.1	Assembly Max. U-Factor NFRC-certified or per 1006	Assembly Max. SHGC NFRC-certified or per 1312.1
Total fenestration (vertical and overhead) area relative to the gross exterior wall area	0-30% of wall			
Vertical Fenestration				
Nonmetal framing: All	U-0.27	For all frame types: SHGC 0.35 all OR SHGC-0.45 all PF≥0.50 permanent PF≥0.50 on west, south and east	U-0.27	
Metal framing: Fixed/operable	U-0.34		U-0.34	
Entrance doors (revolving doors & vestibules)	U-0.60 (U-0.65)		U-0.60 (U-0.65)	
Skylights				
Without curb (i.e., sloped glazing)	U-0.40	SHGC-0.30 all	U-0.40	SHGC-0.35 all
With curb (i.e., individual unit skylights)	U-0.50		U-0.50	
Total fenestration (vertical and overhead) area relative to the gross exterior wall area	>30-40% of wall			
Vertical Fenestration				
Nonmetal framing: All	U-0.25	For all frame types: SHGC-0.33 all OR SHGC-0.45 all PF≥0.50 permanent PF≥0.50 on west, south and east	U-0.25	
Metal framing: Fixed/operable	U-0.31		U-0.31	
Entrance doors (revolving doors & vestibules)	U-0.60 (U-0.65)		U-0.60 (U-0.65)	
Skylights				
Without curb (i.e., sloped glazing)	U-0.36	SHGC-0.30 all	U-0.36	SHGC-0.35 all
With curb (i.e., individual unit skylights)	U-0.45		U-0.45	

c.i. = continuous insulation, Ls = liner system (see definitions)

Section 1411.1, HVAC Equipment Performance Requirements, General: Building projects to have high-efficiency mechanical equipment, meaning that 90% of the equipment from each table (same category) has an efficiency that is 1.10 times the corresponding minimum efficiency in Tables 14-1A through 14-1G. The absolute gain in minimum efficiency shall be in addition to that required elsewhere in the code such as for Section 1433 and Section 1132.2.

Section 1521, Prescriptive Interior Lighting Requirements: This section is not allowed to be used.

Section 1531, Interior Lighting Power Allowance: The interior lighting power allowance shall be no greater than 0.90 times the lighting power allowance in Table 15-1.

Section 1532, Exterior Lighting Power Allowance: The exterior lighting power allowance shall be no greater than 0.90 times the lighting power allowance in Table 15-2.

Section 18. A new Reference Standard 36 to the Seattle Energy Code is adopted, as follows:

REFERENCE STANDARD - 36
ILLUSTRATIVE GOALS FOR THE 2030 CHALLENGE IN SEATTLE

Note that these tables are only a reference point, not prescriptive standards nor a means of compliance.

How to use these tables:

The building types listed in bold define a broad building activity category. Some of the broader building type categories are broken down into more specific building activities. The building types in regular type are regional numbers calculated by Target Finder for zip code 98104 using default project parameters. For building types available in Target Finder, use Target Finder and input project specific parameters in order to establish an accurate target.

When identifying your building within this table, first identify where your building's function falls within the broader bold categories. Then determine if you are able to identify your building's function more specifically by the wider categories underneath. Matching your building's main use activities most closely with the building use descriptions below will give you the most accurate energy performance target. Please note all site EUI values displayed below are annual figures.

Targets can be calculated for mixed use buildings by multiplying site EUI for each type by the square footage for that type, summing the totals of energy use by type and dividing by total square footage.

Secondary Space/Building Types – Ambulatory Surgical Center, Computer Data Center, Garage, Open Parking Lot, and Swimming Pool – available in Target Finder, are not presented here. More complex projects containing these secondary uses are advised to use Target Finder to establish a target.

Table B-1. Seattle 2030 Challenge Targets
for Nonresidential buildings
based on U.S. National Averages and Regional Averages calculated with Energy Star Target Finder based on CBECS (2003)

Building Use Description	Available in Target Finder	Average Site EUI kBtu/ft^2-yr	Average Percent Electric	60% Target for 2010	70% Target for 2015	Energy Star Rating @ 60% Target
Education		75	65%	30	23	
K-12 School[1]	X	75	45%	31	24	90
College/University (Campus)		120	63%	48	36	
Food Sales		225	86%	90	68	
Grocery Store/Food Market[2]	X	218	52%	87	65	100
Convenience Store (with or w/o gas station)		241	90%	96	72	
Food Service						
Restaurant/Cafeteria[2]		302	54%	121	91	
Fast Food		534	62%	214	160	
Health Care: Inpatient (Specialty Hospitals, Excluding Children's)		227	47%	91	68	
Hospital (Acute Care, Children's)[3]	X	356	35%	142	107	100
Health Care: Long Term Care (Nursing Home, Assisted Living)		124	54%	50	37	
Health Care: Outpatient		73	76%	29	22	
Clinic/Other Outpatient Health		84	76%	34	25	
Medical Office[4]	X	85	62%	34	26	91
Lodging		87	61%	35	26	
Dormitory/Fraternity/Sorority[5]	X	83	48%	33	25	95
Hotel, Motel or Inn[6]	X	97	48%	39	29	99
Mall (Strip Mall or Enclosed)		107	71%	43	32	
Office[7]		105	70%	42	32	92
Bank/Financial Institution[5]	X	90	70%	36	27	97
Public Assembly		56	57%	26	20	
Entertainment/Culture		95	63%	38	29	
Library		104	59%	42	31	
Recreation		65	55%	26	20	
Social/Meeting		52	57%	21	16	
Public Order and Safety		90	57%	36	27	
Fire Station/Police Station		78	56%	31	23	
Courthouse[7]	X	85	70%	24	28	97

Table B-1. Seattle 2030 Challenge Targets for Nonresidential buildings based on U.S. National Averages and Regional Averages calculated with Energy Star Target Finder based on CBECS (2003)

Building Use Description	Available in Target Finder	Average Site EUI kBtu/ft²/yr	Average Percent Electric	60% Target for 2010	70% Target for 2015	Energy Star Rating @ 60% Target
Service (Vehicle Repair/Service, Postal Service)		77	63%	31	23	
Storage/Shipping/Nonrefrigerated Warehouse		25	36%	10	8	
Self-storage		6	44%	2	1	
Non-Refrigerated Warehouse[1]	X	45	61%	18	14	92
Refrigerated Warehouse[1]	X	63	62%	25	19	92
Distribution/Shipping Center		11	63%	18	13	
Refrigerated Warehouse[12]		62	63%	25	19	91
Religious Worship		46	52%	18	14	
House of Worship[2]	X	34	39%	13	10	86
Retail (Non-mall Stores, Vehicle Dealerships)		83	67%	33	25	
Retail Stores[14]	X	56	78%	22	17	95
Other[15]		104	55%	42	31	

[1] 100,000 ft², open weekends, 250 PCs, 2 walk-in refrigeration/freezer units, cooking facilities, night school
[2] 105,500 ft², 145 operating hours, 50 workers on main shift, 5 walk-in refrigeration/freezer units, cooking facilities
[3] 105,500 ft², 700 fixed seats, 4 floors, tertiary use
[4] 100,000 ft², 100 workers, 72 operating hours
[5] 100,000 ft², 220 rooms
[6] 100,000 ft², 220 rooms, 12 workers on Main Shift, 5 Commercial Refrigeration/Freezer Units, cooking facilities
[7] 100,000 ft², 72 weekly operating hours, 400 workers on main shift, 375 PCs
[8] 100,000 ft², 66 weekly operating hours, 200 workers on main shift, 200 PCs
[9] 100,000 ft², 60 weekly operating hours, 300 workers on main shift, 150 PCs
[10] 100,000 ft², 12 workers on main shift, 100 weekly operating hours, 2 walk-in refrigeration/freezer units
[11] 100,000 ft², 12 workers on main shift, 100 weekly operating hours
[12] 100,000 ft², 12 workers on main shift, 100 weekly operating hours
[13] 100,000 ft², seating is mainly 30%, 5 weekly operation, 12 PCs, cooking, 3 commercial refrigerators/freezers
[14] 100,000 ft², 84 weekly operating hours, 3 open refrigeration/freezer cases, 1 walk-in refrigerator/freezer unit, 25 workers on main shift, 4 PCs, 12 cash registers, exterior entrance to the public
[15] For all building types not defined by the list above, the applicant may choose to use the performance benchmark categorized by "other". Note that this category is not well defined; therefore, in order to qualify for the EPA Energy Star rating, over 1500 kBtu/ft²-yr. As categorized by EIA, "other" may include: airplane hangars, laboratory, crematorium, data center, etc.

Table B-2. Seattle 2030 Challenge Targets by Residential Space/Building Type based on U.S. West Regional Averages (RECS 2001)

Building Use Description	Average Site kBtu/ft²/yr	Average Percent Electric	60% Target for 2010	70% Target for 2015	Energy Star Rating @ 60% Target
Single-Family Detached	38		5	12	
Single-Family Attached	39		16	12	
Multi-Family, 2 to 4 units	48		15	14	
Multi-Family, 5 or more units	40		14	13	
Mobile Homes	66		26	20	

Section 19. Sections 2-10 of Ordinance 122530 are repealed, effective on the effective date of the 2009 Washington State Energy Code.

Section 20. The provisions of this ordinance are declared to be separate and severable. The invalidity of any clause, sentence, paragraph, subdivision, section or portion of this ordinance, or the invalidity of the application thereof to any person, owner, or circumstance shall not affect the validity of the remainder of this ordinance, or the validity of its application to other persons, owners, or circumstances. The repeal of provisions by this ordinance or the amendment of the Seattle Municipal Code to remove provisions incorporating any code, or provision thereof, shall not relieve any person of the obligation to comply with the terms and conditions of any permit issued pursuant to the provisions as in effect prior to the effectiveness of such repeal or amendment, nor shall it relieve any person or property of any obligations, conditions or restrictions in any agreement or instrument made or granted pursuant to, or with reference to, the provisions in effect prior to the effectiveness of such repeal or amendment.

Section 21. If a complete building permit application is submitted before the earlier of (1) the date 60 days after the effective date of the ordinance introduced as Council Bill 116934 (Seattle Building Code), or (2) the effective date of the 2009 Washington State Energy Code, the applicant may elect to comply with either the requirements of the Seattle Energy Code as enacted by this Ordinance or with the Washington State Energy Code with Seattle amendments as enacted by Ordinance 122530, and the Director may approve the application based upon either of those codes.

Section 22. Except as otherwise expressly provided in this ordinance, (a) this ordinance shall take effect and be in force 30 days from and after its approval by the Mayor, or (b) if not approved and returned by the Mayor within ten days after presentation, it shall take effect as provided by Seattle Municipal Code Section 1.04.020.

Passed by the City Council the 18th day of October, 2010, and signed by me in open session in authentication of its passage this 18th day of October, 2010.

RICHARD CONLIN,

President of the City Council.

Approved by me this 22nd day of october, 2010.

MICHAEL McGINN,

Mayor.

Filed by me this 22nd day of October, 2010.

(Seal) /s/

City Clerk.

Date of publication in the Seattle Daily Journal of Commerce, November 4, 2010

. 11/4(262604)

ORDINANCE 123429

[redacted]

Passed by the City Council the 18th day of October, 2010, and signed by me in open session in authentication of its passage this 18th day of October, 2010.

RICHARD CONLIN,

President of the City Council.

Approved by me this 22nd day of october, 2010.

MICHAEL McGINN,

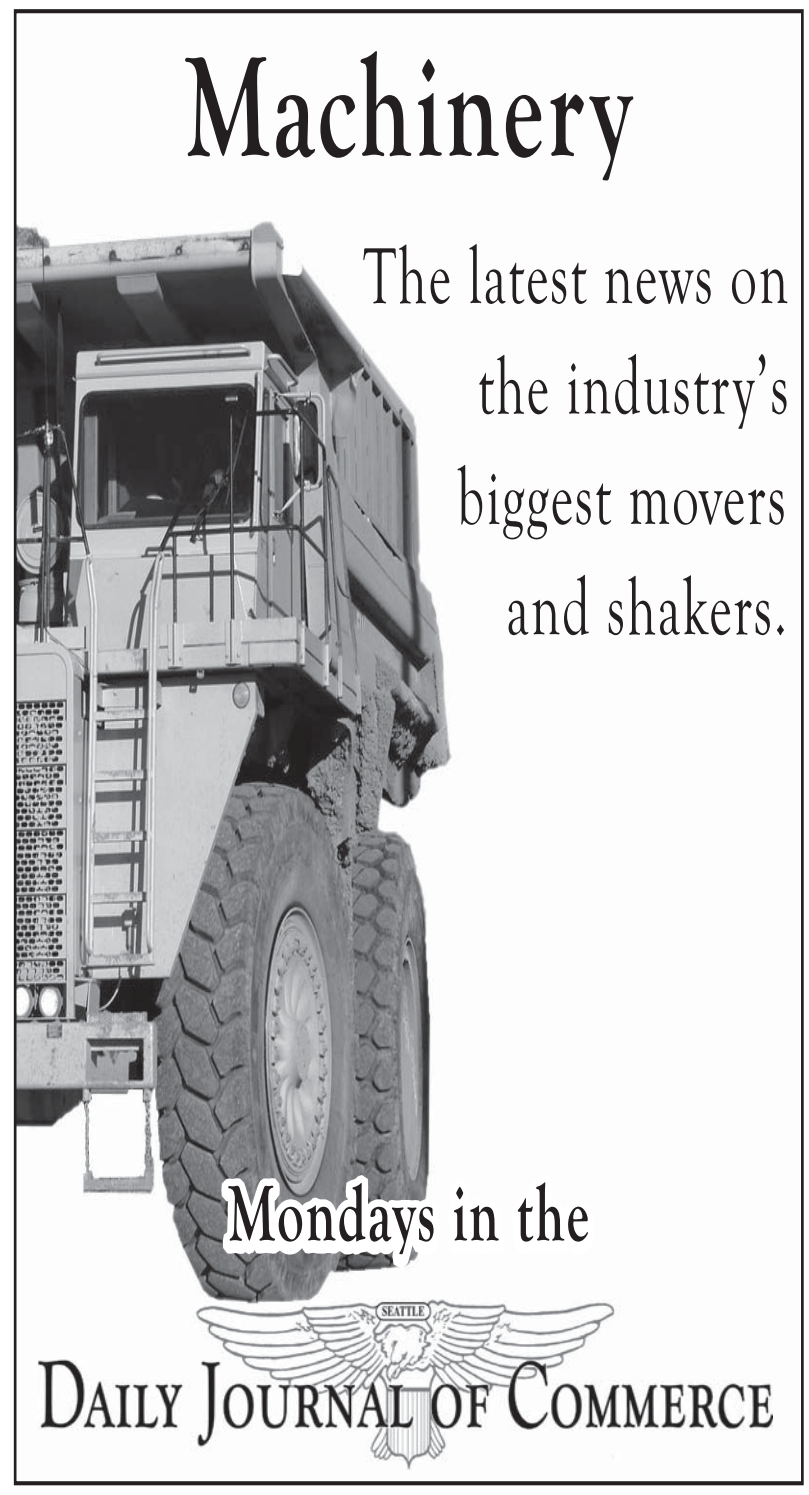
Mayor.

Filed by me this 22nd day of October, 2010.

(Seal) /s/

City Clerk.

Attachment A-Site map of the Seward Park Inn.

Date of publication in the Seattle Daily Journal of Commerce, November 4, 2010

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