APPENDIX

REFERENCE STANDARD 29
(RS-29)

NONRESIDENTIAL BUILDING DESIGN
BY SYSTEMS ANALYSIS
Section 1 — Scope

1.1 General: This Standard establishes design criteria in terms of total energy consumption of a building, including all of its systems. General principles and requirements are outlined in Section 2. Specific modeling assumptions are listed in Section 3.

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 design for the project corresponds with the annual energy analysis. If credit is proposed to be taken for lighting energy savings, then electrical drawings shall also be included with the building permit application.

Due to the various assumptions that are necessary, the results of the analysis shall not be construed as a guarantee of the actual energy performance of the project.

Section 2 — General Principles and Requirements

2.1 Energy Analysis: Compliance with this Standard will require an analysis of the annual energy usage, hereinafter called an annual energy analysis.

A building designed in accordance with this Standard will be deemed as complying with this Code, if:

a. The calculated annual energy consumption is not greater than that of a corresponding “standard design,” as defined below and in Section 3; and,

b. Whose enclosure elements and energy-consuming systems comply with Sections 1310 through 1314, 1410 through 1416, 1440 through 1443, 1450 through 1454, and 1510 through 1513. Buildings shall only vary from those requirements in Sections 1330 through 1334, 1432 through 1439, and 1530 through 1532 where those variations have been accurately and completely modeled. Where variations are not specifically analyzed, the building shall comply with these requirements.

For a proposed building design to be considered similar to a “standard design,” it shall utilize the same energy source(s) for the same functions and have equal floor area and the same ratio of envelope area to floor area, environmental requirements, occupancy, climate data and usage operational schedule. Inputs to the energy analysis relating to occupancy and usage shall correspond to the expected occupancy and usage of the building.

Except as noted below, the systems identified, and, to the extent possible, the assumptions made in assigning energy inputs to each system, shall be the same for the standard design and the proposed design. When electrically driven heat pumps, other than multiple units connected to a common water loop, are employed to provide all or part of the heat for the proposed design, the standard design shall also, for the purposes of the analysis, assume that electrically driven heat pump, in conformance with Chapter 14 of the Code and having capacity at least as great as those used in the proposed design are employed.

2.2 Design: The standard design and the proposed design shall be designed on a common basis as specified herein:

a. The comparison 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.

b. If the proposed design results in an increase in consumption of one energy source and a decrease in another energy source, even though similar sources are used for similar purposes, the difference in each energy source shall be converted to equivalent energy units for purposes of comparing the total energy used.

2.3 Analysis Procedure: The analysis of the annual energy usage of the standard and the proposed building and system design shall meet the following criteria:

a. The building heating/cooling load calculation procedure used for annual energy consumption analysis shall be detailed to permit the evaluation of effect of factors specified in Section 2.4.

b. The calculation procedure used to simulate the operation of the building and its service systems through a full-year operating period shall be detailed to permit the evaluation of the effect of system design, climatic factors, operational characteristics and mechanical equipment on annual energy usage. Manufacturer’s data or comparable field test data shall be used when available in the simulation of systems and equipment. The calculation procedure shall be based upon 8,760 hours of operation of the building and its service systems and shall utilize the design methods, specified in Standard RS-1 listed in Chapter 7 of the Code or in other programs approved by the building official.

2.4 Calculation Procedure: The calculation procedure shall cover the following items:

a. Design requirements—Design heating conditions and design cooling conditions as defined in Chapter 2 of the Code.
b. Climatic data—Coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.

c. Building data—Orientation, size, shape, mass, air and heat transfer characteristics.

d. Operational characteristics—Temperature, humidity, ventilation, illumination and control mode for occupied and unoccupied hours.

e. Mechanical equipment—Design capacity and part load profile.

f. Building loads—Internal heat generation, lighting, equipment and number of people during occupied and unoccupied periods.

2.5 Documentation: All analyses submitted shall be accompanied by an energy analysis comparison report. The report shall provide technical detail on the two building and system designs and on the data used in and resulting from the comparative analysis to verify that both the analysis and the designs meet the criteria of Section 1.

The calculation procedure for the standard design and the proposed design shall separately identify the calculated annual energy consumption for each different occupancy type, if possible, for each of the following end uses:

a. Interior lighting; 
   g. Parking ventilation/fans;

b. Parking lighting; 
   h. Exhaust fans;

c. Exterior lighting; 
   i. Service water heater;

d. Space heating; 
   j. Elevators; and

e. Space cooling; 
   k. Appliances.

f. Interior ventilation/fans;

e. Mechanical equipment—Design capacity and part load profile.

Energy consumption of the following items shall be included but is not required to be separated out by each individual item:

a. Office equipment;

b. Refrigeration other than comfort cooling;

c. Cooking; and

d. Any other energy-consuming equipment.

The specifications of the proposed building project used in the analysis shall be as similar as is reasonably practical to those in the plans submitted for a building permit.

SECTION 3 — SPECIFIC MODELING ASSUMPTIONS

The specific modeling assumptions consist of methods and assumptions for calculating the standard energy consumption for the standard building and the proposed energy consumption of the proposed design. In order to maintain consistency between the standard and the proposed design energy consumptions, the input assumptions in this section shall be used.

“Prescribed” assumptions shall be used without variation. “Default” assumptions shall be used unless the designer can demonstrate that a different assumption better characterizes the building’s use over its expected life. Any modification of a default assumption shall be used in modeling both the standard building and the proposed design unless the designer demonstrates a clear cause to do otherwise.

3.1 Orientation and Shape: The standard building shall consist of the same number of stories and gross floor area for each story as the proposed design. Each floor shall be oriented exactly as the proposed design. The geometric form shall be the same as the proposed design.

3.2 Internal Loads: Internal loads shall be modeled as noted in the following parts of Section 3.2. The systems specified for calculating the standard energy consumption in Section 3.2 are intended only as constraints in calculating the consumption. They are not intended as requirements or recommendations for systems to be used in the proposed building or for the calculation of the proposed energy consumption.

3.2.1 Occupancy: Occupancy schedules shall be default assumptions. The same assumptions shall be made in computing proposed energy consumption as were used in calculating the standard energy consumption. Occupancy levels vary by building type and time of day. Table 3-1 establishes the density presented as ft²/person of conditioned floor area that will be used by each building type. Table 3-2 establishes the percentage of the people that are in the building by hours of the day for each building type.

3.2.2 Lighting: The interior and exterior lighting power allowance for calculating the standard energy consumption shall be determined from Sections 1531 and 1532. The lighting power used to calculate the proposed energy consumption shall be the actual lighting power of the proposed lighting design. Exempt lighting in the standard design shall be equal to the exempt lighting in the proposed design.

Lighting levels in buildings vary based on the type of uses within buildings, by area and by time of day. Table 3-2 contains the lighting energy profiles which establish the percentage of the lighting load that is switched ON in each prototype or reference building by hour of the day. These profiles are default assumptions and can be changed if required when calculating the standard energy consumption to provide, for example, a 12-hour rather than an 8-hour work day or to reflect the use of automatic lighting controls. The lighting schedules used in the standard and proposed designs shall be identical and shall reflect the type of controls to be installed in the proposed design. The controls in the proposed design shall comply with the requirements in Section 1513 and no credit shall be given for the use of any additional controls, automatic or otherwise.
3.2.3 **Receptacle**: Receptacle loads and profiles are default assumptions. The same assumptions shall be made in calculating proposed energy consumption as were used in calculating the standard energy consumption. Receptacle loads include all general service loads that are typical in a building. These loads should include additional process electrical usage but exclude HVAC primary or auxiliary electrical usage. Table 3-1 establishes the density in W/ft² to be used. The receptacle energy profiles shall be the same as the lighting energy profiles in Table 3-2. This profile establishes the percentage of the receptacle load that is switched ON by hour of the day and by building type.

3.3 **Envelope**

3.3.1 **Insulation and Glazing**: Glazing area and U-factor of the standard building envelope shall be determined by using the Target UA requirements of Equation 13-1 and U-factor values in Table 13-1 or 13-2. The glazing solar heat gain coefficient (SHGC) or shading coefficient of the standard building shall be the lesser of 0.65 and the SHGC required by Table 13-1 or 13-2 for the vertical or overhead glazing area for the appropriate wall type. The opaque area U-factors of the standard building shall be determined by using the Target UA requirements from Equation 13-1 including the appropriate mass for walls. The insulation characteristics and glazing area are prescribed assumptions for the standard building for calculating the standard energy consumption. In the calculation of the proposed energy consumption of the proposed design, the envelope characteristics of the proposed design shall be used. The standard design shall use the maximum glazing areas listed in Tables 13-1 or 13-2 for the appropriate use. The distribution of vertical glazing in the gross wall area of the standard design shall be equal to the distribution of vertical glazing in the proposed design or shall constitute an equal percentage of gross wall area on all sides of the standard building. The distribution of overhead glazing in the gross roof/ceiling area of the standard design shall be equal to the distribution of overhead glazing in the proposed design. The distribution of doors in the gross opaque wall area of the standard design shall be identical to the distribution of doors in the proposed design.

3.3.2 **Infiltration**: For standard and proposed buildings, infiltration assumptions shall be equal.

3.3.3 **Envelope and Ground Absorptivities**: For the standard building, absorptivity assumptions shall be default assumptions for computing the standard energy consumption and default assumptions for computing the proposed energy consumption. The solar absorptivity of opaque elements of the building envelope shall be assumed to be 70%. The solar absorptivity of ground surfaces shall be assumed to be 80% (20% reflectivity).

3.3.4 **Window Treatment**: No draperies or blinds shall be modeled for the standard or proposed building.

3.3.5 **Shading**: For standard building and the proposed design, 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. Credit may be taken for external shading devices that are part of the proposed design.

3.4 **HVAC Systems and Equipment**: For the standard building, the HVAC system used shall be the system type used in the proposed design. If the proposed HVAC system does not comply with Sections 1432 through 1439, the standard design system shall comply in all respects with those sections.

**EXCEPTION**: When approved by the building official, a prototype HVAC system may be used, if the proposed design system cannot be modified to comply with Sections 1422 and 1432 through 1439, as a standard design. Use of prototype HVAC systems shall only be permitted for the building types listed below. For mixed-use buildings, the floor space of each building type is allocated within the floor space of the standard building. The specifications and requirements for the HVAC systems of prototype buildings shall be those in Table 3-3.

| 1. assembly       | 6. restaurant     |
| 2. health/institution | 7. retail (mercantile) |
| 3. hotel/motel    | 8. school (educational) |
| 4. light manufacturing | 9. warehouse (storage) |
| 5. office (business) |

3.4.1 **HVAC Zones**: HVAC zones for calculating the standard energy consumption and proposed energy consumption shall consist of at least four perimeter and one interior zone per floor, with at least one perimeter zone facing each orientation. The perimeter zones shall be 15 feet in width or one-third the narrow dimension of the building when this dimension is between 30 and 45 feet inclusive, or half the narrow dimension of the building when this dimension is less than 30 feet.

**EXCEPTIONS**: 1. Building types such as assembly or warehouse may be modeled as a single zone if there is only one space.
2. Thermally similar zones, such as those facing one orientation on different floors, may be grouped together for the purposes of either the standard or proposed building simulation.

3.4.2 **Process Equipment Sizing**: Process sensible and latent loads shall be equal in calculating both the standard energy consumption and the proposed energy consumption. The designer shall document the installation of process equipment and the size of process loads.
3.4.3 HVAC Equipment Sizing: The equipment shall be sized to include the capacity to meet the process loads. For calculating the proposed energy consumption, actual air flow rates and installed equipment size shall be used in the simulation. Equipment sizing in the simulation of the proposed design shall correspond to the equipment intended to be selected for the design and the designer shall not use equipment sized automatically by the simulation tool.

Equipment sizing for the standard design shall be based on the same as the proposed design or lesser sizing ratio of installed system capacity to the design load for heating and for cooling.

Chilled water systems for the standard building shall be modeled using a reciprocating chiller for systems with total cooling capacities less than 175 tons, and centrifugal chillers for systems with cooling capacities of 175 tons or greater. For systems with cooling capacities of 600 tons or more, the standard energy consumption shall be calculated using two centrifugal chillers, lead/lag controlled. Chilled water shall be assumed to be controlled at a constant 44°F temperature rise, from 44°F to 56°F, operating at 65% combined impeller and motor efficiency. Condenser water pumps shall be sized using a 10°F temperature rise, operating at 60% combined impeller and motor efficiency. The cooling tower shall be an open circuit, centrifugal blower type sized for the larger of 85°F leaving water temperature or 10°F approach to design wetbulb temperature. The tower shall be controlled to provide a 65°F leaving water temperature whenever weather conditions permit, floating up to design leaving water temperature at design conditions.

3.4.4 Fans: The power of the combined fan system per air volume at design conditions (w/cfm) of the proposed design shall be equal to that of the standard design.

Variable air volume fan systems in the standard building shall be variable speed.

3.5 Service Water Heating: The service water heating loads for prototype buildings are defined in terms of Btu/person-hour in Table 3-1. The values in the table refer to energy content of the heated water. The service water heating loads from Table 3-1 are default for all buildings. The same service-water-heating load assumptions shall be made in calculating proposed energy consumption as were used in calculating the standard energy consumption. The service water heating system for the standard building shall be modeled as closely as possible as if it were designed in accordance with RS-11 and meeting all the requirements of Sections 1440 through 1443.

3.6 Controls

3.6.1: All occupied conditioned spaces in standard and proposed design buildings in all climates shall be simulated as being both heated and cooled.

EXCEPTIONS: 1. If a building or portion of a building is to be provided with only heating or cooling, both the standard building and the proposed design shall be simulated using the same assumptions.

2. If warehouses are not intended to be mechanically cooled, both the standard and proposed energy consumption shall be modeled assuming no mechanical cooling.

3.6.2: Space temperature controls for the standard building shall be set at 70°F for space heating and 75°F for space cooling, with a deadband in accordance with Section 1412.2. The system shall be OFF during off-hours according to the appropriate schedule in Table 3-2, except that the heating system shall cycle ON if any space should drop below the night setback setting 55°F. There shall be no similar setpoint during the cooling season. Lesser deadband ranges may be used in calculating the proposed energy consumption.

EXCEPTIONS: 1. Setback shall not be modeled in determining either the standard or proposed energy consumption if setback is not realistic for the proposed design such as a facility being operated 24 hours/day. For instance, health facilities need not have night setback during the heating season.

2. If deadband controls are not to be installed, the proposed energy consumption shall be calculated with both heating and cooling thermostat setpoints set to the same value between 70°F and 75°F inclusive, assumed to be constant for the year.

3.6.3: When providing for outdoor air ventilation when calculating the standard energy consumption, controls shall be assumed to close the outside air intake to reduce the flow of outside air to 0.0 cfm during “setback” and “unoccupied” periods. Ventilation using inside air may still be required to maintain scheduled setback temperature. Outside air ventilation, during occupied periods, shall be as required by the Washington State Ventilation and Indoor Air Quality Code, Chapter 51-13 WAC.

3.6.4: If humidification is to be used in the proposed design, the same level of humidification and system type shall be used in the standard building.
### TABLE 3-1

Acceptable Occupancy Densities, Receptacle Power Densities and Service Hot Water Consumption

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Occupancy Density(^2) Sq.Ft./Person (Btu/h \cdot ft(^2))</th>
<th>Receptacle Power Density(^3) Watts/Sq.Ft. (Btu/h \cdot ft(^2))</th>
<th>Service Hot Water Quantities(^4) Btu/h \cdot Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly</td>
<td>50 (4.60)</td>
<td>0.25 (0.85)</td>
<td>215</td>
</tr>
<tr>
<td>Health/Instutional</td>
<td>200 (1.15)</td>
<td>1.00 (3.41)</td>
<td>135</td>
</tr>
<tr>
<td>Hotel/Motel</td>
<td>250 (0.92)</td>
<td>0.25 (0.85)</td>
<td>1,110</td>
</tr>
<tr>
<td>Light Manufacturing</td>
<td>750 (0.31)</td>
<td>0.20 (0.68)</td>
<td>225</td>
</tr>
<tr>
<td>Office</td>
<td>275 (0.84)</td>
<td>0.75 (2.56)</td>
<td>175</td>
</tr>
<tr>
<td>Parking Garage</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Restaurant</td>
<td>100 (2.30)</td>
<td>0.10 (0.34)</td>
<td>390</td>
</tr>
<tr>
<td>Retail</td>
<td>300 (0.77)</td>
<td>0.25 (0.85)</td>
<td>135</td>
</tr>
<tr>
<td>School</td>
<td>75 (3.07)</td>
<td>0.50 (1.71)</td>
<td>215</td>
</tr>
<tr>
<td>Warehouse</td>
<td>15,000 (0.02)</td>
<td>0.10 (0.34)</td>
<td>225</td>
</tr>
</tbody>
</table>

1. The occupancy densities, receptacle power densities, and service hot water consumption values are from ASHRAE Standard 90.1-1989 and addenda.
2. Values are in square feet of conditioned floor area per person. Heat generation in Btu per person per hour is 230 sensible and 190 latent. Figures in parenthesis are equivalent Btu per hour per square foot.
3. Values are in Watts per square foot of conditioned floor area. Figures in parenthesis are equivalent Btu per hour per square foot. These values are the minimum acceptable. If other process loads are not input (such as for computers, cooking, refrigeration, etc.), it is recommended that receptacle power densities be increased until total process energy consumption is equivalent to 25% of the total.
4. Values are in Btu per person per hour.
TABLE 3-2A
Assembly Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Percent of Maximum Load</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water Percent of Maximum Load</th>
<th>Schedule for Elevator Percent of Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
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<td>0</td>
<td>5</td>
<td>5</td>
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<tr>
<td>6 (5-6 am)</td>
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<td>0</td>
<td>5</td>
<td>5</td>
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<td>7 (6-7 am)</td>
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<td>5</td>
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<td>8 (7-8 am)</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>9 (8-9 am)</td>
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<td>10 (9-10 am)</td>
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<td>5</td>
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<td>12 (11-12 pm)</td>
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<td>0</td>
<td>5</td>
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<tr>
<td>16 (3-4 pm)</td>
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<td>17 (4-5 pm)</td>
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<td>24 (11-12 am)</td>
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<td>5</td>
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<tr>
<td></td>
<td>Total/Day</td>
<td>710</td>
<td>750</td>
<td>700</td>
<td>1155</td>
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<tr>
<td></td>
<td>Total/Week</td>
<td>50.50 hours</td>
<td>74.20 hours</td>
<td>124 hours</td>
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<tr>
<td></td>
<td>Total/Year</td>
<td>2633 hours</td>
<td>3869 hours</td>
<td>6465 hours</td>
<td>308 hours</td>
</tr>
</tbody>
</table>

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 3-2B

**Health Occupancy**

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Percent of Maximum Load</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water Percent of Maximum Load</th>
<th>Schedule for Elevator Percent of Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>10</td>
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<tr>
<td>2 (1-2 am)</td>
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<td>0</td>
<td>0</td>
<td>10</td>
<td>10</td>
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<tr>
<td>3 (2-3 am)</td>
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<td>10</td>
<td>10</td>
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<tr>
<td>4 (3-4 am)</td>
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<td>0</td>
<td>10</td>
<td>10</td>
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<tr>
<td>5 (4-5 am)</td>
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<td>0</td>
<td>10</td>
<td>10</td>
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<tr>
<td>6 (5-6 am)</td>
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<td>10</td>
<td>10</td>
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<tr>
<td>7 (6-7 am)</td>
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<td>0</td>
<td>10</td>
<td>10</td>
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<tr>
<td>8 (7-8 am)</td>
<td>10</td>
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<td>0</td>
<td>50</td>
<td>20</td>
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<tr>
<td>9 (8-9 am)</td>
<td>50</td>
<td>30</td>
<td>5</td>
<td>90</td>
<td>40</td>
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<tr>
<td>10 (9-10 am)</td>
<td>80</td>
<td>40</td>
<td>5</td>
<td>90</td>
<td>40</td>
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<tr>
<td>11 (10-11 am)</td>
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<td>5</td>
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<td>40</td>
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<tr>
<td>12 (11-12 pm)</td>
<td>80</td>
<td>40</td>
<td>5</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
<td>80</td>
<td>40</td>
<td>5</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>14 (1-2 pm)</td>
<td>80</td>
<td>40</td>
<td>5</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
<td>80</td>
<td>40</td>
<td>5</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>16 (3-4 pm)</td>
<td>80</td>
<td>40</td>
<td>5</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
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<td>5</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
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<td>0</td>
<td>30</td>
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<tr>
<td>19 (6-7 pm)</td>
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<td>30</td>
<td>10</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>30</td>
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<td>0</td>
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<td>10</td>
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<tr>
<td>21 (8-9 pm)</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>10</td>
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<tr>
<td>22 (9-10 pm)</td>
<td>20</td>
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<tr>
<td>23 (10-11 pm)</td>
<td>0</td>
<td>0</td>
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<td>10</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
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<td>0</td>
<td>0</td>
<td>10</td>
<td>10</td>
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</tbody>
</table>

Total/Day: 850 380 40 1060 550 160 2400 2400 2400 783 249 24 1136 540 16
Total/Week: 46.70 hours 60.10 hours 168 hours 41.88 hours 62.36 hours
Total/Year: 2435 hours 3134 hours 8760 hours 2148 hours 3251 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 3-2C
Hotel/Motel Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Wk Sat Sun</th>
<th>Schedule for Lighting Receptacle Wk Sat Sun</th>
<th>Schedule for HVAC System Wk Sat Sun</th>
<th>Schedule for Service Hot Water Wk Sat Sun</th>
<th>Schedule for Elevator Wk Sat Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (12-1 am)</td>
<td>90 90 70</td>
<td>20 20 30</td>
<td>On On On</td>
<td>20 20 25</td>
<td>40 44 55</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>90 90 70</td>
<td>15 20 30</td>
<td>On On On</td>
<td>15 15 20</td>
<td>33 35 55</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
<td>90 90 70</td>
<td>10 10 20</td>
<td>On On On</td>
<td>15 15 20</td>
<td>33 35 43</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
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<td>10 10 20</td>
<td>On On On</td>
<td>15 15 20</td>
<td>33 35 43</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
<td>90 90 70</td>
<td>10 10 20</td>
<td>On On On</td>
<td>20 20 20</td>
<td>33 35 43</td>
</tr>
<tr>
<td>6 (5-6 am)</td>
<td>90 90 70</td>
<td>10 10 20</td>
<td>On On On</td>
<td>25 25 30</td>
<td>33 35 43</td>
</tr>
<tr>
<td>7 (6-7 am)</td>
<td>70 70 70</td>
<td>40 30 30</td>
<td>On On On</td>
<td>50 40 50</td>
<td>42 40 52</td>
</tr>
<tr>
<td>8 (7-8 am)</td>
<td>40 50 70</td>
<td>50 30 40</td>
<td>On On On</td>
<td>60 50 50</td>
<td>42 32 52</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
<td>40 50 50</td>
<td>40 40 40</td>
<td>On On On</td>
<td>55 50 50</td>
<td>52 45 65</td>
</tr>
<tr>
<td>10 (9-10 am)</td>
<td>20 30 50</td>
<td>40 40 30</td>
<td>On On On</td>
<td>45 50 55</td>
<td>52 45 65</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>20 30 50</td>
<td>25 30 30</td>
<td>On On On</td>
<td>40 45 50</td>
<td>40 42 53</td>
</tr>
<tr>
<td>12 (11-12 pm)</td>
<td>20 30 30</td>
<td>25 25 30</td>
<td>On On On</td>
<td>45 50 50</td>
<td>51 60 60</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
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<td>25 25 30</td>
<td>On On On</td>
<td>40 50 40</td>
<td>51 65 53</td>
</tr>
<tr>
<td>14 (1-2 pm)</td>
<td>20 30 20</td>
<td>25 25 20</td>
<td>On On On</td>
<td>35 45 40</td>
<td>51 65 51</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
<td>20 30 20</td>
<td>25 25 20</td>
<td>On On On</td>
<td>30 40 30</td>
<td>51 65 50</td>
</tr>
<tr>
<td>16 (3-4 pm)</td>
<td>30 30 20</td>
<td>25 25 20</td>
<td>On On On</td>
<td>30 40 30</td>
<td>51 65 44</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
<td>50 30 30</td>
<td>25 25 20</td>
<td>On On On</td>
<td>30 35 30</td>
<td>63 65 64</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
<td>50 50 40</td>
<td>25 25 20</td>
<td>On On On</td>
<td>40 40 40</td>
<td>80 75 62</td>
</tr>
<tr>
<td>19 (6-7 pm)</td>
<td>50 60 40</td>
<td>60 60 50</td>
<td>On On On</td>
<td>55 55 50</td>
<td>86 80 65</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>70 60 60</td>
<td>80 70 70</td>
<td>On On On</td>
<td>60 55 50</td>
<td>70 80 63</td>
</tr>
<tr>
<td>21 (8-9 pm)</td>
<td>70 60 60</td>
<td>90 70 80</td>
<td>On On On</td>
<td>50 50 40</td>
<td>70 75 63</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>80 70 80</td>
<td>80 70 60</td>
<td>On On On</td>
<td>55 55 50</td>
<td>70 75 63</td>
</tr>
<tr>
<td>23 (10-11 pm)</td>
<td>90 70 80</td>
<td>60 60 50</td>
<td>On On On</td>
<td>45 40 40</td>
<td>45 55 40</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
<td>90 70 80</td>
<td>30 30 30</td>
<td>On On On</td>
<td>25 30 20</td>
<td>45 55 40</td>
</tr>
</tbody>
</table>

Total/Day: 1390 1390 1300 855 785 810 2400 2400 2400 915 930 900 1217 1303 1287
Total/Week: 96.40 hours 58.70 hours 168.0 hours 64.05 hours 86.75 hours
Total/Year: 5026 hours 3061 hours 8760 hours 3340 hours 4523 hours

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 3-2D
Light Manufacturing Occupancy¹

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Percent of Maximum Load</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water Percent of Maximum Load</th>
<th>Schedule for Elevator Percent of Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
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<td>0</td>
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</tr>
<tr>
<td>5 (4-5 am)</td>
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<td>0</td>
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<tr>
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<td>0</td>
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<td>5</td>
</tr>
<tr>
<td>7 (6-7 am)</td>
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<td>5</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8 (7-8 am)</td>
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<td>5</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
<td>95</td>
<td>30</td>
<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>10 (9-10 am)</td>
<td>95</td>
<td>30</td>
<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>95</td>
<td>30</td>
<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>12 (11-12 pm)</td>
<td>95</td>
<td>30</td>
<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
<td>95</td>
<td>10</td>
<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>14 (1-2 pm)</td>
<td>95</td>
<td>10</td>
<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
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<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>16 (3-4 pm)</td>
<td>95</td>
<td>10</td>
<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
<td>95</td>
<td>10</td>
<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>19 (6-7 pm)</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>10</td>
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<td>0</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>21 (8-9 pm)</td>
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<td>0</td>
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<td>5</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>10</td>
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<td>0</td>
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<td>5</td>
</tr>
<tr>
<td>23 (10-11 pm)</td>
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<td>0</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
<td>5</td>
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<td>0</td>
<td>5</td>
<td>5</td>
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</tbody>
</table>

**Total/Day**

<table>
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<th></th>
<th>920</th>
<th>200</th>
<th>60</th>
<th>1040</th>
<th>280</th>
<th>120</th>
<th>1600</th>
<th>1200</th>
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<th>537</th>
<th>256</th>
<th>113</th>
<th>555</th>
<th>151</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total/Week</strong></td>
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<td>hours</td>
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<td>hours</td>
<td>30.54</td>
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<td>29.26</td>
<td>hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2534</td>
<td>hours</td>
<td>2920</td>
<td>hours</td>
<td>4797</td>
<td>hours</td>
<td>1592</td>
<td>hours</td>
<td>1526</td>
<td>hours</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 3-2E
Office Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Occupancy Percent of Day</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water Percent of Maximum Load</th>
<th>Schedule for Elevator Percent of Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
<td>0</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>0</td>
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<td>0</td>
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<td>5</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
<td>0</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6 (5-6 am)</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7 (6-7 am)</td>
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<td>5</td>
<td>10</td>
<td>10</td>
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<tr>
<td>8 (7-8 am)</td>
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<td>10</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
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<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>10 (9-10 am)</td>
<td>95</td>
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<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>95</td>
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<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>12 (11-12 pm)</td>
<td>95</td>
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<td>5</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
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<td>5</td>
<td>80</td>
<td>15</td>
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<tr>
<td>14 (1-2 pm)</td>
<td>95</td>
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<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
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<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>16 (3-4 pm)</td>
<td>95</td>
<td>10</td>
<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
<td>95</td>
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<td>5</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
<td>30</td>
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<td>5</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>19 (6-7 pm)</td>
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<td>0</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>10</td>
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<td>0</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>21 (8-9 pm)</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>23 (10-11 pm)</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total/Day</td>
<td>920</td>
<td>200</td>
<td>60</td>
<td>1040</td>
<td>280</td>
</tr>
<tr>
<td>Total/Week</td>
<td>48.60 hours</td>
<td>56.00 hours</td>
<td>92.00 hours</td>
<td>30.54 hours</td>
<td>29.26 hours</td>
</tr>
<tr>
<td>Total/Year</td>
<td>2534 hours</td>
<td>2920 hours</td>
<td>4797 hours</td>
<td>1592 hours</td>
<td>1526 hours</td>
</tr>
</tbody>
</table>

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 3-2F
Parking Garage Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Percent of Maximum Load Wk</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load Wk</th>
<th>Schedule for HVAC System Percent of Maximum Load Wk</th>
<th>Schedule for Service Hot Water Percent of Maximum Load Wk</th>
<th>Schedule for Elevator Percent of Maximum Load Wk</th>
</tr>
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<tbody>
<tr>
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<td>100</td>
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<td>NA</td>
</tr>
<tr>
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<tr>
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<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
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<td>100</td>
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<td>NA</td>
</tr>
<tr>
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<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>6 (5-6 am)</td>
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<tr>
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<tr>
<td>8 (7-8 am)</td>
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<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
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<td>100</td>
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<tr>
<td>10 (9-10 am)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
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<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
<td>100</td>
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<td>100</td>
<td></td>
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</tr>
<tr>
<td>14 (1-2 pm)</td>
<td>100</td>
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<td></td>
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</tr>
<tr>
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<td>NA</td>
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<td></td>
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<td>20 (7-8 pm)</td>
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<td>100</td>
<td>100</td>
<td></td>
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<tr>
<td>21 (8-9 pm)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>23 (10-11 pm)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
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</tr>
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<td>2400</td>
<td>2400</td>
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<td>Based on likely use</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Percent of Maximum Load</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water Percent of Maximum Load</th>
<th>Schedule for Elevator Percent of Maximum Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
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<td>20</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
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<td>20</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
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<td>5</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
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<td>0</td>
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<td>15</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
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<td>0</td>
<td>15</td>
<td>15</td>
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<tr>
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<td>0</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
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<td>0</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>7 (7-8 am)</td>
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<td>0</td>
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<td>30</td>
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<tr>
<td>8 (8-9 am)</td>
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<td>60</td>
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<tr>
<td>10 (10-11 am)</td>
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<td>10</td>
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<td>80</td>
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<tr>
<td>11 (11-12 pm)</td>
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<td>20</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>12 (12-1 pm)</td>
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<td>25</td>
<td>90</td>
<td>80</td>
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<tr>
<td>13 (1-2 pm)</td>
<td>70</td>
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<td>25</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>14 (2-3 pm)</td>
<td>40</td>
<td>35</td>
<td>15</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>15 (3-4 pm)</td>
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<td>30</td>
<td>20</td>
<td>90</td>
<td>80</td>
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<tr>
<td>16 (4-5 pm)</td>
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<td>25</td>
<td>90</td>
<td>80</td>
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<tr>
<td>17 (5-6 pm)</td>
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<td>35</td>
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<td>90</td>
</tr>
<tr>
<td>18 (6-7 pm)</td>
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<tr>
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<td>65</td>
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<td>90</td>
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<td>70</td>
<td>90</td>
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<tr>
<td>21 (9-10 pm)</td>
<td>50</td>
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<td>35</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>22 (10-11 pm)</td>
<td>35</td>
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<td>20</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>23 (11-12 am)</td>
<td>20</td>
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<td>20</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Total/Day</td>
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<tr>
<td>Total/Year</td>
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<td>5086 hours</td>
<td>7039 hours</td>
<td>2766 hours</td>
<td>0 hours</td>
</tr>
</tbody>
</table>

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 3-2H
Retail Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy</th>
<th>Schedule for Lighting Receptacle</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water</th>
<th>Schedule for Elevator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>0</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
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<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
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<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6 (5-6 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7 (6-7 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8 (7-8 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>10 (9-10 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>12 (11-12 pm)</td>
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<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>14 (1-2 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>16 (3-4 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>19 (6-7 pm)</td>
<td>0</td>
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<td>0</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>0</td>
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<td>0</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>21 (8-9 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>10</td>
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<tr>
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<tr>
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<td>0</td>
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<td>0</td>
<td>5</td>
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</tr>
</tbody>
</table>

**Total/Day**

<table>
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<tr>
<th></th>
<th>720</th>
<th>750</th>
<th>280</th>
<th>1115</th>
<th>985</th>
<th>525</th>
<th>1500</th>
<th>1600</th>
<th>900</th>
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</table>

**Total/Week**

<table>
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<tr>
<th></th>
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<th>70.85 hours</th>
<th>100 hours</th>
<th>44.59 hours</th>
<th>52.69 hours</th>
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</table>

**Total/Year**

<table>
<thead>
<tr>
<th></th>
<th>2414 hours</th>
<th>3694 hours</th>
<th>5214 hours</th>
<th>2325 hours</th>
<th>2747 hours</th>
</tr>
</thead>
</table>

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 3-2I
School Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy Percent of Maximum Load Wk Sat Sun</th>
<th>Schedule for Lighting Receptacle Percent of Maximum Load Wk Sat Sun</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water Percent of Maximum Load Wk Sat Sun</th>
<th>Schedule for Elevator Percent of Maximum Load Wk Sat Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (12-1 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>6 (5-6 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>7 (6-7 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>5 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>8 (7-8 am)</td>
<td>5 0 0</td>
<td>30 5 5</td>
<td>On Off Off</td>
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<td>0 0 0</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
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<td>30 0 0</td>
</tr>
<tr>
<td>10 (9-10 am)</td>
<td>90 10 0</td>
<td>95 15 5</td>
<td>On On Off</td>
<td>60 5 5</td>
<td>30 0 0</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>90 10 0</td>
<td>95 15 5</td>
<td>On On Off</td>
<td>63 5 5</td>
<td>30 0 0</td>
</tr>
<tr>
<td>12 (11-12 pm)</td>
<td>80 10 0</td>
<td>95 15 5</td>
<td>On On Off</td>
<td>72 5 5</td>
<td>30 0 0</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
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<td>80 15 5</td>
<td>On On Off</td>
<td>79 5 5</td>
<td>30 0 0</td>
</tr>
<tr>
<td>14 (1-2 pm)</td>
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<td>80 5 5</td>
<td>On Off Off</td>
<td>83 3 5</td>
<td>30 0 0</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
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<td>80 5 5</td>
<td>On Off Off</td>
<td>83 3 5</td>
<td>30 0 0</td>
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<tr>
<td>16 (3-4 pm)</td>
<td>45 0 0</td>
<td>70 5 5</td>
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<td>65 3 3</td>
<td>15 0 0</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
<td>15 0 0</td>
<td>50 5 5</td>
<td>On Off Off</td>
<td>10 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
<td>5 0 0</td>
<td>50 5 5</td>
<td>On Off Off</td>
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<td>0 0 0</td>
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<tr>
<td>19 (6-7 pm)</td>
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<td>35 5 5</td>
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<td>0 0 0</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>20 0 0</td>
<td>35 5 5</td>
<td>On Off Off</td>
<td>25 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>21 (8-9 pm)</td>
<td>20 0 0</td>
<td>35 5 5</td>
<td>On Off Off</td>
<td>22 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>10 0 0</td>
<td>30 5 5</td>
<td>On Off Off</td>
<td>22 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>23 (10-11 pm)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>12 3 3</td>
<td>0 0 0</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
<td>0 0 0</td>
<td>5 5 5</td>
<td>Off Off Off</td>
<td>9 3 3</td>
<td>0 0 0</td>
</tr>
</tbody>
</table>

Total/Day 710 50 0 990 170 120 1500 500 0 691 80 84 285 0 0
Total/Week 36.00 hours 52.40 hours 80.00 hours 36.19 hours 14.25 hours
Total/Year 1877 hours 2732 hours 4171 hours 1887 hours 743 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 3-2J
Warehouse Occupancy

<table>
<thead>
<tr>
<th>Hour of Day (Time)</th>
<th>Schedule for Occupancy</th>
<th>Schedule for Lighting Receptacle</th>
<th>Schedule for HVAC System</th>
<th>Schedule for Service Hot Water</th>
<th>Schedule for Elevator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk</td>
<td>Sat</td>
<td>Sun</td>
<td>Wk</td>
<td>Sat</td>
</tr>
<tr>
<td>1 (12-1 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2 (1-2 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3 (2-3 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4 (3-4 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5 (4-5 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6 (5-6 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7 (6-7 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8 (7-8 am)</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>9 (8-9 am)</td>
<td>70</td>
<td>20</td>
<td>0</td>
<td>70</td>
<td>8</td>
</tr>
<tr>
<td>10 (9-10 am)</td>
<td>90</td>
<td>20</td>
<td>0</td>
<td>90</td>
<td>24</td>
</tr>
<tr>
<td>11 (10-11 am)</td>
<td>90</td>
<td>20</td>
<td>0</td>
<td>90</td>
<td>24</td>
</tr>
<tr>
<td>12 (11-12 pm)</td>
<td>90</td>
<td>20</td>
<td>0</td>
<td>90</td>
<td>24</td>
</tr>
<tr>
<td>13 (12-1 pm)</td>
<td>50</td>
<td>10</td>
<td>0</td>
<td>80</td>
<td>5</td>
</tr>
<tr>
<td>14 (1-2 pm)</td>
<td>85</td>
<td>10</td>
<td>0</td>
<td>90</td>
<td>5</td>
</tr>
<tr>
<td>15 (2-3 pm)</td>
<td>85</td>
<td>10</td>
<td>0</td>
<td>90</td>
<td>5</td>
</tr>
<tr>
<td>16 (3-4 pm)</td>
<td>85</td>
<td>10</td>
<td>0</td>
<td>90</td>
<td>5</td>
</tr>
<tr>
<td>17 (4-5 pm)</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>5</td>
</tr>
<tr>
<td>18 (5-6 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>19 (6-7 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>20 (7-8 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>21 (8-9 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>22 (9-10 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>23 (10-11 pm)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>24 (11-12 am)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total/Day</strong></td>
<td>680</td>
<td>120</td>
<td>0</td>
<td>915</td>
<td>180</td>
</tr>
<tr>
<td><strong>Total/Week</strong></td>
<td>35.20 hours</td>
<td>48.75 hours</td>
<td>58.00 hours</td>
<td>22.88 hours</td>
<td>3.50 hours</td>
</tr>
<tr>
<td><strong>Total/Year</strong></td>
<td>1835 hours</td>
<td>2542 hours</td>
<td>3024 hours</td>
<td>1193 hours</td>
<td>182 hours</td>
</tr>
</tbody>
</table>

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 3-3
HVAC Systems of Prototype Buildings

<table>
<thead>
<tr>
<th>Use</th>
<th>System #</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Churches (any size)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. ≤ 50,000 ft² or ≤ 3 floors</td>
<td>1 or 3</td>
<td>Note 2</td>
</tr>
<tr>
<td>c. &gt; 50,000 ft² or &gt; 3 floors</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2. Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Nursing Home (any size)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>b. ≤ 15,000 ft²</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. &gt; 15,000 ft² and ≤ 50,000 ft²</td>
<td>4</td>
<td>Note 3</td>
</tr>
<tr>
<td>d. &gt; 50,000 ft²</td>
<td>5</td>
<td>Note 3</td>
</tr>
<tr>
<td>3. Hotel/Motel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ≤ 3 Stories</td>
<td>2</td>
<td>Note 6</td>
</tr>
<tr>
<td>b. &gt; 3 Stories</td>
<td>6</td>
<td>Note 7</td>
</tr>
<tr>
<td>4. Light Manufacturing</td>
<td>1 or 3</td>
<td>Note 2</td>
</tr>
<tr>
<td>5. Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ≤ 20,000 ft²</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. &gt; 20,000 ft² and either ≤ 3 floors or ≤ 75,000 ft²</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>c. &gt; 75,000 ft² or &gt; 3 floors</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6. Restaurant</td>
<td>1 or 3</td>
<td>Note 2</td>
</tr>
<tr>
<td>7. Retail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ≤ 50,000 ft²</td>
<td>1 or 3</td>
<td>Note 2</td>
</tr>
<tr>
<td>b. &gt; 50,000 ft²</td>
<td>4 or 5</td>
<td>Note 2</td>
</tr>
<tr>
<td>8. Schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ≤ 75,000 ft² or ≤ 3 floors</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. &gt; 75,000 ft² or &gt; 3 floors</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>9. Warehouse</td>
<td></td>
<td>Note 5</td>
</tr>
</tbody>
</table>

**Footnote to Table 3-3:** The systems and energy types presented in this table are not intended as requirements or recommendations for the proposed design. Floor areas in the table are the total conditioned floor areas for the listed use in the building. The number of floors indicated in the table is the total number of occupied floors for the listed use.

### TABLE 3-3 (Continued)
HVAC System Descriptions for Prototype Buildings

<table>
<thead>
<tr>
<th>HVAC Component</th>
<th>System #1</th>
<th>System #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Description</td>
<td>Packaged rooftop single zone, one unit per zone</td>
<td>Packaged terminal air conditioner with space heater or heat pump, heating or cooling unit per zone</td>
</tr>
<tr>
<td>Fan system Design Supply Circulation Rate</td>
<td>Note 10</td>
<td>Note 11</td>
</tr>
<tr>
<td>Supply Fan Control</td>
<td>Constant volume</td>
<td>Fan cycles with call for heating or cooling</td>
</tr>
<tr>
<td>Return Fan Control</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Cooling System</td>
<td>Direct expansion air cooled</td>
<td>Direct expansion air cooled</td>
</tr>
<tr>
<td>Heating System</td>
<td>Furnace, heat pump or electric resistance</td>
<td>Heat pump with electric resistance auxiliary or air conditioner with space heater</td>
</tr>
<tr>
<td>Remarks</td>
<td>Drybulb economizer per Section 1433, heat recovery if required by Section 1433</td>
<td>No economizer, if not required by Section 1433</td>
</tr>
</tbody>
</table>
### TABLE 3-3 (Continued)
HVAC System Descriptions for Prototype Buildings

<table>
<thead>
<tr>
<th>HVAC Component</th>
<th>System #3</th>
<th>System #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Description</td>
<td>Air handler per zone with central plant</td>
<td>Packaged rooftop VAV with perimeter reheat and fan-powered terminal units</td>
</tr>
<tr>
<td>Fan system Design Supply Circulation Rate</td>
<td>Note 10</td>
<td>Note 10</td>
</tr>
<tr>
<td>Supply Fan Control</td>
<td>Constant volume</td>
<td>VAV with forward curved centrifugal fan and variable inlet fans</td>
</tr>
<tr>
<td>Return Fan Control</td>
<td>Constant volume</td>
<td>VAV with forward curved centrifugal fan and discharge dampers</td>
</tr>
<tr>
<td>Cooling System</td>
<td>Chilled water (Note 12)</td>
<td>Direct expansion air cooled</td>
</tr>
<tr>
<td>Heating System</td>
<td>Hot water (Note 13)</td>
<td>Hot water (Note 13) or electric resistance</td>
</tr>
<tr>
<td>Remarks</td>
<td>Drybulb economizer per Section 1433, heat recovery if required by Section 1436</td>
<td>Drybulb economizer per Section 1433. Minimum VAV setting per Section 1435 Exception 1, Supply air reset by zone of greatest cooling demand, heat recovery if required by Section 1436</td>
</tr>
</tbody>
</table>

### TABLE 3-3 (Continued)
HVAC System Descriptions for Prototype Buildings

<table>
<thead>
<tr>
<th>HVAC Component</th>
<th>System #5</th>
<th>System #6</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Description</td>
<td>Built-up central VAV with perimeter reheat and fan-powered terminal units</td>
<td>Four-pipe fan coil per zone with central plant</td>
</tr>
<tr>
<td>Fan system Design Supply Circulation Rate</td>
<td>Note 10</td>
<td>Note 10</td>
</tr>
<tr>
<td>Supply Fan Control</td>
<td>VAV with air-foil centrifugal fan and AC frequency variable speed drive</td>
<td>Fan cycles with call for heating or cooling</td>
</tr>
<tr>
<td>Return Fan Control</td>
<td>VAV with air-foil centrifugal fan and AC frequency variable speed drive</td>
<td>NA</td>
</tr>
<tr>
<td>Cooling System</td>
<td>Chilled water (Note 12)</td>
<td>Chilled water (Note 12)</td>
</tr>
<tr>
<td>Heating System</td>
<td>Hot water (Note 13) or electric resistance</td>
<td>Hot water (Note 13) or electric resistance</td>
</tr>
<tr>
<td>Remarks</td>
<td>Drybulb economizer per Section 1433. Minimum VAV setting per Section 1435 Exception 1, Supply air reset by zone of greatest cooling demand, heat recovery if required by Section 1436</td>
<td>No economizer, if not required by Section 1433</td>
</tr>
</tbody>
</table>
Numbered Footnotes for Table 3-3
HVAC System Descriptions for Prototype Buildings

1. The systems and energy types presented in this Table are not intended as requirements or recommendations for the proposed design.

2. For occupancies such as restaurants, assembly and retail that are part of a mixed use building which, according to Table 3-3, includes a central chilled water plant (systems 3, 5, or 6), chilled water system type 3 or 5 shall be used as indicated in the table.

3. Constant volume may be used in zones where pressurization relationships must be maintained by code. Where constant volume is used, the system shall have heat recovery if required by Section 1436. VAV shall be used in all other areas, in accordance with Sections 1432 through 1439.

4. Provide run-around heat recovery systems for all fan systems with a minimum outside air intake greater than 70%. Recovery effectiveness shall be 0.50.

5. If a warehouse is not intended to be mechanically cooled, both the standard and proposed designs shall be calculated assuming no mechanical cooling.

6. The system listed is for guest rooms only. Areas such as public areas and back-of-house areas shall be served by system 4. Other areas such as offices and retail shall be served by systems listed in Table 3-3 for these occupancy types.

7. The system listed is for guest rooms only. Areas such as public areas and back-of-house areas shall be served by system 5. Other areas such as offices and retail shall be served by systems listed in Table 3-3 for these occupancy types.

8. Reserved.

9. Reserved.

10. Design supply air circulation rate shall be based on a supply-air to room-air temperature difference of 20°F. A higher supply-air temperature may be used if required to maintain a minimum circulation rate of 4.5 air changes per hour or 15 cfm per person to each zone served by the system, at design conditions. If return fans are specified, they shall be sized for the supply fan capacity less the required minimum ventilation with outside air, or 75% of the supply fan capacity, whichever is larger. Except where noted, supply and return fans shall be operated continuously during occupied hours.

11. Fan energy when included in the efficiency rating of the unit as defined in Section 1411, need not be modeled explicitly for this system. The fan shall cycle with calls for heating or cooling.

12. Chilled water systems shall be modeled using a reciprocating chiller for systems with total cooling capacities less than 175 tons, and centrifugal chillers for systems with cooling capacities of 175 tons or greater. For systems with cooling capacities of 600 tons or more, the standard design energy consumption shall be calculated using two centrifugal chillers, lead/lag controlled. Chilled water shall be assumed to be controlled at a constant 44°F. Chiller water pumps shall be sized using a 12°F temperature rise, from 44°F to 56°F, operating at 65% combined impeller and motor efficiency. Condenser water pumps shall be sized using a 10°F temperature rise, operating at 60% combined impeller and motor efficiency. The cooling tower shall be an open circuit, centrifugal blower type sized for the larger of 85°F leaving water temperature or 10°F approach to design wetbulb temperature. The tower shall be controlled to provide a 65°F leaving water temperature whenever weather conditions permit, floating up to design leaving water temperatures at design conditions. Chilled water supply temperature shall be reset in accordance with Section 1432.2.2.

13. Hot water system shall include a natural draft fossil fuel or electric boiler. The hot water pump shall be sized based on a 30°F temperature drop, from 180°F to 150°F, operating at a combined impeller and motor efficiency of 60%. Hot water supply temperature shall be reset in accordance with Section 1432.2.2.
SECTION 4 — SUGGESTED SOFTWARE FOR SYSTEMS ANALYSIS APPROACH

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