

## Chapters Comm 50—64

### APPENDIX A

The material contained in the appendix is for clarification purposes only. The notes, illustrations, etc. are numbered to correspond to the number of the rule as it appears in the text of the code.

**Comm A-50.06 (3) ISSUANCE OF BUILDING PERMITS.** Section Comm 50.06 (3) refers to s. Comm 83.25 (2), which reads as follows:

**Comm 83.25 (2) ISSUANCE OF BUILDING PERMITS. (a) General.** Pursuant to s. 66.036, Stats., the issuance of building permits by a municipality for unsanwered properties shall be in accordance with this subsection.

(b) *New construction.* A municipality may not issue a building permit to commence construction or installation of a structure that necessitates the use of a POWTS to serve the structure, unless:

1. The owner of the property possesses a sanitary permit for the installation of a POWTS in accordance with s. Comm 83.21; or

*Note:* Section Comm 83.21 outlines the procedures for the issuance of sanitary permits. Sections 145.135 and 145.19, Stats., mandate that no private sewage system may be installed unless the owner of the property holds a valid sanitary permit.

2. A POWTS of adequate capability and capacity to accommodate the wastewater flow and contaminant load already exists to serve the structure.

*Note:* See ss. Comm 83.02 and 83.03 concerning the application of current code requirements to existing POWTS.

(c) *Construction affecting wastewater flow or contaminant load.*

1. A municipality may not issue a building permit to commence construction of any addition or alteration to an existing structure when the proposed construction will modify the design wastewater flow or contaminant load, or both, to an existing POWTS, unless the owner of the property:

- a. Possesses a sanitary permit to either modify the existing POWTS or construct a POWTS to accommodate the modification in wastewater flow or contaminant load, or both; or
- b. Provides documentation to verify that the existing POWTS is sufficient to accommodate the modification in wastewater flow or contaminant load, or both.

2. For the purpose of this paragraph, a modification in wastewater flow or contaminant load shall be considered to occur:

- a. For commercial facilities, public buildings, and places of employment, when there is a proposed change in occupancy of the structure; or the proposed modification affects either the type or number of plumbing appliances, fixtures or devices discharging to the system; and

- b. For dwellings, when there is an increase or decrease in the number of bedrooms.

(d) *Documentation of existing capabilities.* Documentation to verify whether an existing POWTS can accommodate a modification in wastewater flow or contaminant load, or both, shall include at least one of the following:

1. A copy of the plan for the existing POWTS that delineates minimum and maximum performance capabilities and which has been previously approved by the department or the governmental unit.

2. Information on the performance capabilities for the existing POWTS that has been recognized through a product approval under ch. Comm 84.

3. A written investigative report prepared by an architect, engineer, designer of plumbing systems, designer of private sewage systems, master plumber, master plumber-restricted service or certified POWTS inspector analyzing the proposed modification and the performance capabilities of the existing POWTS.

(e) *Setbacks.* 1. A municipality may not issue a building permit for construction of any structure or addition to a structure on a site where there exists a POWTS, unless the proposed construction conforms to the applicable setback limitations under s. Comm 83.43 (8) (i).

2. The applicant for a building permit shall provide documentation to the municipality issuing the building permit showing the location and setback distances for the proposed construction relative to all of the following:

- a. Existing POWTS treatment components.
- b. Existing POWTS holding components.
- c. Existing POWTS dispersal components.

*Note:* A municipality which issues building permits may delegate to the governmental unit responsible for issuing sanitary permits the determination of whether the proposed construction will affect or interfere with an existing POWTS relating to capability or location of the existing POWTS.

**A-51.01 (12) BUILDING.** The intent was to consider permanent awnings as part of a building.

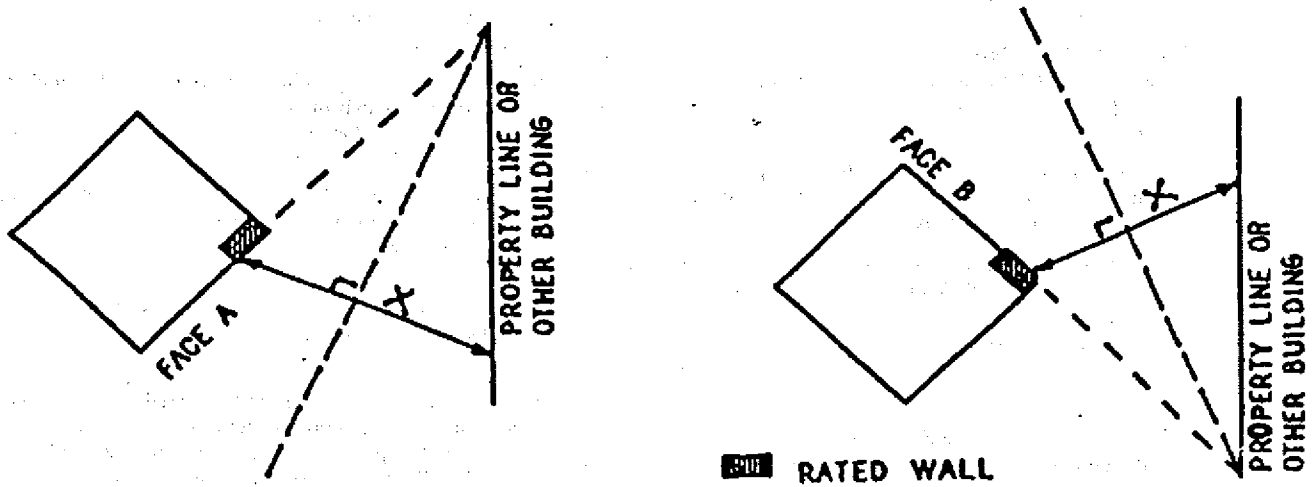
**A-51.01 (42) FAMILY.** The intent of this definition is to clarify the use of the word "family" in reference to s. Comm 51.01 (102a); it is not intended as a variance to the definition stated under s. Comm 51.01 (102a) (b).

**A-51.01 (67a) HABITABLE ROOM.** It is the intent that rooms designated as recreation, study, den, family room, office, etc. and providing the only space for living and/or sleeping are considered

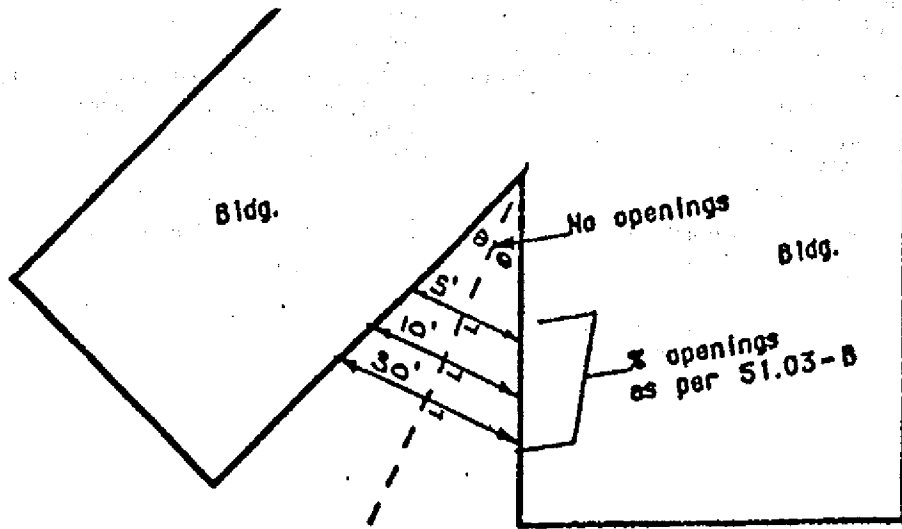
habitable rooms.

**A-51.01 (115) SETBACK.** The intent was to not include gutters, downspouts, outdoor lighting fixtures, signs and similar attachments as part of a building.

To determine the portion of a wall (A) that is within a distance X from a property line or another building, extend the wall face to its intersection with the property line or other building. Bisect the angle formed by the intersection. Measure X perpendicular to the bisector. Repeat these steps for wall face B.



The following sketch shows setback measurements between intersecting or projected intersection of building faces.



**A-51.01 (121) STORIES, NUMBER OF.** For further clarification, refer to A-51.02 (14).

**A-51.01 (144) WALL (DIVISION).**

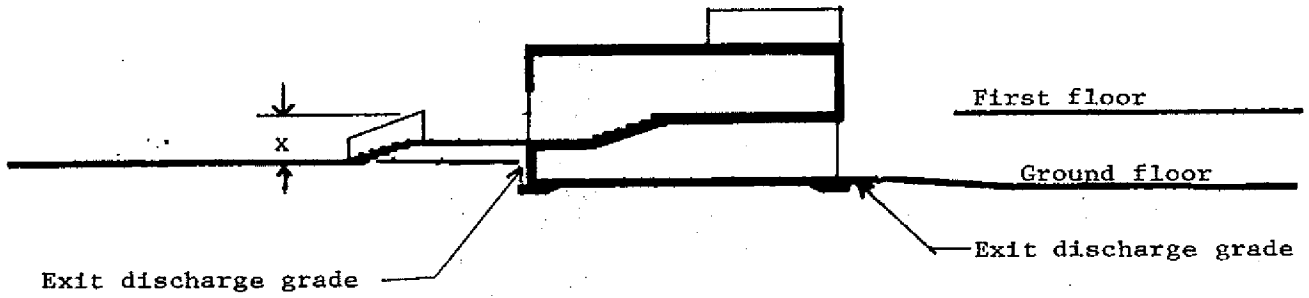
(a) *Building division wall* is intended to denote a wall constructed in a manner sufficient to meet requirements for a party wall [see "Wall (Party)"] and is acceptable as a dividing wall or enclosing wall when determining the volume of a building as referred to in ss. Comm 50.07, 50.10 and 50.12.

(b) *Fire division wall* is intended to relate to construction that provides separation between portions of a building to satisfy allow-

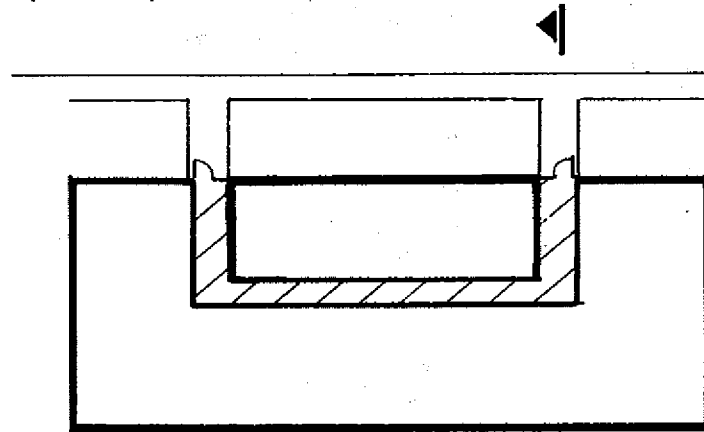
able floor area limitations, separation between 2 classes of construction, or separation of hazardous occupancies. For other separations, see "occupancy separations" and isolation of hazards sections of this code.

**A-51.01 (151) WALL (PARTY).** It is intended that a property consisting of joining plotted subdivisions owned by one individual, that can be owned by separate individuals, is included in the definition of party wall.

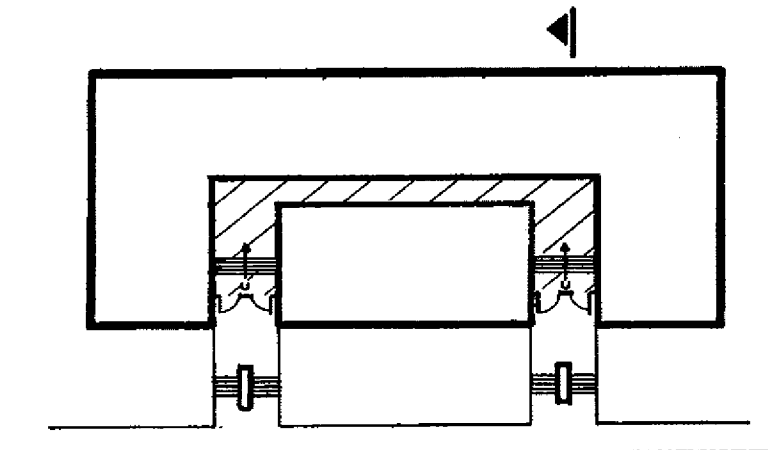
**A-51.02 (14) DETERMINATION OF NUMBER OF STORIES.** The following illustrations are provided to give visual aid to this rule and the definition of s. Comm 51.01 (121) Stories, Number of.



Note: X = 6'-0" (maximum)

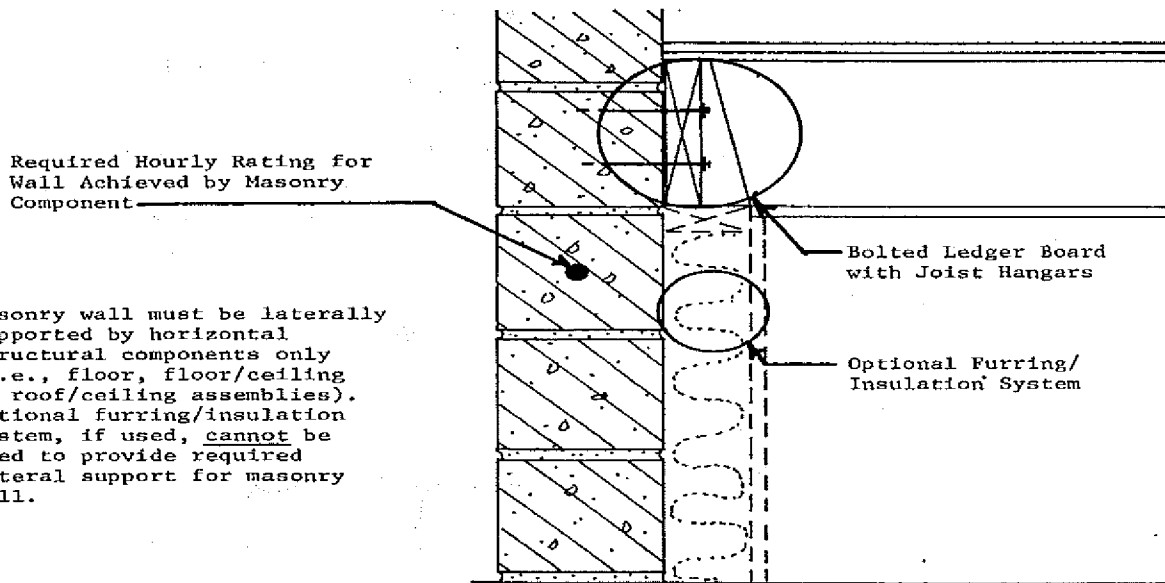


Ground floor



First floor

**A-51.03 (5) (a) EXTERIOR MASONRY CONSTRUCTION.** The following Figures 1, 2, 3, 4, 5A and 5B illustrate typical details for various wall construction alternatives, which satisfy the intent of this rule for Type 5—Exterior Masonry Construction.



**FIGURE 1**  
Single Wythe Masonry Wall  
(Bearing Condition)

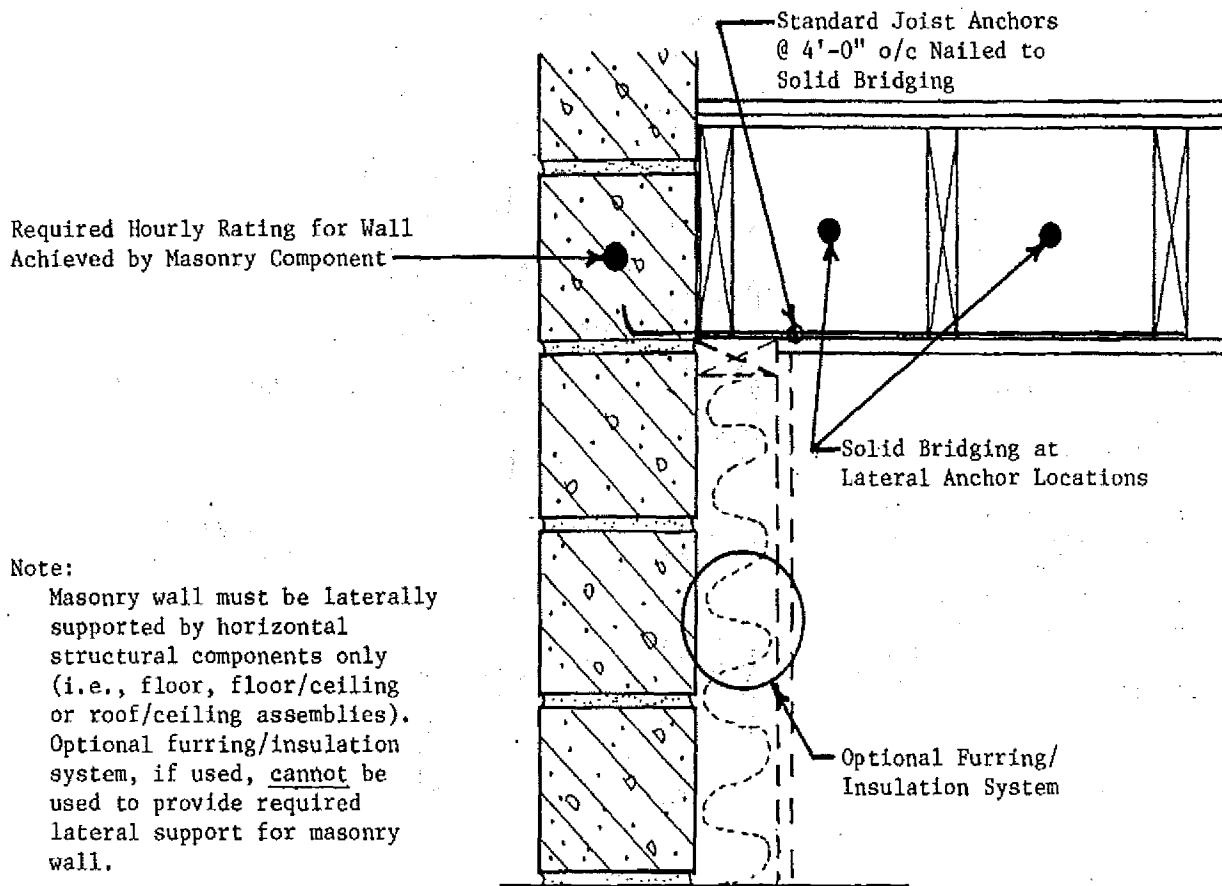
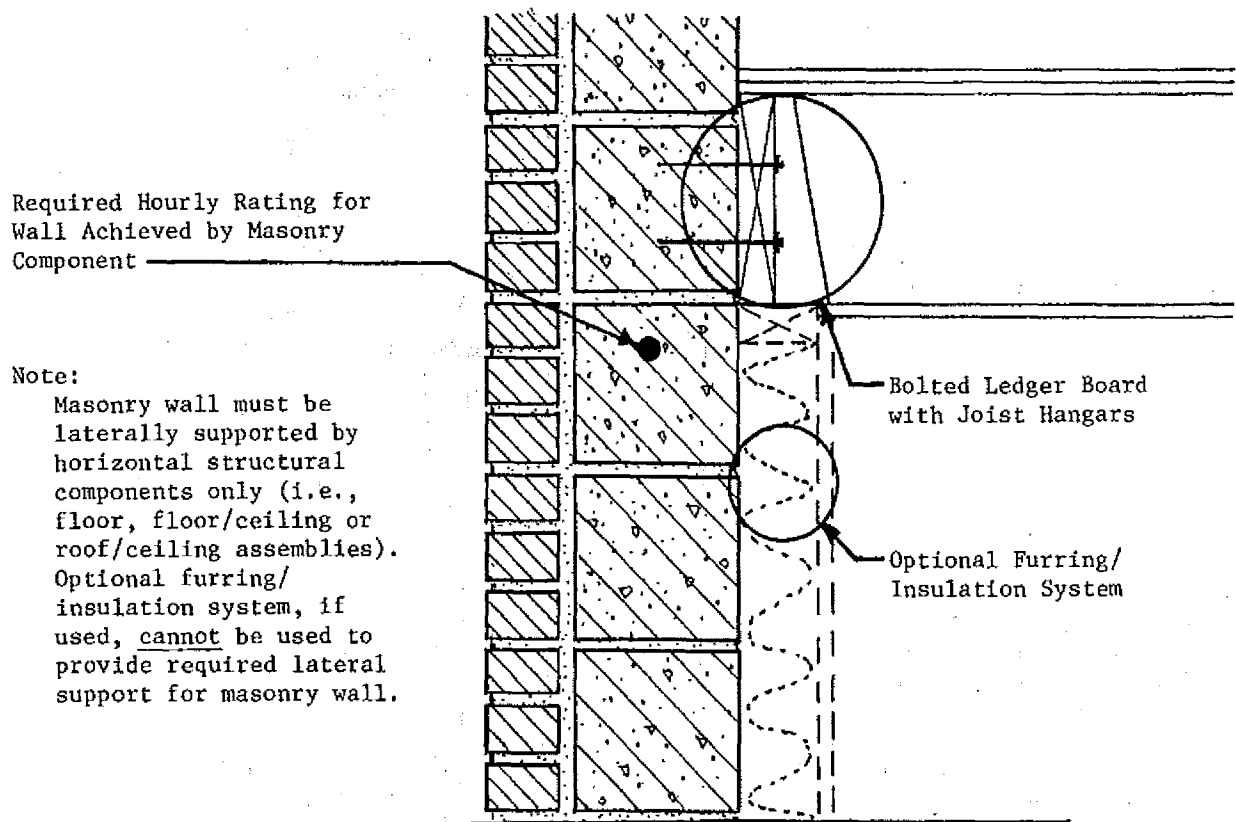


FIGURE 2  
Single Wythe Masonry Wall  
(Non-Bearing Condition)



**FIGURE 3**  
Multi-Wythe Masonry Wall  
(Bearing Condition)

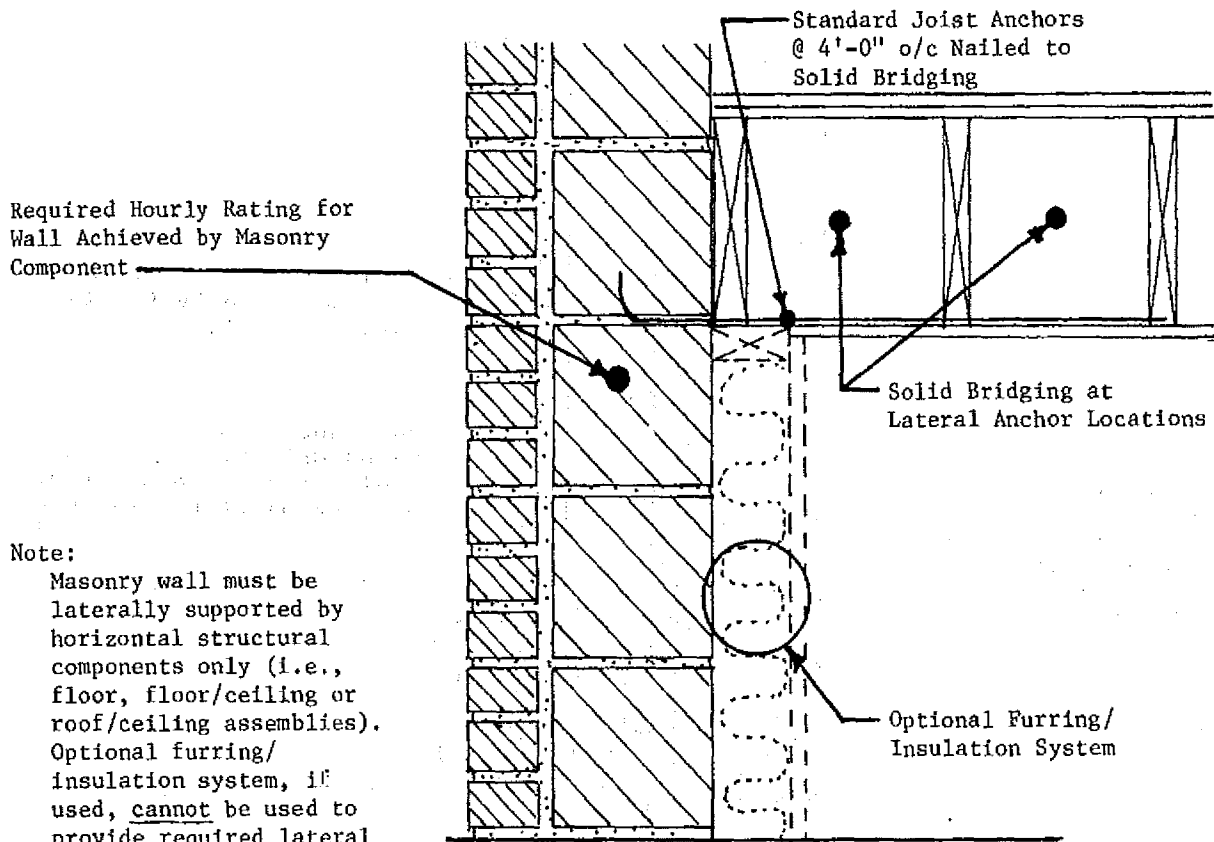


FIGURE 4  
Multi-Wythe Masonry Wall  
(Non-Bearing Condition)

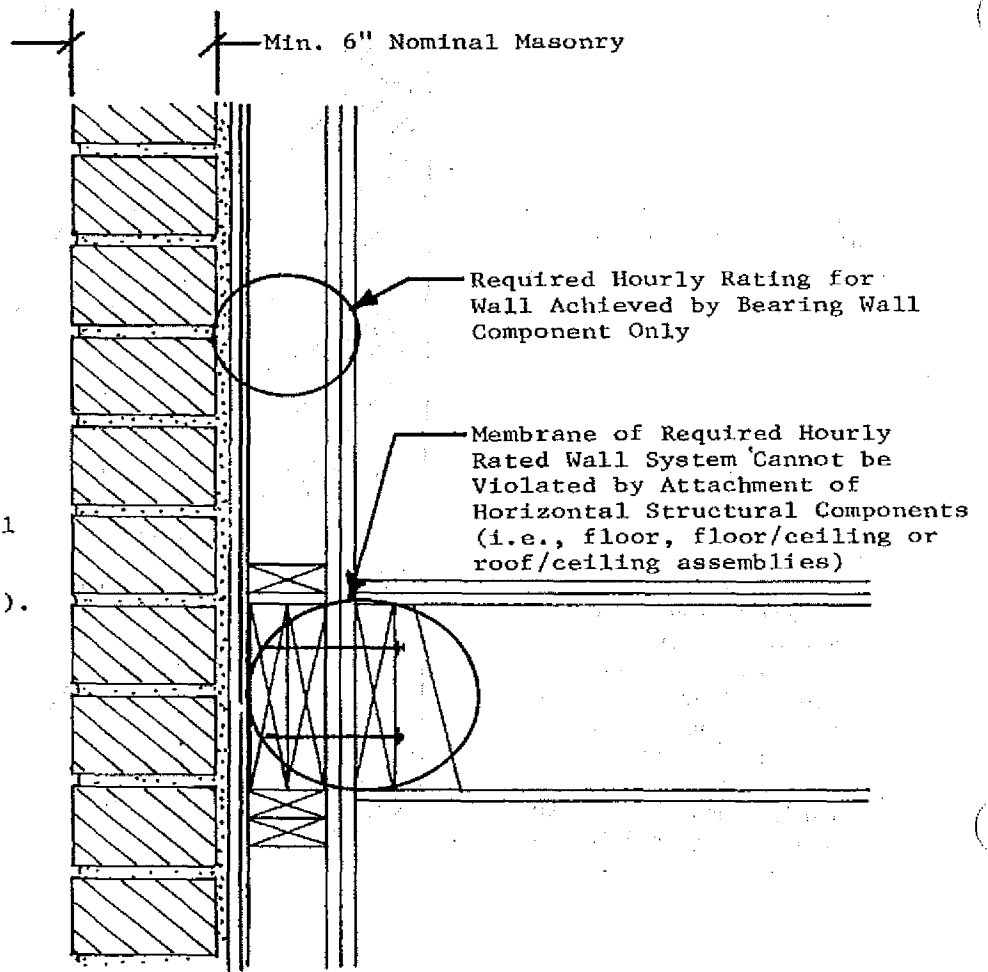
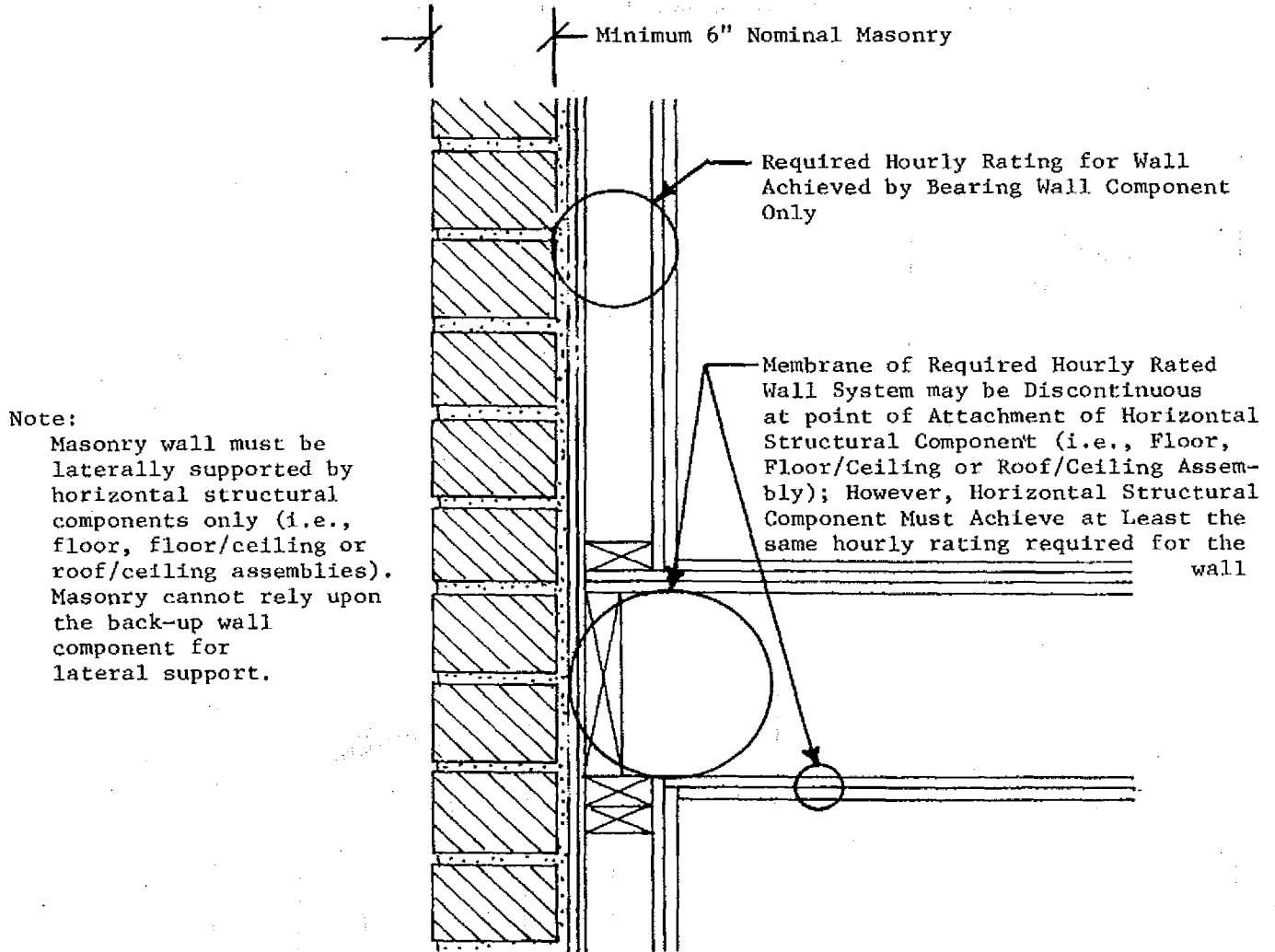


FIGURE 5A  
Combination Masonry/Frame Wall  
(Bearing and Non-Bearing Condition)

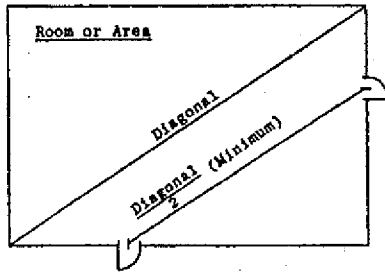




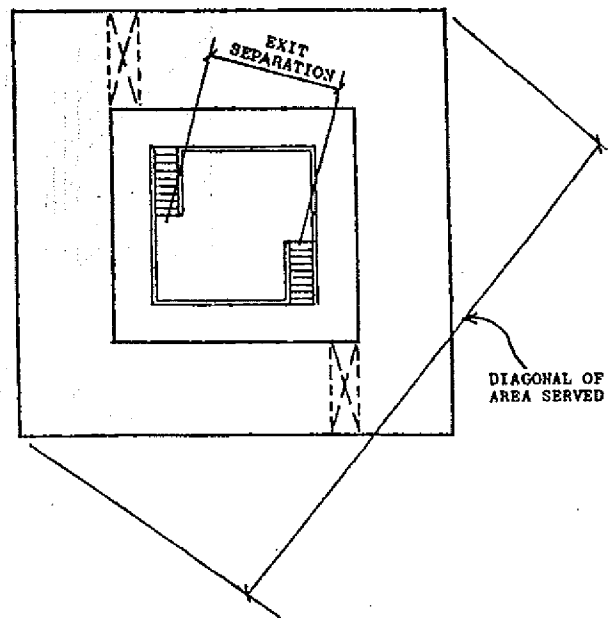
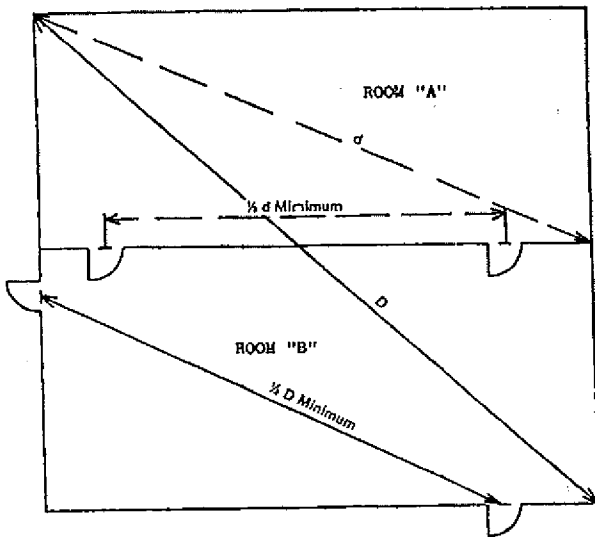
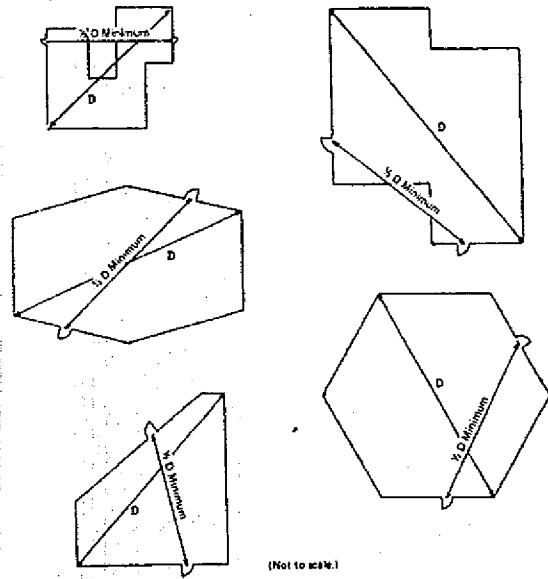
**FIGURE 5B**  
**Combination Masonry/Frame Wall**  
**(Bearing and Non-Bearing Condition)**

A-51.151 EXIT DISTRIBUTION. The following diagrams are provided to aid building designers in determining proper exit distribution:

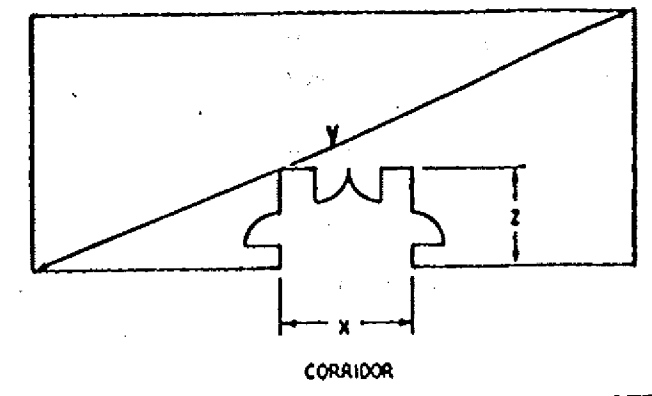
ARRANGEMENT OF EXITS



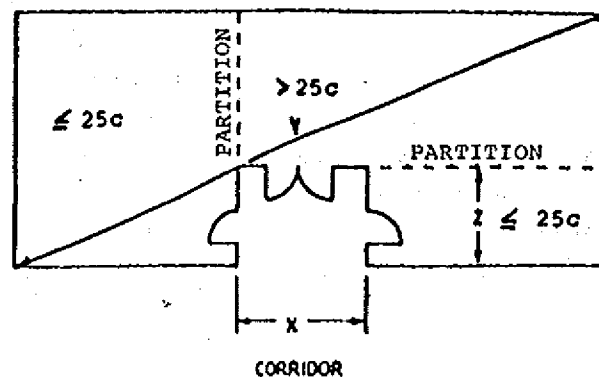
Minimum Distance = One-half of Diagonal



**A-51.152** EGRESS CONFIGURATIONS. The following diagrams are provided to aid building designers in determining proper egress configurations:



$$20' \leq x \leq \frac{y}{2}$$



$$20' \leq x \leq \frac{y}{2}$$

**A-51.22** FIRE EXTINGUISHERS. The following information is taken from the National Fire Protection Association Standard #10-1988 - Portable Fire Extinguishers. The information is provided to assist building designers in determining the number, type and location of fire extinguishers needed to comply with the provisions of the standard.

#### 1-4 CLASSIFICATION AND RATINGS OF FIRE EXTINGUISHERS.

1-4.1 Portable fire extinguishers are classified for use on certain classes of fires and rated for relative extinguishing effectiveness at a temperature of plus 70°F by testing laboratories. This is based upon the preceding classification of fires and the fire-extinguishment potentials as determined by fire tests.

1-4.2 The classification and rating system described in this standard is that used by Underwriters Laboratories, Inc., and Underwriters Laboratories of Canada and is based on extinguishing pre-planned fires of determined size and description as follows:

Class A Rating — Wood and excelsior.

Class B Rating — Two-inch depth n-heptane fires in square pans.

Class C Rating — No fire test. Agent must be a nonconductor of electricity.

Class D Rating — Special tests on specific combustible metal fires.

#### 1-5 CLASSIFICATION OF HAZARDS

1-5.1 Light (low) hazard. Light hazard occupancies are locations where the total amount of Class A combustible materials, including furnishings, decorations and contents, is of minor quantity. This may include some buildings or rooms occupied as offices, classrooms, churches, assembly halls, etc. This classification anticipates that the majority of contents items are either noncombustible or so arranged that a fire is not likely to spread rapidly. Small amounts of Class B flammables used for duplicating machines, art departments, etc., are included provided that they are kept in closed containers and safely stored.

1-5.2 Ordinary (moderate) hazard. Ordinary hazard occupancies are locations where the total amount of Class A combustibles and Class B flammables are present in greater amounts than expected under light (low) hazard occupancies. These occupancies could consist of offices, classrooms, mercantile shops and allied stor-

age, light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of light (low) hazard occupancies and warehouses containing Class I or Class II commodities as defined by NFPA 231, Standard for General Storage.

1-5.3 Extra (high) hazard. Extra hazard occupancies are locations where the total amount of Class A combustibles and Class B flammables present, in storage, production use, and/or finished product is over and above those expected and classed as ordinary (moderate) hazards. These occupancies could consist of woodworking, vehicle repair, aircraft and boat servicing, individual product display showrooms, product convention center displays, storage and manufacturing processes such as painting, dipping, coating, including flammable liquid handling. Also included is warehousing of, or in-process storage of other than Class I and Class II commodities.

#### 3-2 FIRE EXTINGUISHER SIZE AND PLACEMENT FOR CLASS A HAZARDS.

3-2.1 Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 3-2.1 except as modified by 3-2.3. Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 3-2.1, except as modified by 3-2.3.

3-2.1.1 Certain smaller extinguishers which are charged with multipurpose dry chemical or Halon 1211 are rated on Class B and Class C fires, but have insufficient effectiveness to earn the minimum 1-A rating even though they have value in extinguishing smaller Class A fires. They shall not be used to meet the requirements of 3-2.1.

3-2.2 Up to one-half of the complement of extinguishers as specified in Table 3-2.1 may be replaced by uniformly spaced 1½ inch hose stations for use by the occupants of the building. When hose stations are so provided they shall conform to NFPA 14, Installation of Standpipe and Hose Systems. The location of hose stations and the placement of fire extinguishers shall be in such a manner that the hose stations do not replace more than every other extinguisher.

3-2.3 Where the floor area of a building is less than that specified in Table 3-2.1, at least one extinguisher of the minimum size recommended shall be provided.

3-2.4 The protection requirements may be fulfilled with extinguishers of higher rating provided the travel distance to such larger extinguishers shall not exceed 75 feet.

Table 3-2.1

|   | Light (Low)<br>Hazard Occupancy | Ordinary (Moderate)<br>Hazard Occupancy | Extra (High)<br>Hazard Occupancy |
|---|---------------------------------|---|----------------------------------|
| Minimum rated single extinguisher       | 2-A                             | 2-A                                     | 4-A*                             |
| Maximum floor area per unit of A        | 3,000 sq. ft.                   | 1,500 sq. ft.                           | 1,000 sq. ft.                    |
| Maximum floor area for extinguisher     | 11,250 sq. ft.                  | 11,250 sq. ft.                          | 11,250 sq. ft.                   |
| Maximum travel distance to extinguisher | 75 ft.                          | 75 ft.                                  | 75 ft.                           |

\*Two 2 1/2 gal water type extinguishers can be used to fulfill the requirements of one 4-A rated extinguisher.

**A-52.011 HAZARD CLASSIFICATIONS.** The following information is provided to assist building owners and designers in determining the hazard classifications of typical building usage or occupancy:

| HAZARD CLASSIFICATION | DESCRIPTION OF FUEL LOAD  | TYPICAL EXAMPLES   |
|-----------------------|---|--|
| Low Hazard            | Buildings or structures used for the manufacture or storage of noncombustible or low hazard materials, that do not ordinarily burn rapidly, such as but not limited to: asbestos; chalk; non-alcoholic beverages; brick and masonry; ceramic products; gypsum; glass and metals; foods in noncombustible containers; fresh fruits and vegetables in non-plastic containers; dairy products in non-wax coated paper containers; beer or wine in metal or glass containers; electrical motors and coils; and fertilizer.  | Metal fabricating and assembly; foundries; water pumping and waste water treatment plants; fertilizer storage; telephone exchanges; freezer warehouses; storage in closed front metal cabinets; storage of noncombustible or low hazard materials on wood pallets or in paper cartons without significant amounts of combustible wrappings; and similar occupancies with slight combustibles.  |
| Moderate Hazard       | Buildings and structures used for the manufacture or storage of moderate hazard materials, which are likely to burn with moderate rapidity, but which do not produce either poisonous gases, fumes or explosives, such as but not limited to: cloth, burlap and paper bags; bamboo and rattan; canvas and leather belting; baskets; books and paper in rolls or packs; boots and shoes; cardboard and cardboard boxes; clothing; cordage; furniture; furs; glue, mucilage, paste and size; linoleum; silk; soap; sugar; tobacco products; wax candles; athletic equipment; musical instruments; beverages containing more than 12% alcohol; furniture other than metal; business machines; electronics; and plastic products not classified as high hazard. | Mercantile storage and display; offices; school-rooms; auto showrooms; aircraft storage; light manufacturing; school shop areas; leather enameling or japanning operations; grain elevators with less than one million bushel bulk storage capacity; livestock shelters; fertilizer bagging operations; feed, flour and grist mills; lumber yards; motor vehicle repair shops; petroleum warehouses for storage of lubricating oils with a flash point of 200°F. or higher; photo engraving operations; public garages; stables; upholstering and mattress manufacturing; aircraft servicing; woodworking and millworking; bakeries; boat building operations; food processing; condensed and powdered milk manufacturing; paper mills or products; printing or publishing; refuse incinerators; and textile mills.  |
| High Hazard           | Buildings and structures used for the storage, manufacture or processing of: highly combustible or explosive products or materials, which are likely to burn with extreme rapidity or which may produce poisonous fumes or explosions; highly corrosive, toxic or noxious alkalies, acids or other liquids or chemicals producing flame, fumes, poisonous, irritant or corrosive gases; materials producing explosive mixtures or dusts or which result in the division of matter into fine particles subject to spontaneous ignition.  | Ammunition, explosive and firework manufacture; artificial flowers and synthetic leather manufacture; celluloid and celluloid products; cotton batting and waste processes; dry cleaning establishments using or storing more than 3 gallons of flammable liquids with a flash point below 100°F. or more than 60 gallons of flammable liquids with a flash point between 100°F. and 140°F.; feather renovating; fruit ripening processes; grain elevators with one million bushel or more bulk storage capacity; hydrogenation processes; match manufacture and storage; metal enameling and japanning; nitro-cellulose film exchanges and laboratories; paint and varnish manufacture; petroleum manufacture; processing of paper or cardboard in loose form; pyroxylin product storage and manufacture; smoke houses; factories or warehouses where loose combustible fibers or dust are manufactured, processed, generated or stored; handling or using flammable liquids under conditions involving possible release of flammable vapors; and fabrication facilities and research and development areas in which hazardous production materials are used. |

**A-52.07 (11) ACCEPTANCE OF THE ATRIUM SMOKE CONTROL SYSTEM.** The following is a reprint of an approved test procedure:  
Acceptance test procedure for the atrium smoke management system.

1. All testing shall be in the presence of a representative from the department.
2. All exhaust and supply-air systems shall be operationally balanced and tested. Complete air-balance reports shall be recorded on each piece of equipment, all exhaust inlets, and all supply outlets.
3. Each automatic initiating device shall be tripped to observe proper function. This test shall be performed on both normal and emergency power.
4. Each manual switch and override shall be tripped to observe proper function. This test shall be performed on both normal and emergency power.
5. All indicator lights shall display the appropriate detection and operating status.
6. Select a location on the first floor approximately 5 ft. outside the perimeter of the atrium opening. The location shall be acceptable to the department's representative.
7. Prepare three two-minute smoke bombs.
8. Ignite all three smoke bombs. When they become fully active, manually activate the atrium smoke-management system.
9. Observe and record the results.
10. After all smoke has been cleared, select an additional location on an upper level acceptable to the department's representative.

11. Prepare three more two-minute smoke bombs.
12. Ignite all three smoke bombs. When they become fully activated, again manually activate the atrium smoke-management system.
13. Observe and record the results.
14. Acceptable performance shall be movement of the smoke from the source into the atrium and out through exhaust at the top of the atrium. Smoke migration down the corridors shall be limited to no more than a light haze at a point 25 ft from the source. Furthermore, the balconies around the perimeter of the atrium shall maintain a smoke-free zone.
15. Upon the successful completion of these tests, a signed and dated copy of the department's acceptance shall be filed with the test records and a copy shall be maintained with the quarterly test log.
16. A copy of this acceptance test procedure and all plans, specifications, and calculations for the building shall be maintained with the quarterly test log.

**A-52.20 Chapter Comm 16, Wisconsin State Electrical Code, Volume 2,** requires the installation of standby emergency power for certain occupancies; the following is a reprint of s. Comm 16.46 (1):

**(1) WHERE REQUIRED.** Standby emergency power of a type recognized by NEC 700-12 (a), (b), (c) or (f) shall be provided as a source of supply for required exit lights, emergency lighting or power in occupancies where people are housed, assembled or confined with a capacity or area equal to or greater than those listed in Column B of Table 16.46.

**TABLE 16.46**  
**OCCUPANCIES REQUIRING STANDBY EMERGENCY POWER**

| Column A<br>Occupancy  | Column B<br>Calculated Capacity or Area  |
|--|--|
| 1. Apartment buildings .....   | 50 bedrooms, including efficiency units  |
| 2. Arenas .....  | 800 square feet (Use seated space only)  |
| 3. Art galleries .....   | 20,000 square feet   |
| 4. Assembly halls such as church dining rooms and fellowship halls, dance halls, banquet halls, dining rooms, restaurants, taverns, night clubs, school and day care center multi-purpose rooms, and similar occupancies ..... | 2,000square feet   |
| 5. Assembly halls with stage .....   | 1,400 square feet  |
| 6. Auditoriums .....   | 1,400 square feet  |
| 7. Banks .....   | 30,000 square feet   |
| 8. Bowling alleys .....  | 200 persons based on 5 persons per alley plus number of spectator seats and 10 square feet per person for bar and dining areas |
| 9. Centers for developmentally disabled .....  | 20 inmate beds   |
| 10. Children's homes .....   | 20 beds  |
| 11. Community-based residential facilities .....   | 20 beds  |
| 12. Convents .....   | 200 beds   |
| 13. Dormitories, including those used in detention schools .....   | 200beds  |
| 14. Exhibition buildings .....   | 12,000 square feet   |
| 15. Factories .....  | 30,000 square feet   |
| 16. Field houses .....   | 800 square feet (Use seated space only)  |
| 17. Gymnasiums .....   | 200 persons based on 6 square feet per person for seated space and 15 square feet per person for unseated space                |
| 18. Hospitals .....  | 20 patient beds  |
| 19. Hotels .....   | 200 rooms  |
| 20. Jails .....  | 20 inmate beds   |
| 21. Lecture halls .....  | 1,400 square feet  |
| 22. Libraries .....  | 200 persons based on 20 square feet per person for reading rooms and 100 square feet per person for balance                    |
| 23. Lodge halls .....  | 200 persons based on 6 square feet per person for seated space and 15 square feet per person for unseated space                |
| 24. Motels .....   | 100 rooms  |
| 25. Museums .....  | 20,000 square feet   |
| 26. Nursing homes .....  | 20 patient beds  |
| 27. Office buildings .....   | 30,000 square feet   |
| 28. Rooming houses .....   | 200 rooms  |
| 29. Skating rinks .....  | 3,000 square feet  |
| 30. Stores .....   | 200 persons based on 30 square feet per person for first floor and 60 square feet per person for second floor and above        |
| 31. Swimming pools (indoor) .....  | 450 square feet  |
| 32. Theaters and theater lobbies .....   | 1,400 square feet (Theater and lobby must be combined in determining total area)   |
| 33. Warehouses .....   | 120,000 square feet  |

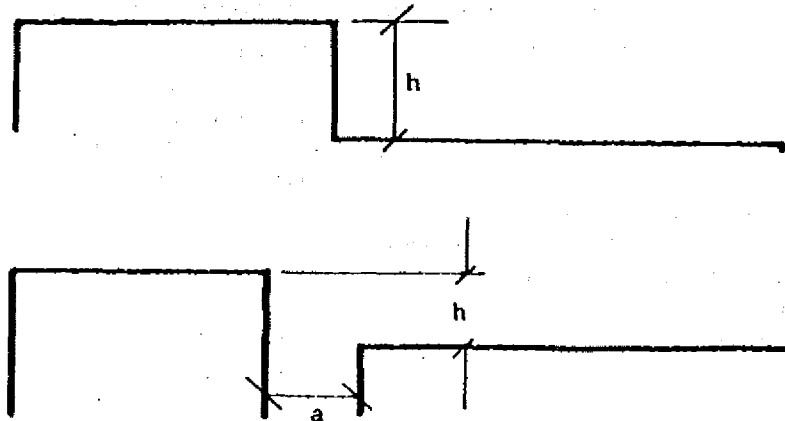
**A-52.60 (1) WATER CLOSETS.** The following is a reprint of s. Comm 84.20 (5) (m) 7. from the plumbing code:

7. A water closet may not be located closer than 15 inches from its center to any side wall, partition, vanity, or other obstruction, nor closer than 30 inches center to center, between water closets.

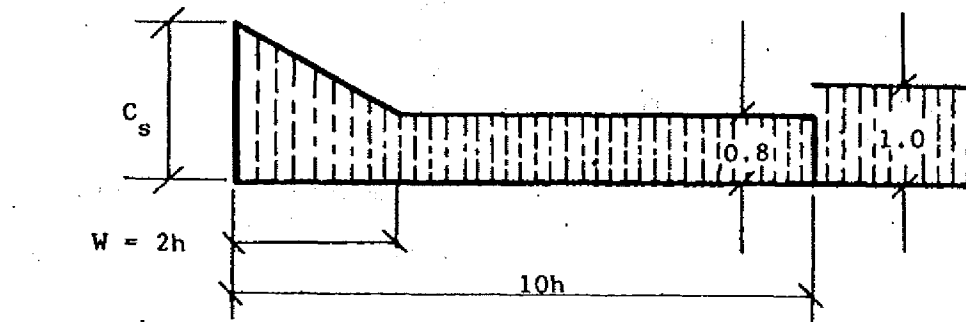
There shall be at least 24 inches clearance in front of a water closet to any wall, fixture or door.

**A-53.11 (4) (c) Increase in roof loads.** The following design provisions may be used to determine the increase in roof loads as required by this section.

## ROOF SHAPES



Lower level of multi-level roofs (when upper roof is part of the same building or on an adjacent building not more than 15 feet away).

SNOW LOAD DISTRIBUTIONS AND COEFFICIENTS, LIMITATIONS

$$C_s = 15 \frac{h}{g}$$

when  $15 \frac{h}{g} < 1.0$  use  $C_s = 1.0$

when  $15 \frac{h}{g} > 3.0$  use  $C_s = 3.0^*$

$$W = 2h$$

when  $h < 5$  ft use  $W = 10$

$h > 15$  ft use  $W = 30$

$h$  = difference of roof heights in ft.

$g$  = roof live load in psf [ILHR 53.11 (4)]

$w$  = width of drift from higher building in ft.

$a$  = distance between buildings  $< 15$  ft.

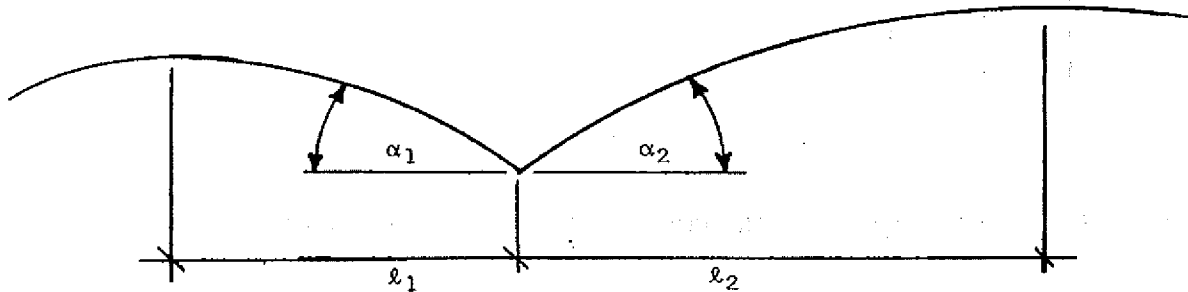
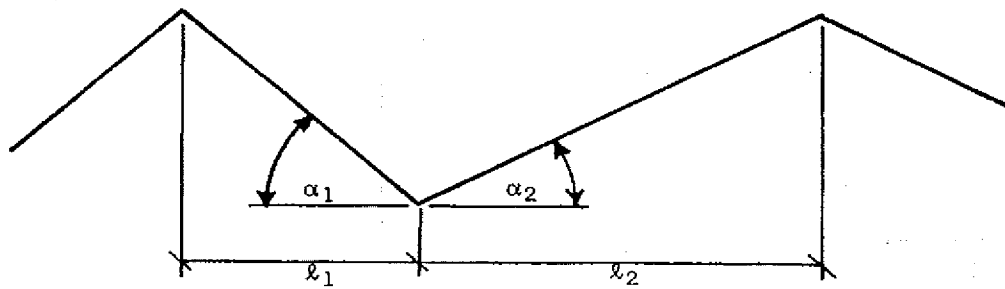
Design upper roof for loads applicable to single-level roofs.

\*An upper limit of 3 times the basic roof load has been suggested. It should be noted, however, that higher loads have been observed where an upper roof was very long (measured perpendicularly to the step between the upper and lower roofs). On the other hand, for relatively short upper roofs (say less than 50 ft), a reduction below the calculated  $C_s$  value may be judged adequate by the designer.



ROOF SHAPES

Valley areas of two-span and multi-span sloped or curved roofs

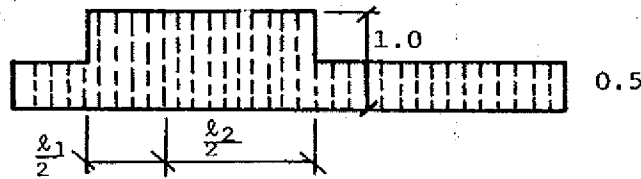


SNOW LOAD DISTRIBUTIONS AND COEFFICIENTS, LIMITATIONS

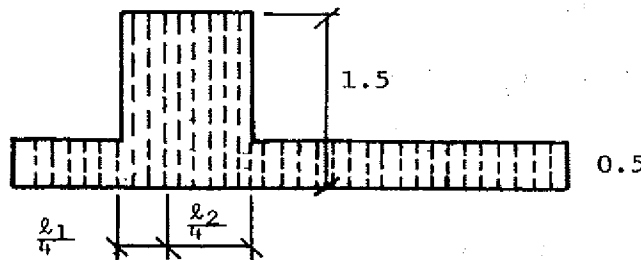
CASE I



CASE II

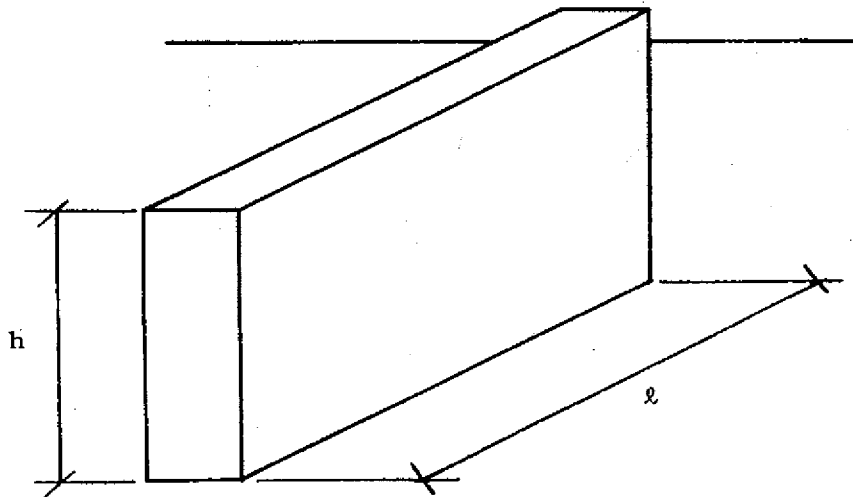


CASE III



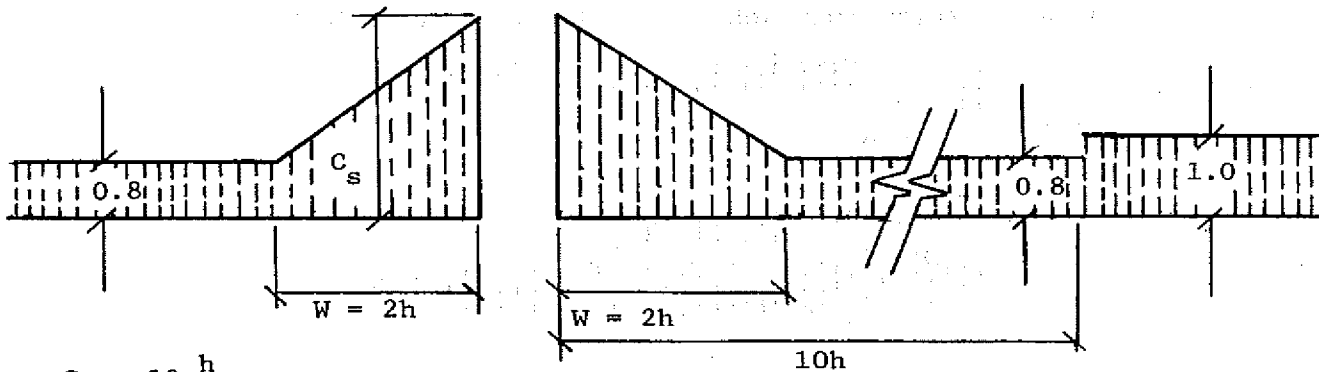
For both  $\alpha_1$  and  $\alpha_2 \leq 10^\circ$  use Case I only; otherwise use Case I, II and III

ROOF SHAPES



Roof areas adjacent to projections and obstructions on roofs

SNOW LOAD DISTRIBUTIONS AND COEFFICIENTS, LIMITATIONS



$$C_s = 10 \frac{h}{g}$$

when  $10 \frac{h}{g} < 1.0$  use  $C_s = 1.0$

when  $10 \frac{h}{g} > 2.0$  use  $C_s = 2.0$

when  $l < \frac{lg}{6}$  use  $C_s = 1.0$

$$W = 2h$$

when  $h < 5$  ft use  $W = 10$

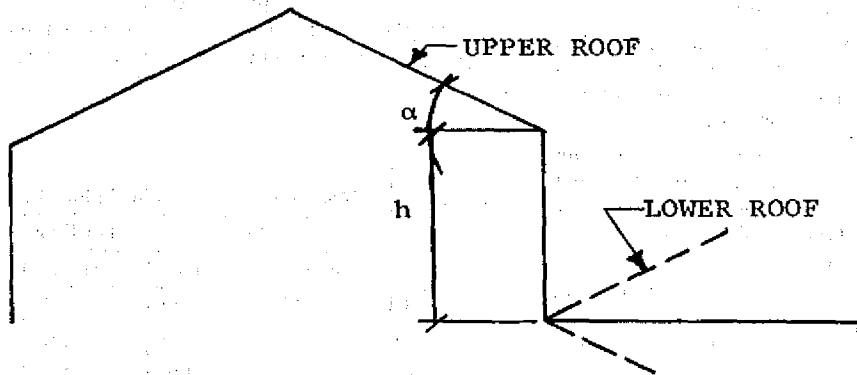
when  $h > 15$  ft use  $W = 30$

$h$  = height of projection in ft.

$g$  = roof live load in psf

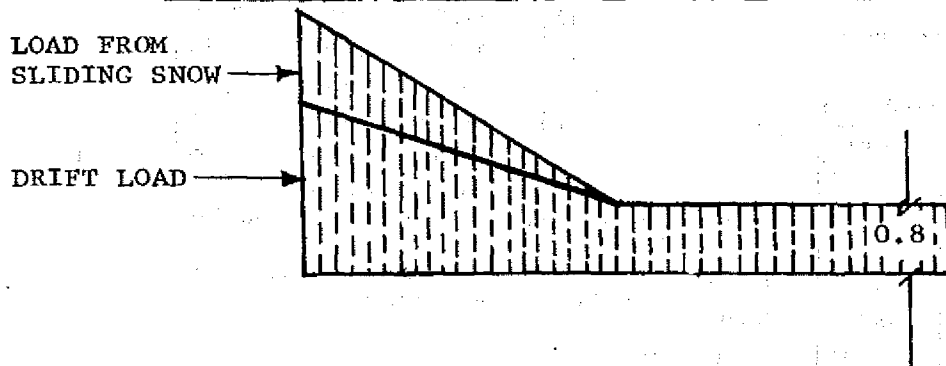
$w$  = width of snow drift in ft.

$l$  = length of projection in ft.



Lower of multi-level roofs with upper roof sloped towards lower roof, where  $\alpha$  exceeds  $10^\circ$ .

#### SNOW LOAD DISTRIBUTIONS AND COEFFICIENTS, LIMITATIONS



Design lower roof for loads applicable to multi-level roof plus a portion of the sliding snow from the upper roof.\*

Design upper roof for loads applicable to single-level roofs.

\*Where snow is likely to slide onto a lower roof from an upper roof, the lower roof should be designed for the load as provided for multi-level roofs plus an additional load produced by the snow that may slide from the upper roof. It is not possible to provide coefficients for this situation, but the following guide is recommended. Because of the remote probability that both upper and lower roofs will have their full load over the full areas simultaneously when sliding occurs, it may be assumed that the lower roof would be carrying its full load and that sliding of 50% of the total weight of the applicable uniformly distributed snow load from the upper roof would occur.

**A-53.11 (4) (d) ROOF DESIGNED FOR CONTROL FLOW DRAINAGE.** This section refers to the requirements of the Plumbing Code (ch. Comm 82) for storm drain sizes where control flow drainage roof design is used. The following information from the plumbing code is provided for use by the building designer:

Partial Reprint of s. Comm 82.36 (4) and (5)

(4) **LOAD ON DRAIN PIPING.** (a) *Storm water drainage.* The load factor on storm water drain piping shall be computed in terms of gallons per minute or on the square footage of the horizontal projection of roofs, paved areas, yards and other tributary areas.

(b) *Continuous flow devices.* Where there is a continuous or semi-continuous discharge into the storm building drain or storm building sewer, as from a pump, air conditioning unit, or similar device, each gallon per minute of such discharge shall be computed as being equivalent to 26 square feet of roof area.

(5) **SELECTING SIZE OF STORM AND CLEAR WATER DRAIN PIPING.** (a) *Horizontal storm water drain piping.* The pipe size for horizontal drain piping for storm water shall be determined from Tables 82.36-1 to 82.36-4.

**Table 82.36-1  
MINIMUM SIZE OF STORM WATER HORIZONTAL  
DRAIN PIPING ROOF AREAS**

| Pipe<br>Diameters<br>(in inches) | Maximum Roof Areas (in square feet) |          |          |          |
|----------------------------------|-------------------------------------|----------|----------|----------|
|                                  | Pitch of Piping Per Foot            |          |          |          |
|                                  | 1/16 inch                           | 1/8 inch | 1/4 inch | 1/2 inch |
| 3                                | 650                                 | 910      | 1,300    | 1,820    |
| 4                                | 1,300                               | 1,950    | 2,990    | 3,770    |
| 5                                | 2,470                               | 3,640    | 5,070    | 7,020    |
| 6                                | 4,160                               | 5,980    | 8,320    | 11,700   |
| 8                                | 9,320                               | 13,000   | 18,200   | 26,000   |
| 10                               | 17,680                              | 24,700   | 33,800   | 50,440   |
| 12                               | 27,300                              | 41,080   | 57,200   | 81,900   |
| 15                               | 52,000                              | 72,800   | 105,300  | 146,640  |
| 18                               | 85,800                              | 121,550  | 174,200  | 247,000  |
| 21                               | 156,520                             | 179,660  | 256,880  | 374,400  |
| 24                               | 187,200                             | 261,560  | 382,200  | 546,000  |

Divide square footage by 26 to obtain flow in gpm.

**Table 82.36-4  
MAXIMUM CAPACITY OF STORM WATER  
HORIZONTAL DRAIN PIPING FLOWING FULL**

| Pipe<br>Diameters<br>(in<br>inches) | Maximum Capacities in Gallons Per Minute |          |          |          |
|-------------------------------------|--|----------|----------|----------|
|                                     | Pitch of Piping Per Foot                 |          |          |          |
|                                     | 1/16 inch                                | 1/8 inch | 1/4 inch | 1/2 inch |
| 3                                   | 25                                       | 35       | 50       | 70       |
| 4                                   | 50                                       | 75       | 115      | 145      |
| 5                                   | 97                                       | 140      | 195      | 270      |
| 6                                   | 160                                      | 230      | 320      | 450      |
| 8                                   | 355                                      | 500      | 700      | 1,000    |
| 10                                  | 680                                      | 950      | 1,300    | 1,940    |
| 12                                  | 1,050                                    | 1,580    | 2,200    | 3,150    |
| 15                                  | 2,000                                    | 2,800    | 4,050    | 5,640    |
| 18                                  | 3,300                                    | 4,675    | 6,700    | 9,500    |
| 21                                  | 6,020                                    | 6,910    | 9,880    | 14,400   |
| 24                                  | 7,200                                    | 10,060   | 14,700   | 21,000   |

(b) *Vertical conductors for storm water.* 1. A vertical conductor for storm water shall not be smaller than the largest horizontal branch connected thereto.

2. Vertical conductors shall be sized in accordance with Table 82.36-5 or the diameter D, where

$$D = 1.128 \sqrt{\frac{A}{X}}$$

Where,

A = the area of the roof in square feet

- X = 300 square feet per square inch for a roof covered with gravel or slag and with a pitch not exceeding 1/4 inch per foot; or
- = 250 square feet per square inch for a roof covered with gravel or slag and with a pitch of greater than 1/4 inch per foot; or
- = 200 square feet per square inch for a roof with a metal, tile, brick or slate covering and of any pitch.

Table 82.36-5  
MINIMUM DIAMETER OF VERTICAL CONDUCTORS

| Type of Roof   | Maximum Roof Areas (in square feet) |       |       |       |       |        |
|--|-------------------------------------|-------|-------|-------|-------|--------|
|  | Pipe Diameters (in inches)          |       |       |       |       |        |
|  | 2 1/2                               | 3     | 4     | 5     | 6     | 8      |
| Roofs covered with gravel, slag, or similar material and with a pitch of 1/4" per foot or less.  | 1,645                               | 2,120 | 3,780 | 5,885 | 8,490 | 15,125 |
| Roofs covered with gravel, slag or similar material and with a pitch greater than 1/4" per foot. | 1,220                               | 1,770 | 3,150 | 4,905 | 7,075 | 12,600 |
| Roofs covered with metal, tile, brick, slate or similar material and of any pitch.               | 975                                 | 1,415 | 2,520 | 3,925 | 5,660 | 10,080 |

Divide square footage by 26 to obtain flow in gpm.

**A-53.15 LOAD COMBINATIONS.** It is the intent of this section that the loads specified in ss. Comm 53.10 through 53.14 be considered to act in the following combinations, whichever is critical, for the design of the building frame, foundation or structural member:

1. Dead load plus live load.
2. Dead load plus wind load.
3. Dead load plus live load plus wind load.
4. Dead load plus live load plus crane loads.

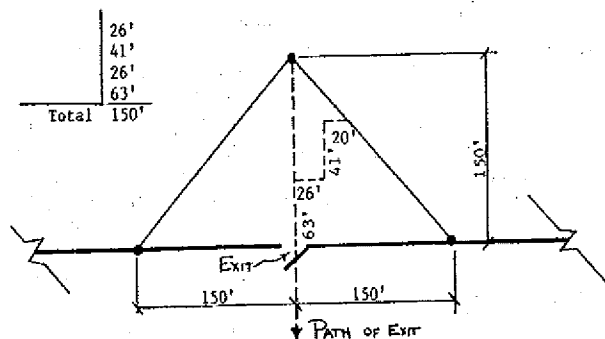
Distribution of live loads which would cause the maximum shear, bending moment or stress in structural members should be investigated.

**A-54.02 (4) EXIT DISTANCE.** The following illustrations and text are provided to explain the procedure and intent of using the triangulation method of exit distance determination.

Exit travel must terminate at one of the following types of exits:

1. Standard exit to grade (Comm 51.15)
2. Enclosed stairways (Comm 51.17 and 51.18)
3. Horizontal exits (Comm 51.19)
4. Fire escapes (Comm 51.20)

Therefore, exit distance must be measured from one of these exit types. All exits must lead to a street, alley or open court which is connected to a street or alley.



**Procedure:**

1. Beginning at designated exit type, measure required exit distance (150 feet, for example) at right angles to and parallel with (on both sides) the exit.
2. Connect end points to form the "exit triangle".

3. All areas within the triangle are within the required exit distance when traveling toward or at right angles to the exit.

4. All the interior space of a building must fall within the "exit triangles" formed by using the required exits for the building.

5. When measuring exit distance in stairways, only the horizontal travel distance is included in the determination.

**A-54.02 (4) (c)** The use of the term "high hazard" as referred to in this section is intended to apply to the following list of operations and occupancies:

1. Aircraft hangars.
2. Dry cleaning establishments: using gasoline or other volatile flammable liquids.
3. Enameling or japanning.
4. Mills: sugar, starch cereal, feed, flour and grist mills.
5. Paint and varnish: manufacturing, storing, handling, spraying, and other related operations.
6. Proxylin products: manufacture and storage.
7. Repair garages.
8. Smoke houses.
9. Storage of: explosive gases under pressure (15 psi and over 2500 cubic feet) such as acetylene, hydrogen, natural gas, etc.
10. Storage of: materials with a flash point under 200° F. such as celluloid products, kerosene, oils, etc.
11. Woodworking establishments.

**A-57.02 (2) (b) VERTICAL DIVISION WALLS.** See drawings and illustrations in s. A 51.03 (5) (a) for typical floor/ceiling-wall connection details for vertical division walls. Disregard masonry components shown in drawings when masonry is not used in the construction of the vertical division wall.

**A-57.07 (3) CHANGES OF ELEVATION WITHIN INDIVIDUAL LIVING UNITS.** Section Comm 57.07 (3) permits the steps, stairs and ramps within individual living units to conform with s. Comm 21.04 of the Uniform Dwelling Code. The following is a reprint of the applicable portions of that section:

**Comm 21.04 Stairs.** Every exterior or interior stairs, except those leading to attics or crawl space or similar non-habitable spaces, shall conform to the requirements of this section.

(1) **LANDINGS.** (a) *Intermediate landings.* Intermediate landings located in a flight of stairs shall be at least as wide as the stairs and shall measure at least 3 feet in the direction of travel. Trim and handrails may project no more than 3 1/2 inches into the required width.

(b) *Landings at the top and base of stairs.* A level landing shall be provided at the top and at the foot of every stairs. The landing

shall be at least as wide as the stairs and shall measure at least 3 feet in the direction of travel.

(c) *Doors at landings.* Except as provided in subds. 1 to 4, level landings shall be provided on each side of any door located at the foot or head of a stairway, regardless of the door swing. In the application of the exceptions given in subds. 1 to 4, stairways to attached garages or porches are considered to be interior stairways.

1. Exception. A landing shall not be required between the door and the head of interior stairs, provided the door does not swing over the stairs.

2. Exception. A landing shall not be required between the door and the head of an interior stairway of 2 or fewer risers, regardless of doorswing.

3. Exception. A landing shall not be required between a sliding glass door and the head of an exterior stairway of 3 or fewer risers.

4. Exception. The exterior landing, platform or sidewalk at an exterior doorway shall be located not more than 8 inches below the interior floor elevation. The landing platform shall have a length at least equal to the width of the door.

(2) *HANDRAILS AND GUARDRAILS.* (a) *Handrails.* Every stairs of more than 3 risers shall be provided with at least one handrail. Handrails shall be provided on all open sides of stairways.

(b) *Guardrails.* All openings between floors, open sides of landings, platforms, balconies or porches which are more than 24 inches above grade or a floor, shall be protected with guardrails.

(c) *Handrail and guardrail details.* 1. Height. Handrails shall be located at least 30 inches, but not more than 34 inches, above the nosing of the treads. Guardrails shall be located at least 36 inches above the upper surface of the floor.

2. Open railings. Open guardrails or handrails shall be provided with intermediate rails or an ornamental pattern to prevent the passage of a sphere with a diameter larger than 9 inches.

3. Clearance. The clearance between the handrail and the wall surface shall be at least 1½ inches.

4. Loading. Handrails and guardrails shall be designed and constructed to withstand a 200 pound load applied in any direction.

5. Exterior rails. Exterior handrails and guardrails shall be constructed of metal, decay resistant or pressure treated wood or shall be protected from the weather.

(3) *STAIR DETAILS.* Stairs shall meet the following requirements:

(a) *Minimum width.* Every stairs shall measure at least 3 feet in width.

(b) *Headroom.* Every stairs shall be provided with a minimum headroom clearance of 6 feet 4 inches. The minimum clearance shall be measured vertically from a line parallel to the nosing of the treads to the ceiling or soffit directly above that line.

(c) *Treads and risers.* Risers shall not exceed 8 inches in height, measured vertically from tread to tread. Treads shall be at least 9 inches wide, measured horizontally from nosing to nosing. There shall be no variation in uniformity exceeding 3/16 inch in the width of tread or in the height of risers. No flight of stairs shall exceed 12 feet in height unless landings are provided.

(d) *Winders.* Winder steps may be used in stairs where the length of the tread is at least 3 feet and the winder tread measures at least 7 inches in width from nosing to nosing at a point one foot from the narrow end of the tread.

(e) *Spiral stairs.* Spiral stairs may be used as an exit stairs. The tread shall measure at least 26 inches from the outer edge of the supporting column to the inner edge of the handrail and at least 7

inches in width from nosing to nosing at a point one foot from the narrow end of the tread.

**A-57.11** The intent of this section is to apply to floor levels not more than one story below grade (at building).

**A-57.11 (1) (f)** It is the intent of this subsection that each living unit needs only one means of exit from within the unit and that the entire building be provided with no less than 2 exits.

**A-57.81 Requirement 1. (4) SITE IMPRACTICALITY GUIDELINES.**

(2) Site impracticality. Covered multifamily dwellings with elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route, regardless of terrain or unusual characteristics of the site. Covered multifamily dwellings without elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route unless terrain or unusual characteristics of the site are such that the following conditions are found to exist:

(a) Site impracticality due to terrain. There are two alternative tests for determining site impracticality due to terrain; the individual building test provided in paragraph (i), or the site analysis test provided in paragraph (ii). These tests may be used as follows.

A site with a single building having a common entrance for all units may be analyzed only as described in paragraph (i).

All other sites, including a site with a single building having multiple entrances serving either individual dwelling units or clusters of dwelling units, may be analyzed using the methodology in either paragraph (i) or paragraph (ii). For these sites for which either test is applicable, regardless of which test is selected, at least 20% of the total ground floor units in nonelevator buildings, on any site, must comply with the guidelines.

(i) Individual building test. It is impractical to provide an accessible entrance served by an accessible route when the terrain of the site is such that:

(A) the slopes of the undisturbed site measured between the planned entrance and all vehicular or pedestrian arrival points within 50 feet of the planned entrance exceed 10 percent; and

(B) the slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet of the planned entrance also exceed 10 percent.

If there are no vehicular or pedestrian arrival points within 50 feet of the planned entrance, the slope for the purposes of this paragraph (i) will be measured to the closest vehicular or pedestrian arrival point.

For purposes of these guidelines, vehicular or pedestrian arrival points include public or resident parking areas; public transportation stops; passenger loading zones; and public streets or sidewalks. To determine site impracticality, the slope would be measured at ground level from the point of the planned entrance on a straight line to (i) each vehicular or pedestrian arrival point that is within 50 feet of the planned entrance, or (ii) if there are no vehicular or pedestrian arrival points within that specified area, the vehicular or pedestrian arrival point closest to the planned entrance. In the case of sidewalks, the closest point to the entrance will be where a public sidewalk entering the site intersects with the sidewalk to the entrance. In the case of resident parking areas, the closest point to the planned entrance will be measured from the entry point to the parking area that is located closest to the planned entrance.

(ii) Site analysis test. Alternatively, for a site having multiple buildings, or a site with a single building with multiple entrances, impracticality of providing an accessible entrance served by an accessible route can be established by the following steps:

(A) The percentage of the total buildable area of the undisturbed site with a natural grade less than 10% slope shall be calculated. The analysis of the existing slope (before grading) shall be done

on a topographic survey with two foot (2') contour intervals with slope determination made between each successive interval. The accuracy of the slope analysis shall be certified by a professional licensed engineer, landscape architect, architect or surveyor.

(B) To determine the practicality of providing accessibility to planned multifamily dwellings based on the topography of the existing natural terrain, the minimum percentage of ground floor units to be made accessible should equal the percentage of the total buildable area (not including floodplains, wetlands, or other restricted use areas) of the undisturbed site that has an existing natural grade of less than 10% slope.

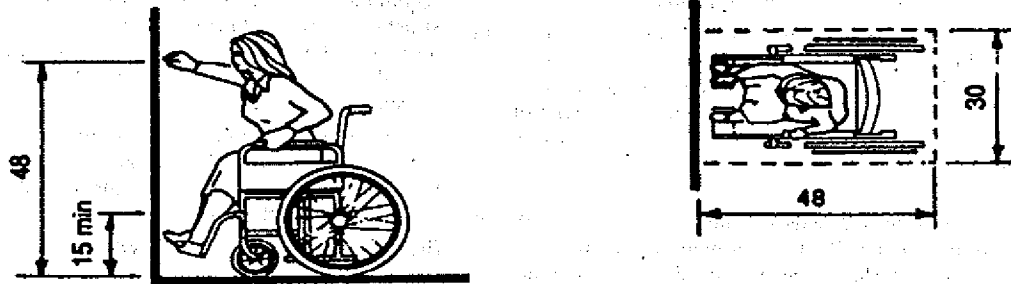
(C) In addition to the percentage established in paragraph (B), all ground floor units in a building, or ground floor units served by a particular entrance, shall be made accessible if the entrance to the units is on an accessible route, defined as a walkway with a slope between the planned entrance and a pedestrian or vehicular arrival point that is no greater than 8.33%.

(b) Site impracticality due to unusual characteristics. Unusual characteristics include sites located in a federally-designed floodplain or coastal high-hazard area and sites subject to other similar requirements of law or code that the lowest floor or the lowest structural member of the lowest floor must be raised to a specified level at or above the base flood elevation. An accessible route to a building entrance is impractical due to unusual characteristics of the site when:

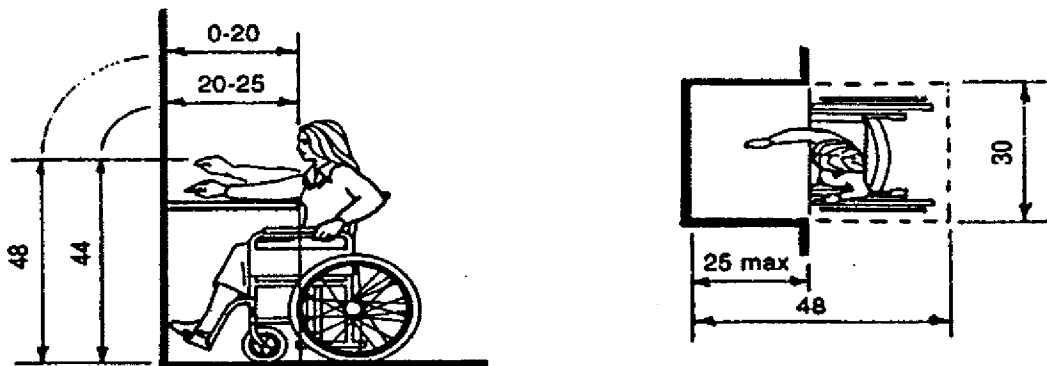
(i) the unusual site characteristics result in a difference in finished grade elevation exceeding 30 inches and 10 percent measured between an entrance and all vehicular or pedestrian arrival points within 50 feet of the planned entrance; or

(ii) if there are no vehicular or pedestrian arrival points within 50 feet of the planned entrance, the unusual characteristics result in a difference in finished grade elevation exceeding 30 inches and 10 percent measured between an entrance and the closest vehicular or pedestrian arrival point.

**A-57.85 REACH DIMENSIONS OVER AN OBSTRUCTION.**

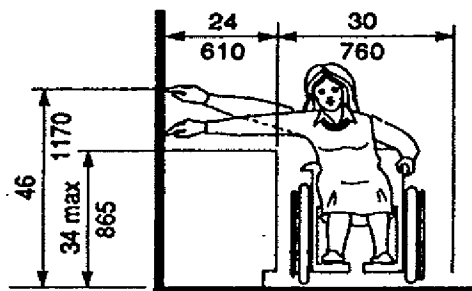


(a) Forward Reach Limit



NOTE: Clear knee space should be as deep as the reach distance.

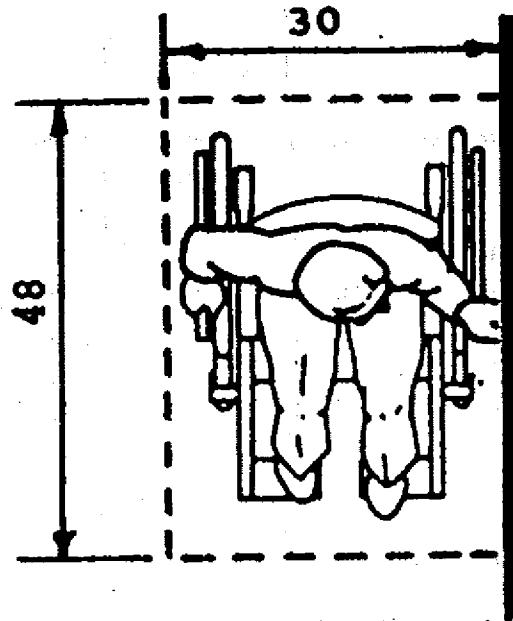
(b) Maximum Forward Reach Over an Obstruction



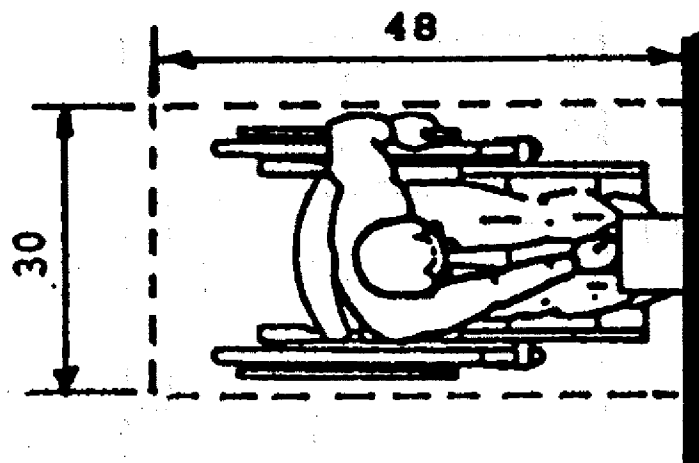
(c) Maximum Side Reach Over Obstruction



**A-57.87 Usable kitchens. MINIMUM CLEAR FLOOR SPACE FOR WHEELCHAIRS.**

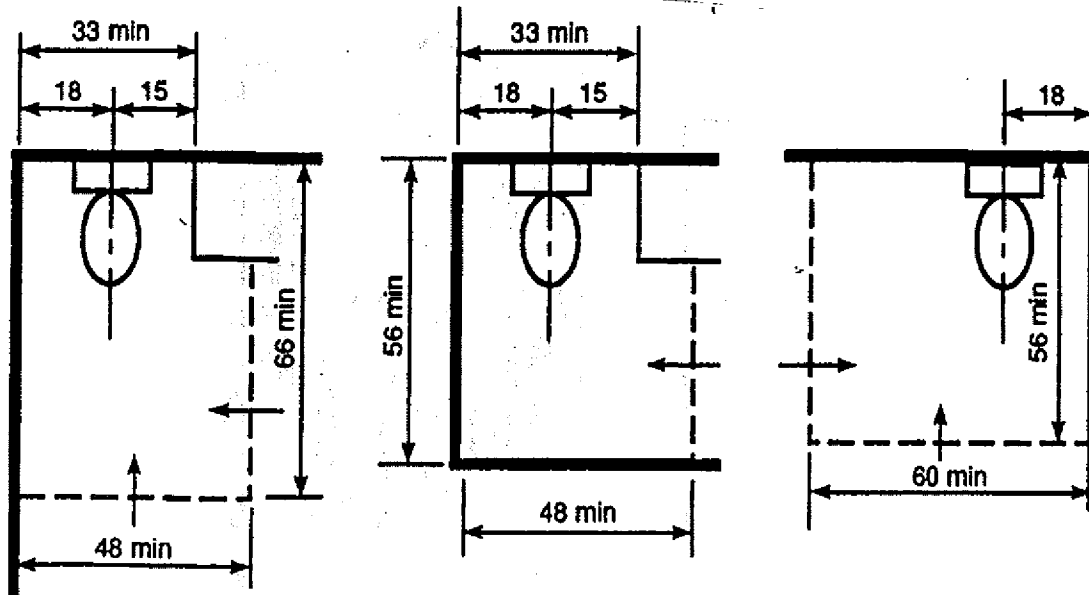


**(a) Parallel Approach**



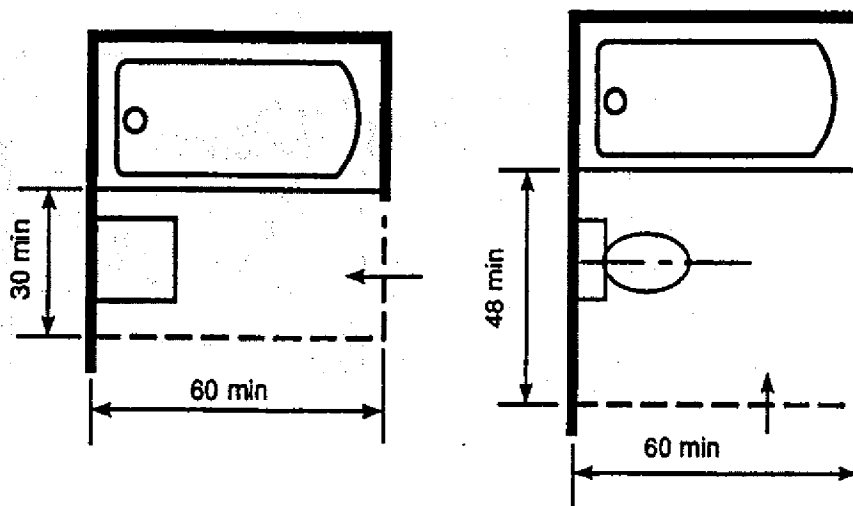
**(b) Forward Approach**

**A-57.871 (1) BASIC USABILITY AND 57.871 (2) HIGHER LEVEL OF USABILITY: CLEAR FLOOR SPACE FOR WATER CLOSETS.**



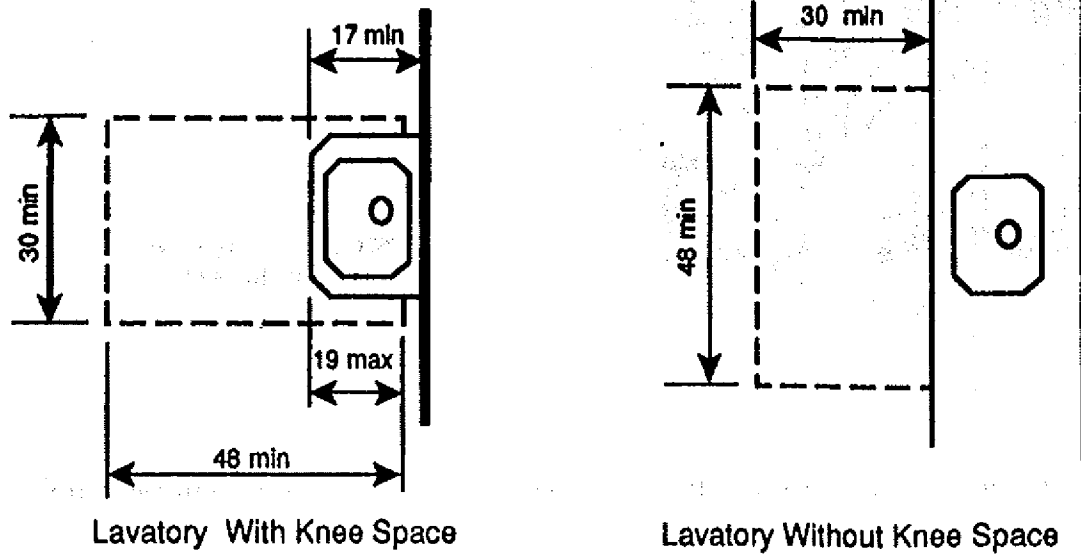
**Clear Floor Space for Water Closets**

**A-57.871 (1) BASIC USABILITY: CLEAR FLOOR SPACE AT BATHTUBS.**



**Clear Floor Space at Bathtubs**

**A-57.871 (1) BASIC USABILITY AND 57.871 (2) HIGHER LEVEL OF USABILITY: CLEAR FLOOR SPACE AT LAVATORIES.**

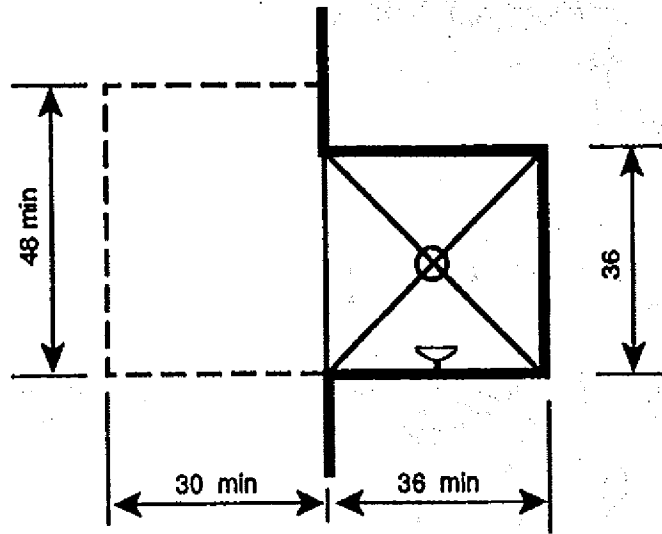


Lavatory With Knee Space

Lavatory Without Knee Space

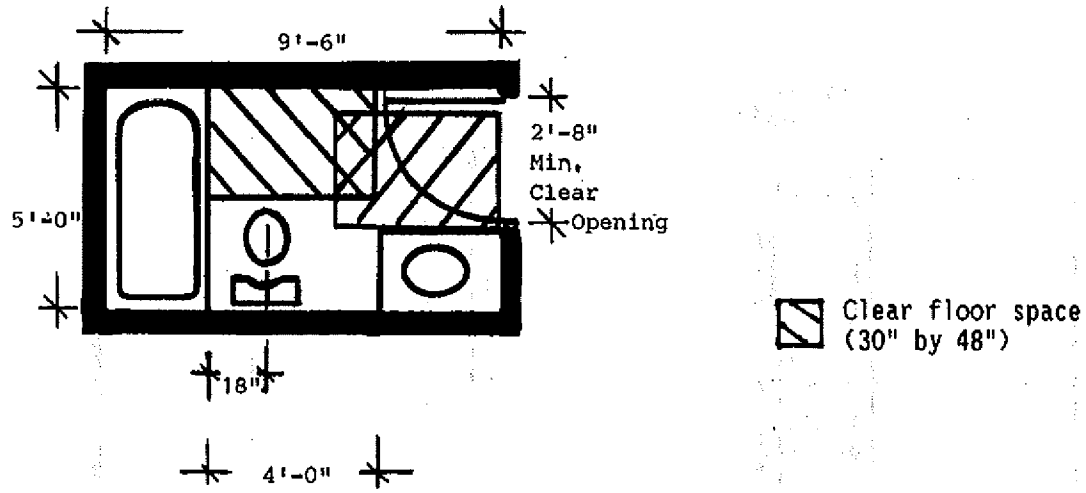
**Clear Floor Space at Lavatories**

**A 57.871 (1) BASIC USABILITY AND 57.871 (2) HIGHER USABILITY: CLEAR FLOOR SPACE AT SHOWERS.**

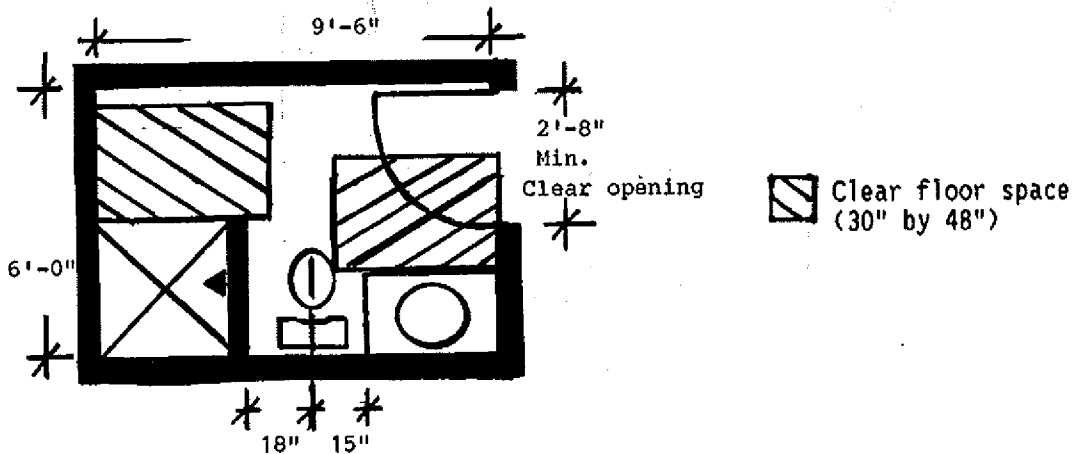
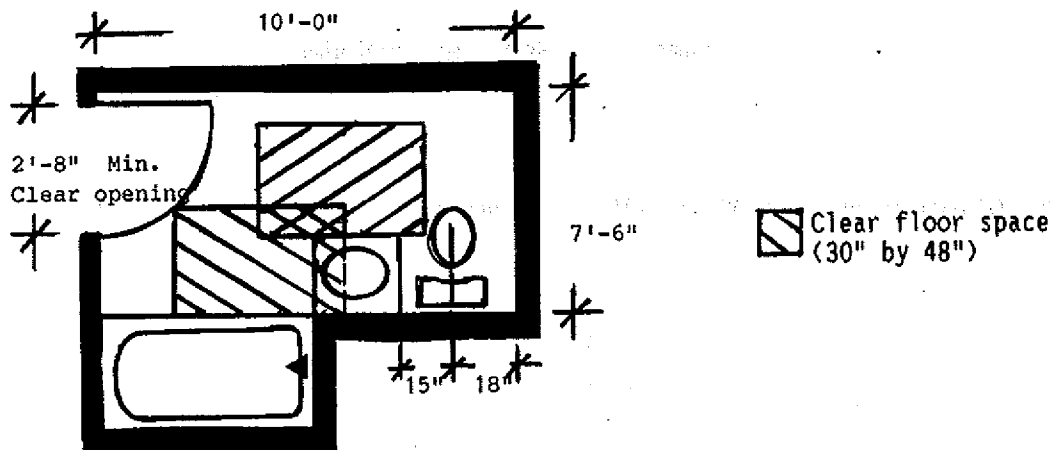


Clear Floor Space at Shower

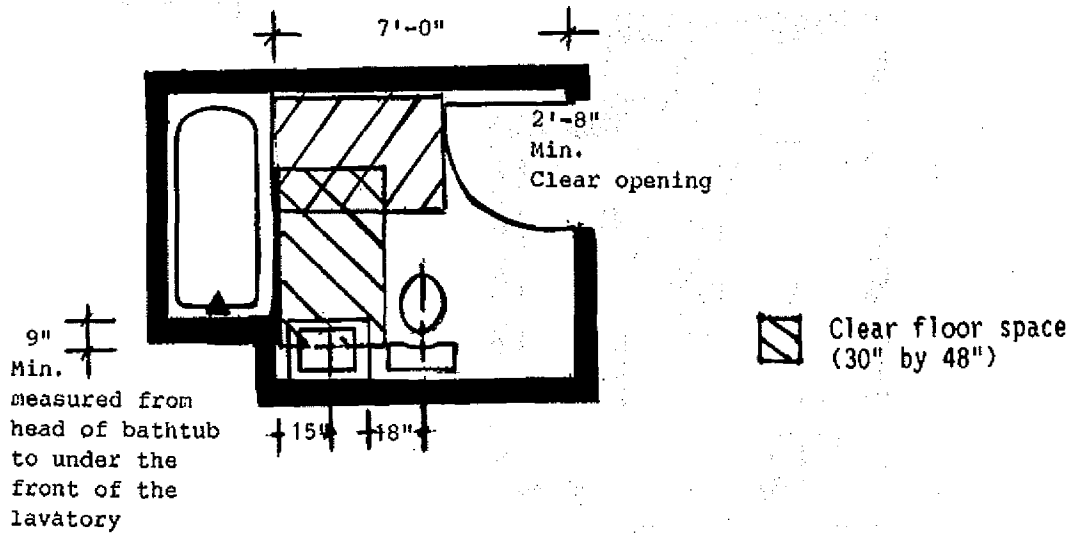
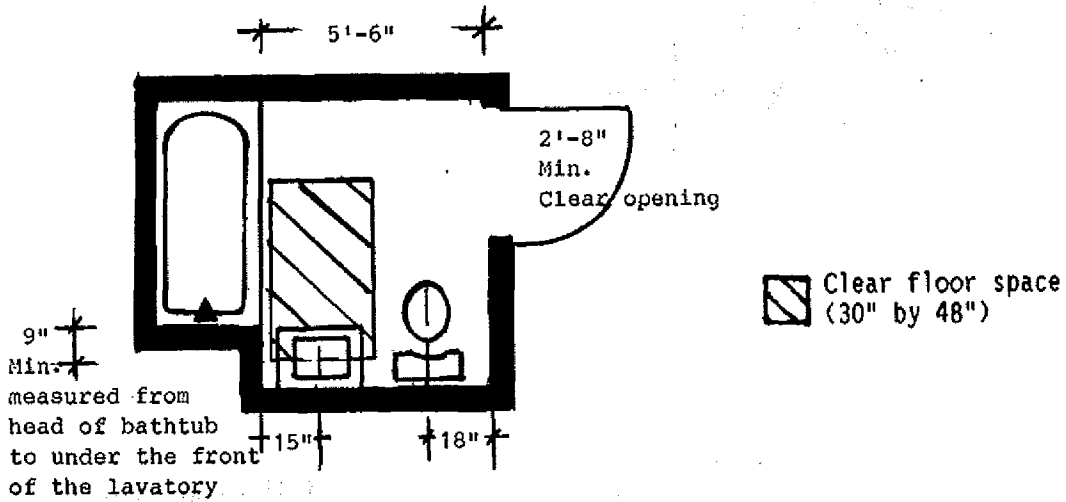
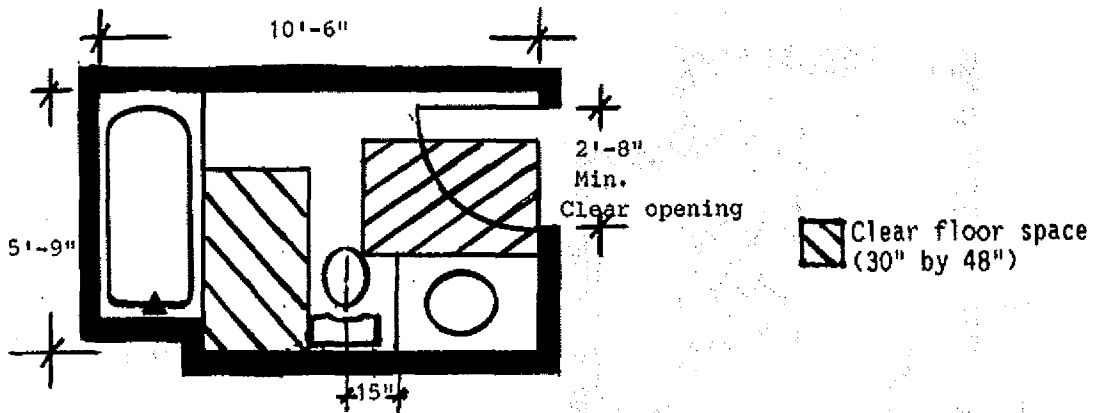
A-57.871 (1) BASIC USABILITY: EXAMPLE OF A COMPLETE BATHROOM COMPLYING WITH BASIC USABILITY.



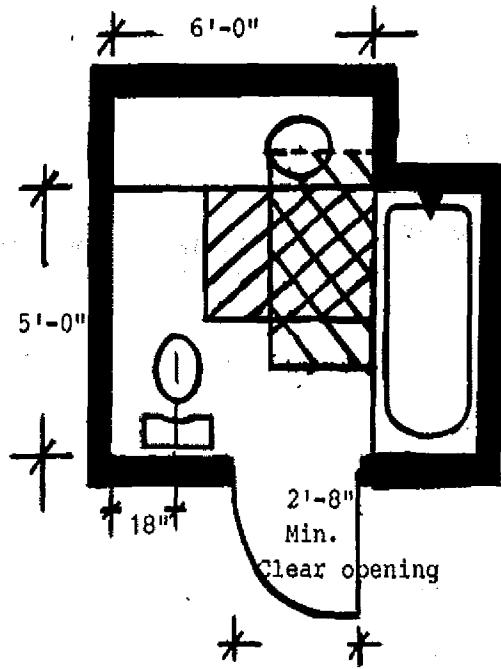
A-57.871 (2) HIGHER LEVEL OF USABILITY: EXAMPLES OF COMPLETE BATHROOMS COMPLYING WITH THE HIGHER LEVEL OF USABILITY.




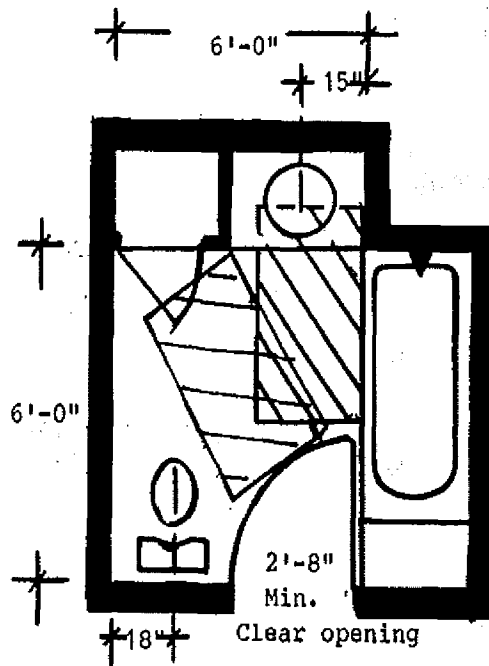
A-57.871 (2) HIGHER LEVEL OF USABILITY: EXAMPLES OF COMPLETE BATHROOMS COMPLYING WITH THE HIGHER LEVEL OF USABILITY.




**A-57.871 (2) HIGHER LEVEL OF USABILITY: EXAMPLES OF COMPLETE BATHROOM COMPLYING WITH THE HIGHER DEGREE OF USABILITY.**

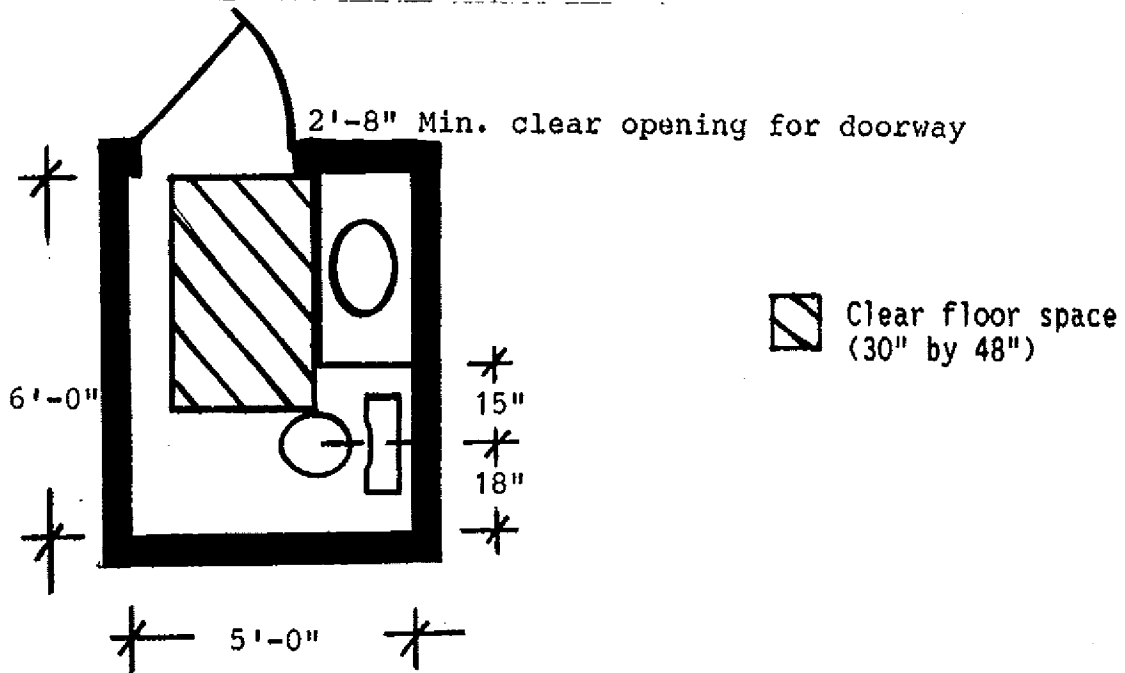
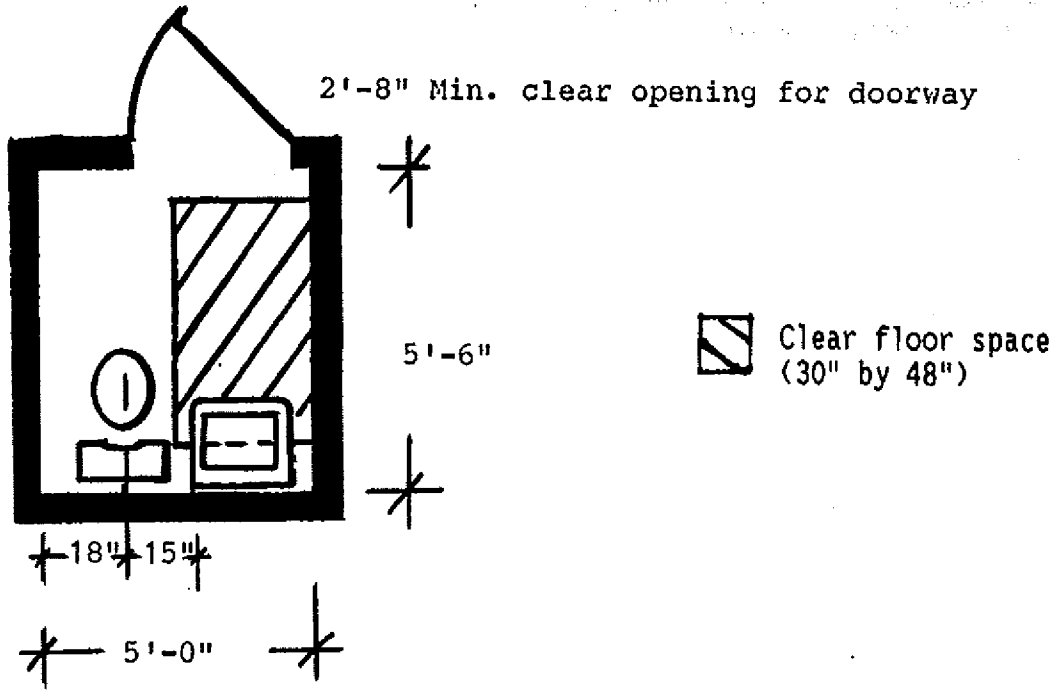


 Clear floor space  
(30" by 48")



 Clear floor space  
(30" by 48")

A-57.871 (3) POWDER ROOMS: EXAMPLES OF ADAPTABLE POWDER ROOMS.



**A-59.14 (2) (c) EXIT DISTANCE.** See the information and illustration contained in A-54.02 (4).

**A-60.19 (4)** The standard is available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

**A-60.35** Class A fires are fires in ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics. Class B fires are fires in flammable liquids, gases and greases.

**A-60.36 (1) (a)** See A-60.19 (4).

**A-62.25 (1) CLEARANCE LIMITATIONS.** The intent is to require the minimum 7 feet 0 inches clearance only in traffic lanes and in all areas normally used by the public to leave from and return to their vehicles.

**A-62.50 FIRE EXTINGUISHERS.** See A-51.22 for related information.





# **CHAPTERS COMM 63 & 64 PLAN CHECK WORKSHEETS**

## **SECTION I. ENERGY/HVAC FORM INDEX**

## **SECTION II. BUILDING ENVELOPE**

## **SECTION III. LIGHTING**

## **SECTION IV. HVAC**

The following worksheets, or equivalent information, is required to be submitted with each project. See Comm Ch. 63 and 64 for details.

SBD-10373 (R.10/98)

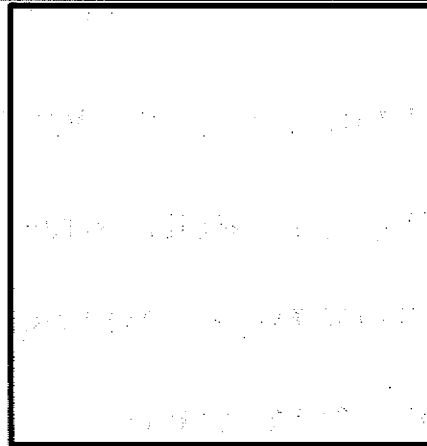
**INDEX**

**I-6**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID#                     | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

All constructions or installations under s. Comm 50.07 (2) and (3) shall be supervised by a Wisconsin registered architect or engineer, except that a Wisconsin registered HVAC designer may supervise the installation of heating, ventilating and air conditioning systems, and a registered electrical designer may supervise the installation of illumination systems. The plans, specifications, and calculations require the signature and seal or stamp of the appropriate professional listed above. Comm 50.08.



Registration Stamp & Signature

**ENERGY EFFICIENCY PLAN CHECK WORKSHEETS**

**I. ENERGY/HVAC FORM INDEX**

Check below if included with submittal

**I-1: Index**

**II. BUILDING ENVELOPE PLAN CHECK WORKSHEETS**

**E-1: Building Envelope Summary**

**E-2: Fenestration Worksheet**

**E-3: Opaque Surfaces Worksheet**

**E-4: Skylight Exemption Worksheet**

**E-5: Opaque Trade-Off Worksheet**

**III. LIGHTING PLAN CHECK WORKSHEETS**

**L-1: Lighting Summary**

**L-2: Exterior Lighting Power Worksheet**

**L-3: Installed Interior Lighting Power Worksheet**

**L-4: Complete Building/Area Category Methods Worksheet**

**L-5: Activity Method Worksheet**

**IV. HVAC PLAN CHECK WORKSHEETS**

**H-1: HVAC Summary**

**H-2: HVAC Prescriptive Worksheet**

**H-3: HVAC Equipment Summary**

The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)].

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## II. BUILDING ENVELOPE PLAN CHECK DOCUMENTS

This section describes the forms and procedures for documenting compliance with the building envelope energy efficiency requirements of the code. It does not describe the details of the requirements; these are presented in the code. Determination of code compliance will be based on the actual code section. The following discussion is addressed to the designer preparing construction documents and compliance statements and to the plan reviewers who are examining those documents for compliance with the code.

The use of each form is briefly described below. The complete instructions for each form are presented in the following subsections.

### **E-Building Envelope Summary.**

This information is required for every project involving the building envelope.

### **E-Fenestration Worksheet.**

Used only for the Component Standards and System Standards methods. This worksheet produces area-weighted average values for the Fenestration U-Value and Shading Coefficient ( $SC_x$ ). For the System Standards method of s. Comm 63.16, one of these worksheets should be completed for each orientation. (It is not necessary to fill this out if there is only one Fenestration U-Value and Shading Coefficient for the entire project.)

### **E-Opaque Surfaces Worksheet.**

This worksheet is used only for the Component Standards method and System Standards method. This worksheet produces the area-weighted average values for the U-values of roof, walls (including opaque doors), and floor assemblies. For the System Standards method, one of these worksheets should be completed for each orientation.

### **E-Skylight Exemption Worksheet.**

This information will only be required when skylights are to be exempt from the roof area thermal performance calculation.

### **E-Opaque Trade-Off Worksheet.**

This information will only be required when opaque trade-offs are used per the requirements of Comm 63.15 (3) & (4).

SBD-10373 (R.10/98)

## BUILDING ENVELOPE SUMMARY E-1

This worksheet is applicable to all projects involving the building envelope.

### Project Information

This information asks for the project name and address and those people responsible for the building design and compliance forms.

### Compliance Approach

Check one of the three boxes:

- Component Standards:** If this box is checked, provide the number of the region in which the building is located from Figure 63.15-2 of the code and the Alternate Component Package (ACP) Table letter.
- System Standards:** If this box is checked, provide the computer printout or other documentation of envelope compliance and E-1 form, or appropriate thermal performance calculations for factories and warehouses as listed in Comm 63.14 (2)(3).
- System Analysis Design:** If the project is demonstrating compliance through the System Analysis Design method, check this box. A complete analysis must be provided.

### Basic Requirements

Fill the boxes in this column with either a check mark or "X" to indicate a positive response or "N/A" to indicate a negative response. If the skylight exemption is marked (see "Special Considerations"), attach the Skylight Exemption Worksheet (E-4).

### Prescriptive/Performance Requirements

If the project is demonstrating compliance through the Component Standards method, all of these items must be completed. The area-weighted properties such as components U-values and fenestration  $SC_x$  are obtained from the Fenestration Worksheet (E-2) and Opaque Surfaces Worksheet (E-3). The items under "Requirements" are obtained from the ACP Table.

If the System Standards method is used (e.g., ASHRAE's ENVSTD Program), only the items in the "Design" column need to be completed. Where there is more than one of a particular assembly, enter all of the values.

If the Opaque Trade-Off is used, provide the design information and demonstrate that the Total Design U•Area is equal to or less than the Total Required U•Area.

If the System Analysis Design method (e.g., ASHRAE's Energy Cost Budget method) is used, the items in the design column should be filled in, where applicable, to speed the plan review.

### Additional Data

This column serves as a reference for additional building envelope forms and calculations. If Worksheets E-2 through E-5 are submitted, it should be indicated on Form I-1. Boxes are provided for other submittal data. An additional blank is provided to indicate attached calculations such as calculation of mass wall heat capacity or interpolations of tables.

## FENESTRATION WORKSHEET E-2

This worksheet is applicable to projects that demonstrate compliance through the Component Standards method or the System Standards method. It is not applicable to projects that demonstrate compliance through the System Analysis Design method.

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Building Envelope Summary (E-1) form.

### Area-Weighted Properties

Assembly ID:

Insert a descriptor of the particular assembly. A separate ID must be supplied for each group of assemblies that have unique U-values or shading coefficients.

Area:

Enter the Total Area (in ft<sup>2</sup>) for that fenestration assembly (glazing and frame) on a project-wide basis. For the System Standards method, this would be the area for that assembly on an orientation basis. The values from all entries in this column should be summed into the box marked "Total Area" at the bottom of the column.

U-Value (or shading coefficient, SC<sub>x</sub>):

Enter the appropriate property for each fenestration assembly (glazing and frame).

U (or SC<sub>x</sub>) • Area:

This column is the product of the assembly area (second column) by the fenestration U-value (or SC<sub>x</sub> from the third column). The values from all entries in this column should be summed into the box marked "Total U•Area" at the bottom of the column.

The area-weighted U-value (or SC<sub>x</sub>) is calculated by dividing the value in "Total U•Area" by the value in "Total Area."

### OPAQUE SURFACES WORKSHEET E-3

This worksheet is applicable to projects that demonstrate compliance through either the Component Standards method or System Standards method. It is not applicable to projects that demonstrate compliance through the System Analysis Design method.

#### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Building Envelope Summary (E-1) form.

**Assembly ID:** Insert a descriptor of the particular assembly. This may be a descriptor or number from the appropriate schedule in the plans. A separate item must be supplied for each group of assemblies that have unique U-values.

**Area:** Enter the Total area (in ft<sup>2</sup>) for that assembly (roof, wall, or floor) on a project-wide basis. For the System Standards method, this would be the area for that assembly on an orientation basis. The values from all entries in this column should be summed into the box marked "Total Area" at the bottom of the column.

**U-Value:** Enter the appropriate property for each assembly. Overall thermal transmittance of assemblies must be calculated in accordance with s. Comm 63.18. The calculation procedure must consider the effect of framing.

If skylights are installed, they must be included in the overall U-value calculation of the roof unless an exemption is obtained under s. Comm 63.12. A skylight exemption worksheet (E-4) must be included.

**U•Area:** This column is the product of the assembly area (second column) by the assembly U-value. The values from all entries in this column should be summed into the box marked "Total U•Area" by the value in "Total Area."

The area-weighted U-value is calculated by dividing the value in "Total U•Area" by the value in "Total Area."

## SKYLIGHT EXEMPTION WORKSHEET E-4

This worksheet is applicable when skylights are exempt from the roof area overall U-value calculation per the requirements of Comm 63.12. It may be used with any method of compliance.

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Building Envelope Summary (E-1) form.

### Skylight Exemption Worksheet

All of the boxes except the item marked "Special Consideration" (50% shading device credit) must be filled in with a check or "X" to indicate affirmation. The 50% shading device credit box must be filled in with either a check, "X," or "N/A."

All of the "Design" and "Requirement" information must be completed. The skylight-to-roof ratio requirement is the maximum percent of skylight area taken from ASHRAE 90.1, Tables 8-3a and 8-3b of Table A63.12. The maximum area will depend on the visible light transmittance (VLT) and whether or not shading is provided for the skylight.

The lighting power density may be taken from the allowed lighting power density from s. Comm 63.47, 63.48, or 63.49, or the actual installed lighting power density adjusted for controls under s. Comm 63.45 (2) may be used.

The design lighting level, in foot-candles, is the judgment of the designer, but should be in general agreement with the recommendations of the Illuminating Engineering Society. (Refer to the IES Lighting Handbook, application volume, 1987.) The designer should choose the lighting level in the table closest to the condition in the proposed building. Interpolation or extrapolation for lighting level is not permitted.

## OPAQUE TRADE-OFF WORKSHEET E-5

This worksheet is applicable to projects that demonstrate compliance through Opaque Trade-Offs as used with the requirements of Comm 63.15 (3) & (4).

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Building Envelope Summary (E-1) form.

- Assembly ID:** Insert a descriptor of the particular assembly. This may be a descriptor or number from the appropriate schedule in the plans. A separate item must be supplied for each group of assemblies that have unique U-values.
- Area:** Enter the Total area (in ft<sup>2</sup>) for that assembly (roof, wall, or floor) on a project-wide basis. For the System Standards method, this would be the area for that assembly on an orientation basis. The values from all entries in this column should be summed into the box marked "Total Area" at the bottom of the column.
- U-Value:** Enter the appropriate property for each assembly. Overall thermal transmittance of assemblies must be calculated in accordance with s. Comm 63.18. The calculation procedure must consider the effect of framing.  
If skylights are installed, they must be included in the overall U-value calculation of the roof unless an exemption is obtained under s. Comm 63.12. A skylight exemption worksheet (E-4) must be included.
- U•Area:** This column is the product of the assembly area (second column) by the assembly U-value.
- Total Design U•Area:** Add all U•Area values associated with the Design column. The U•Area values are to be derived from the designed roofs, walls adjacent to unconditioned spaces, above grade exterior walls, and floors over unconditioned spaces.
- Total Required U•Area:** Add all U•Area values associated with the Requirement column. The U•Area values are to be derived from code required roofs, walls adjacent to unconditioned spaces, above grade exterior walls, and floors over unconditioned spaces.
- Compliance is shown when the "Total Design U•Area" is less than or equal to the "Total Required U•Area."



**BUILDING ENVELOPE SUMMARY**

**E-1**



|                                     |                          |
|-------------------------------------|--------------------------|
| Transaction ID#                     | Submitter's Name         |
| Owner's Name                        | Date                     |
| Building Location (Number & Street) | City Village Township of |

**Compliance Approach**      **Component Standards**      **System Standards**      **System Analysis Design**  
 Region                      (See Comm 63.15)      (See Comm 63.16)      (See Comm 63.70-72)  
    ACP Table                      (See Fig. 63.15-2)

| Basic Requirements       |   | Prescriptive/Performance Requirements   |                |  | Additional Data                                      |  |
|--------------------------|---|---|----------------|--|--|--|
| <input type="checkbox"/> | U-values reported on this form are area-weighted averages. Comm 63.18 (1)   | <b>Fenestration Properties</b>  | <b>Design</b>  | <b>Requirement</b>                                       |  | Fenestration Worksheet (E-2)                                     |
| <input type="checkbox"/> | Windows and doors meet the air infiltration requirements. Comm 63.11  | Window Area (WA)<br>Comm 63.05 (79)   | _____          | If using Component Standards, see ACP Table Fig. 63.15-2 |  | Opaque Surfaces Worksheet (E-3)                                  |
| <input type="checkbox"/> | Fenestration U-values are certified by NFRC or from Table 63.18-3. Comm 63.18 (2) (b)   | Gross Wall Area (GWA)<br>Comm 63.05 (27)<br>Comm 63.18 (2) (b) & (3)                                  | _____          |  |  |  |
| <input type="checkbox"/> | Fenestration shading coefficients are obtained from either the 1989 ASHRAE Handbook of Fundamentals or manufacturer's data. Comm 63.18 (4)  | Window-Wall Ratio (WA/GWA)<br>Comm 63.05 (80)   | _____          | ≤ _____  |  | Skylight Exemption Worksheet (E-4)                               |
| <input type="checkbox"/> | Exterior joints, cracks, and holes in the building envelope are caulked, gasketed, weather stripped, or otherwise sealed. Comm 63.11        | Window U-value<br>Comm 63.18 (2) (b)<br>Window SCx<br>Comm 63.18 (4)                                  | _____<br>_____ |  | <input type="checkbox"/>                             | Opaque Trade-off Worksheet (E-5)<br>Marked Up ACP Table Included |
| <input type="checkbox"/> | Double entry vestibule? (Optional—check if provided)  | Skylights Installed   | _____ Yes      | _____ No   |  |  |
| <input type="checkbox"/> | U-values reported on this form are area-weighted averages. Comm 63.18 (1)   | <b>Wall Design</b>  |                |  | <input type="checkbox"/>                             | COMcheck-EZ Report Included                                      |
| <input type="checkbox"/> | An approved method which accounts for the thermal bridging of framing is used to calculate U-values for envelope assemblies. Comm 63.18 (2) | U-value<br>Comm 63.18 (2) (a)<br><br>Heat Capacity (HC)<br>Comm 63.05 (34)<br>Appendix A63.15 (3) (b) | _____<br>_____ |  | <input type="checkbox"/><br><input type="checkbox"/> | ENVSTID Output Included  |
| <input type="checkbox"/> | Exterior joints, cracks, and holes in the building envelope are caulked, gasketed, weather stripped, or otherwise sealed. Comm 63.11        | Insulation position (interior or exterior)<br>Comm 63.05 (44)   | _____          |  |  |  |
| <input type="checkbox"/> | Vapor barriers are installed to prevent deterioration of insulation performance. Comm 63.11 (4)   | U-Values<br>Roof<br>Comm 63.18 (2) (a)  | _____          | ≤ _____  |  |  |
| <input type="checkbox"/> | Special Consideration<br>The skylight exemption is applied.<br>Comm 63.12   | Walls adjacent to unconditioned space<br>Comm 63.18 (2) (a)   | _____          | ≤ _____  |  |  |
|                          | (Attach Skylight Exemption Worksheet E-4)   | Floors over unconditioned space<br>Comm 63.18 (2) (a)   | _____          | ≤ _____  |  |  |
| <input type="checkbox"/> | R-values reported on this form for slab-on-grade floors and walls before grade include only the insulating material. Comm 63.15 (5) and (6) | R-Values<br><br>Walls below grade<br>Comm 63.18 (2) (a)   | _____          | ≥ _____  |  |  |
| <input type="checkbox"/> | Insulation continuity is maintained.<br>Comm 63.15 (5)  | Slab-on-grade<br>Comm 63.18 (2) (a)   | _____          | ≥ _____  |  |  |

**BUILDING ENVELOPE SUMMARY**

**E-2**



|                                     |                          |
|-------------------------------------|--------------------------|
| Transaction ID#                     | Submitter's Name         |
| Owner's Name                        | Date                     |
| Building Location (Number & Street) | City Village Township of |

Fenestration Orientation:  
For System Standards Method

**Area-Weighted Properties – Comm 63.18**

Fenestration U-Value ( $U_{of}$ ) see Comm 63.18 (2) (b)

| Assembly ID  | Area | U-Value        | U•Area |
|--------------|------|----------------|--------|
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
| Total Area → |      | Total U•Area → |        |

$$\frac{\text{Total U} \cdot \text{Area}}{\text{Total Area}} = \boxed{\phantom{000}}$$

Fenestration Shading Coefficient ( $SC_x$ ) see Comm 63.18 (4)

| Assembly ID  | Area | $SC_x$                           | $SC_x \cdot \text{Area}$ |
|--------------|------|----------------------------------|--------------------------|
|              |      | X                                | =                        |
|              |      | X                                | =                        |
|              |      | X                                | =                        |
|              |      | X                                | =                        |
|              |      | X                                | =                        |
|              |      | X                                | =                        |
|              |      | X                                | =                        |
|              |      | X                                | =                        |
| Total Area → |      | Total $SC_x \cdot \text{Area}$ → |                          |

$$\frac{\text{Total } SC_x \cdot \text{Area}}{\text{Total Area}} = \boxed{\phantom{000}}$$

**OPAQUE SURFACES WORKSHEET**

**E-3**



|                                     |                          |
|-------------------------------------|--------------------------|
| Transaction ID#                     | Submitter's Name         |
| Owner's Name                        | Date                     |
| Building Location (Number & Street) | City Village Township of |

Fenestration Orientation:

*For System Standards Method*

**Area-Weighted Properties – Comm 63.18**

Roofs see Comm 63.18 (2) (a)

| Assembly ID  | Area | U-Value        | U•Area |
|--------------|------|----------------|--------|
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
| Total Area → |      | Total U•Area → |        |

$$\frac{\text{Total U•Area}}{\text{Total Area}} = \boxed{\phantom{000}}$$

**Walls Adjacent to Unconditioned Spaces see Comm 63.18 (2) (a)**

| Assembly ID  | Area | U-Value        | U•Area |
|--------------|------|----------------|--------|
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
| Total Area → |      | Total U•Area → |        |

$$\frac{\text{Total U•Area}}{\text{Total Area}} = \boxed{\phantom{000}}$$

**Above Grade Exterior Walls see Comm 63.18 (2) (a)**

| Assembly ID  | Area | U-Value        | U•Area |
|--------------|------|----------------|--------|
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
| Total Area → |      | Total U•Area → |        |

$$\frac{\text{Total U•Area}}{\text{Total Area}} = \boxed{\phantom{000}}$$

**Floors Over Unconditioned Spaces see Comm 63.18 (2) (a)**

| Assembly ID  | Area | U-Value        | U•Area |
|--------------|------|----------------|--------|
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
|              |      | X              | =      |
| Total Area → |      | Total U•Area → |        |

$$\frac{\text{Total U•Area}}{\text{Total Area}} = \boxed{\phantom{000}}$$

**SKYLIGHT EXEMPTION WORKSHEET**

**E-4**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

| Skylight Exemption Requirements see Comm 63.12  |   | Additional Data    |   |
|---|---|--------------------|---|
|   | Skylight Design Data                          | Design Requirement |   |
| <input type="checkbox"/> U-values of skylight curbs are less than 0.21 Btu/hr•ft <sup>2</sup> •°F.                                    |   |                    | <input type="checkbox"/> ENVSTD output                            |
| <input type="checkbox"/> Overall thermal transmittance of skylight assemblies is less than 0.70 Btu/hr•ft <sup>2</sup> •°F.           | Skylight Area (SA)                            | _____              | <input type="checkbox"/> Calculation of allowed skylight percent. |
|   | Gross Roof Area (GRA)                         | _____              |   |
|   | Skylight-to-Roof Ratio (SA/GRA)               | _____ ≤ _____      |   |
| <input type="checkbox"/> Air leakage is less than 0.5 cfm/ft <sup>2</sup> of skylight.  |   |                    | <input type="checkbox"/> Sketch of shading devices.               |
| <input type="checkbox"/> Automatic daylighting controls installed to reduce electric lighting by 50%.                                 | Skylight U-value                              | _____              |   |
|   | Skylight VLT                                  | _____              |   |
| <input type="checkbox"/> Special Consideration<br>Shading devices used to block 50% of the solar gain during peak cooling conditions. | Lighting Power Density (LPD/ft <sup>2</sup> ) | _____              |   |
|   | Design lighting level (footcandles)           | _____              |   |

**OPAQUE ASSEMBLY TRADE-OFF WORKSHEET**

**E-5**



|                                     |                          |
|-------------------------------------|--------------------------|
| Transaction ID#                     | Submitter's Name         |
| Owner's Name                        | Date                     |
| Building Location (Number & Street) | City Village Township of |

**DESIGN**

**Design – Roofs see Comm 63.18 (2) (a)**

| Assembly ID  | Area | U-Value | U•Area |
|--------------|------|---------|--------|
|              | X    |         | =      |
|              | X    |         | =      |
|              | X    |         | =      |
|              | X    |         | =      |
| Total Area → |      |         |        |

**Design – Above Grade Exterior Walls see Comm 63.18 (2) (a)**

| Assembly ID | Area | U-Value | U•Area |
|-------------|------|---------|--------|
|             | X    |         | =      |
|             | X    |         | =      |
|             | X    |         | =      |
|             | X    |         | =      |

**Design – Walls Adjacent to Unconditioned Space see Comm 63.18 (2) (a)**

| Assembly ID  | Area | U-Value | U•Area |
|--------------|------|---------|--------|
|              | X    |         | =      |
|              | X    |         | =      |
|              | X    |         | =      |
|              | X    |         | =      |
| Total Area → |      |         |        |

**Design – Floors Over Unconditioned Space see Comm 63.18 (2) (a)**

| Assembly ID  | Area | U-Value | U•Area |
|--------------|------|---------|--------|
|              | X    |         | =      |
|              | X    |         | =      |
|              | X    |         | =      |
|              | X    |         | =      |
| Total Area → |      |         |        |

**REQUIREMENT**

**Required – Roofs see Comm 63.15 (4)**

| Total Area | Required U-Value | U• Area |
|------------|------------------|---------|
| X          |                  | =       |

**Required – Above Grade Exterior Walls See Comm 63.15 (4)**

| Total Area | Required U-Value | U• Area |
|------------|------------------|---------|
| X          |                  | =       |

**Required – Walls Adjacent to Unconditioned Space See Comm 63.15 (4)**

| Total Area | Required U-Value | U• Area |
|------------|------------------|---------|
| X          |                  | =       |

**Required – Floors Over Unconditioned Space See Comm 63.15 (4)**

| Total Area | Required U-Value | U• Area |
|------------|------------------|---------|
| X          |                  | =       |

### III. LIGHTING PLAN CHECK DOCUMENTS

This section describes the forms and procedures for documenting compliance with the lighting energy efficiency requirements of the code. It does not describe the details of the requirements; these are presented in the code. The following discussion is addressed to the designer preparing construction documents and compliance statements and to the plan reviewers who are examining those documents for compliance with the code.

The use of each form is briefly described below. The complete instructions for each form are presented in the following subsections.

**L-1: Lighting Summary.**

This information is required for every project involving lighting and lighting controls.

**L-2: Exterior Lighting Power Worksheet.**

This information is also required for every project involving lighting and lighting controls.

**L-3: Installed Interior Lighting Power Worksheet.**

This information is also required for every project involving lighting and lighting controls.

**L-4: Complete Building/Area Category Methods Worksheet**

This information will only be required when calculating the Interior Lighting Power Allowance using either the Complete Building Method or the Area Category Method.

**L-5: Activity Method Worksheet.**

This information will only be required when calculating the Interior Lighting Power Allowance using the activity method.

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## LIGHTING SUMMARY L-1

The Lighting Summary (L-1) form is in four parts. A copy of these forms must be submitted to the Division along with the rest of the compliance submittal at the time of building plan review.

### A. Lighting Summary (L-1) Part 1

#### Project Information

Part 1 of the Lighting Summary form asks for the project name and address and those people responsible for the lighting design and compliance forms. The project name and address should be the same as on the Building Envelope forms for the project.

#### Method of Interior Lighting Compliance

Check one of the four boxes:

- |                    |  |
|--------------------|--|
| Complete Building: | If this box is checked, the Complete Building/Area Category Methods Worksheet (L-4) must be provided.  |
| Area Category:     | If this box is checked, the Complete Building/Area Category Methods Worksheet (L-4) must be provided.  |
| Activity:          | If this box is checked, the Activity Method Worksheet (L-5) must be provided.  |
| Other:             | If compliance for the project is demonstrated through the System Analysis Design method of ss. Comm 63.70-72 where all energy-using systems are considered together, check this box. A complete analysis must be provided. |

#### Basic Requirements

All of the boxes in this column must be filled with either a check or "X" to indicate affirmation or "N/A" to indicate not applicable. For exterior lighting, enter the Exterior Lighting Power (ELP) and the Exterior Lighting Power Allowance (ELPA). These are obtained from the Exterior Lighting Power Worksheet (L-2).

#### Prescriptive/Performance Requirements

Enter the Installed Interior Lighting Power (ILP) and the Interior Lighting Power Allowance (ILPA). The ILP is obtained from the Interior Lighting Power Allowance Worksheet (L-3). The ILPA is obtained from the Complete Building/Area Category Methods Worksheet (L-4) if either the Complete Building Method or the Area Category Method is used. The ILPA is obtained from the Activity Method Worksheet (L-5) if the if the Activity Method is used. The lighting power control credits box is filled with a check or "X" when control credits are taken, otherwise enter "N/A."

#### Worksheets

Indicate which worksheets are attached.

### B. Lighting Summary (L-1) Parts 2 to 4

Parts 2 to 4 of the Lighting Summary should be used to describe the installed lighting schedule, and the control devices associated with the building design. If necessary, make extra copies of the forms. The information on the L-1 parts 2 to 4 forms may be incorporated into equipment schedules on the plans along with light fixture information, rather than presented on the forms. If this is done, however, the same information should be included in one schedule and in a similar format as the forms.

### Lighting Summary (L-1) Part 2

Luminaire Name:                      Record the description by name or type.

- Lamp Type:** Record the type of lamp (Incandescent, Fluorescent or High-Intensity discharge).
- Watts/Lamp:** Record the listed watts per lamp. For track and incandescent medium base socket fixture, see s. Comm 63.45 (4) for how to determine the watts of these types of luminaires. If track lighting is used and the fixtures are not shown on the Installed Lighting Schedule, 45 watts per foot of track is entered in this column.
- Ballasts Type:** Record the ballast type — Standard Energy-Saving Magnetic (S), Electronic High Frequency\* (E) or Other\* (O). If Electronic High Frequency or Other ballast types are used, the exact ballast type and model number should be specified.
- Number/Luminaire:** Record the number of ballasts installed in each Luminaire.

#### **Mandatory Controls (L-1) Part 3**

The Mandatory Controls portion is where those devices to meet the mandatory control requirements are listed. This would include devices for building shut-off, individual room control, and control of exterior lights. If some mandatory controls meet the requirements of s. Comm 63.45 (2), the information should also be recorded on Part 4, Automatic Controls for Credit, if control credits are taken in the ILP calculation.

- Control Location:** Record the location of the control on the plans.
- Control Identification:** Record the symbol of the control on the plans.
- Control Type:** Record the type of certified control device used to meet the mandatory automatic control requirement.
- Space Controlled:** Record the location of controlled lights.  
Typical controls may be covered by general notation.

#### **Automatic Controls for Credit (L-1) Part 4**

The Automatic Controls for Credit portion is similar to the Mandatory Controls portion. The only difference is the last column.

- Luminaires Controlled:** Record the luminaire type and quantity controlled for credit.
- Type:** Record the same name as on the plans.
- Number of Luminaires:** Record the number of luminaires of that type that are controlled by the control type.  
Typical controls may be covered by general notation.

#### **Reviewer Notes**

This space is used by the Department Plan Examiner during review of the submitted information.



## EXTERIOR LIGHTING POWER WORKSHEET L-2

This worksheet is applicable to all projects.

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

### Exterior Lighting Power Allowance — ELPA

- Area Description:** This is a descriptor of each line. These descriptors match those in Comm Table 63.43.
- Allowance:** This is the allowance in either  $W/ft^2$  or watts of lineal feet. These allowances match those in Comm Table 63.43.
- Area or Lineal Feet in Proposed Design:** Record the area ( $ft^2$ ) or lineal footage (lf) as appropriate. These values should be project-wide values.
- ELPA:** Multiply the allowance from Column B by the area (or lineal footage) from Column C. Record the resultant ELPA in Column D. The values should be summed into the box marked "Total ELPA" at the bottom of the column.

### Installed Exterior Lighting Power

Do not include luminaires that are exempted under s. Comm 63.42.

- Fixture Type:** Record the description of the luminaires that are included.
- Number of Luminaires:** Record the total number of similar luminaires in the project.
- Watts per Luminaire:** Record the input wattage for each luminaire, including the ballast.
- Installed Wattage:** Multiply the number of luminaires from Column B by the wattage per luminaire from Column C. Enter the resultant installed wattage in Column D. The values from all entries in the column should be summed into the box marked "Total ELP" at the bottom of the column.

## INSTALLED INTERIOR LIGHTING POWER WORKSHEET L-3

The Installed Interior Lighting Power Worksheet (L-3) will be completed and submitted with all applications. Either the Complete Building/Area Category Method Worksheet (L-4), the Activity Method Worksheet (L-5), or System Analysis Design documentation will be included with L-3, depending on the ILPA calculation method chosen.

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

### Installed Interior Lighting Power

The calculated interior lighting power to be installed is determined by completing this form. *Do not include luminaires that are exempted under s. Comm 63.45.* If necessary, make extra copies of this form. Use as many sheets as needed for the project.

**Luminaire Name or ID No.:** Record the name or symbol. It should be consistent with what is used in the lighting schedule.

**Description:** Record a short list of the technical features (i.e., luminaire size and type, lamp type and number, ballast type, lens/louver type).

**Number of Luminaires:** Record the quantity of each fixture type in the building. If track lighting is used and the fixtures are not shown on the plans, the length of the track is entered in this column.

(Tip: If control credits are to be used and all of any type of luminaires are not controlled or used with the same control, split the luminaries up over several lines, one for each control type.)

**Watts per Luminaire:** Record the total wattage of each luminaire type (including ballasts for fluorescent or high intensity discharge fixtures). For track and incandescent medium base socket fixtures, see s. Comm 63.45 (4) for how to determine the watts of these types of luminaires. If track lighting is used and the fixtures are not shown on the Installed Lighting Schedule, 45 watts per foot of track is entered in this column. The wattage may be a standard value from the data in Table A63.45. Nonstandard values not from Table A63.45 must be substantiated with manufacturer's data sheets.

**Total Watts:** Record the product of the quantity of each luminaire listed times its watts per luminaire. If credit for automatic lighting controls is not sought, the interior lighting power is the sum of this Column E.

**LPAF for Automatic Controls:** If lighting power control credits are used, enter the appropriate lighting power adjustment factor from Table 63.45. If this credit is not used, leave Columns F, G, and H blank.

**Control Credit:** Multiply the total watts of luminaires associated with the control of Column E by the LPAF of Column F. Record the resultant control credit in Column G.

**Adjusted Watts:** Subtract the control credit of Column G from the total watts of Column E. Record the remainder in Column H.

The sum of Column E (or Column H if control credits are used) is the calculated interior lighting power for the building. If more than one sheet is used, enter the total for all sheets. This total cannot be greater than the Interior Lighting Power Allowance calculated on worksheet L-4 or L-5.

### COMPLETE BUILDING/AREA CATEGORY METHODS WORKSHEET L-4

This worksheet will be attached to L-3 whenever the Complete Building Method or the Area Category Method is used to calculate the Interior Lighting Power Allowance.

#### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

#### Interior Lighting Power Allowance

The Interior Lighting Power Allowance (ILPA) is determined by calculating the maximum total watts of lighting that may be installed. As noted on the Lighting Summary, L-1, there are four different methods that may be used. These methods may not be mixed in the same building permit application. This form is used when the ILPA is calculated by the Complete Building or Area Category Method.

#### Complete Building Method

This method may only be used when plans and specifications for the entire building are included in the application.

|                         |  |
|-------------------------|--|
| Building Type of Use:   | This is taken from Table 63.47 for the type of use of the building. If the building has a mixture of uses, the major use must be at least 80 percent of the conditioned floor area. If there is no major use, this method may not be used. |
| Watts per Square Foot:  | Record the allowed lighting power density in watts per square foot for this building type taken from Comm Table 63.47.   |
| Complete Building Area: | Record the conditioned floor area of the entire building, including the conditioned floor area of minor occupancies. See 63.05 (6) for the definition of conditioned floor area.   |
| Allowed Watts:          | Record the product of the watts per square foot times the complete building area. This becomes the Interior Lighting Power Allowance for the building.   |

#### Area Category Method

This method may be used when different primary function areas of a building are included in the application.

|                        |   |
|------------------------|---|
| Primary Function:      | This is taken from Comm Table 63.48 for the primary function of the area. If the building has a mixture of functions, each function area must be listed separately. |
| Watts per Square Foot: | Record the allowed lighting power density watts per square foot for this building type taken from Comm Table 63.48.   |
| Area:                  | Record the conditioned floor area (in square feet) of the primary function area measured from the inside of partitions.   |
| Allowed Watts:         | Record the product of the watts per square foot times the primary function area. This becomes the allowed lighting power for the area.                              |

The sum of the allowed lighting power for each primary function area is the Interior Lighting Power Allowance for the building.

## ACTIVITY METHOD WORKSHEET L-5

This worksheet is applicable to all projects including those that use the Activity Method of s. Comm 63.49. If necessary, make extra copies of this form. Use as many sheets as needed for the project.

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

### Interior Lighting Power Allowance — ILPA

- Column A: Record the room number or room name. A range of similar rooms may also be entered.
- Column B: Record the average ceiling height of the room in feet.
- Column C: Record a description of each line item. The description shall match the appropriate description from Table 63.49.
- Column D: Record any notes from Table 63.49. These notes may limit the Area Factor used in Activity Method calculations.
- Column E: Record the appropriate unit lighting power density (UPD) from Table 63.49.
- Column F: Record the floor area of the room (inside wall to inside wall, ft<sup>2</sup>). Where multiple rooms are included in single line, this is the average area of each type of room and not the total area of all rooms.
- Column G: Record the area factor from either s. Comm 63.49, Figure 63.49, or an applicable footnote from Table 63.49.
- Column H: Record the number of similar spaces.
- Column I: Multiply the UPD from Column E by the floor Column F by the area factor from Column G by the number of similar rooms from Column H. Record the resultant lighting power budget in Column I. The values from all entries in this column should be summed into the box marked "ILPA" at the bottom of the column.

**LIGHTING SUMMARY**

**L-1 - Part 1 of 4**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

**Method of Interior Lighting Compliance (check one)**

- Complete Building s. Comm 63.47
- Area Category s. Comm 63.48
- Activity s. Comm 63.49
- Other s. Comm 63.70-72

| Basic Requirements  | Prescriptive/Performance   | Additional Data   |
|---|--|---|
| <input type="checkbox"/> Exterior lighting not intended for 24-hour use controlled by photocell. Comm 63.50   | $\frac{\text{Installed ELP}}{\text{ELPA}} \leq \frac{\text{ELPA}}{\text{Comm 63.43}}$  | Exterior Lighting Power Worksheet (L-2)   |
| <input type="checkbox"/> Shut-off control in each space enclosed by ceiling-high partitions. Comm 63.50 (1)<br><input type="checkbox"/> Controls to reduce lighting by 50%. Comm 63.50 (2)<br><input type="checkbox"/> Controls to reduce lighting in daylit areas. Comm 63.50 (3)<br><input type="checkbox"/> Automatic shut-off controls. Comm 63.50 (4)<br><input type="checkbox"/> Display lighting separately switched on circuits $\leq$ 20 amps. Comm 63.50 (5)<br><input type="checkbox"/> Hotel/motel guest rooms have master switches at the main door to turn off lights and receptacles. Comm 63.50 (7) |  |   |
| <input type="checkbox"/> Exit signs have installed wattage of 20 watts or less. Comm 63.52<br><input type="checkbox"/> Fluorescent lamps use multiple lamp ballasts with tandem wiring as required. Comm 63.53  | $\frac{\text{ILP}}{\text{ILPA}} \leq \frac{\text{ILPA}}{\text{Comm 63.47, 63.48, or 63.49}}$<br><input type="checkbox"/> Lighting Power Control Credits Applied. Comm 63.45 <ul style="list-style-type: none"> <li><input type="checkbox"/> Daylight Sensing Controls</li> <li><input type="checkbox"/> Occupancy Sensors</li> <li><input type="checkbox"/> Programmable Timing Controls</li> <li><input type="checkbox"/> Lumen Maintenance Controls</li> </ul> | Interior Lighting Power Worksheet (L-3)<br>Interior Lighting Power Allowance Worksheet (L-4)<br>Activity Method Worksheet (L-5) |

The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)].

SBD-10377 (R.10/98)

**LIGHTING SUMMARY L-1 - Part 2 of 4**



|                                     |                                    |
|-------------------------------------|------------------------------------|
| Transaction ID #                    | Submitter's Name                   |
| Owner's Name                        | Date                               |
| Building Location (Number & Street) | City      Village      Township of |

**INSTALLED LIGHTING SCHEDULE**

| Luminaire Name<br>or ID Number<br>(e.g., Type 1, Type 2, etc.) | Lamps |   |   |              | Watts/Lamp | Ballasts |    |    | No./Luminaire | Note<br>to<br>Field |
|--|-------|---|---|--------------|------------|----------|----|----|---------------|---------------------|
|  | Type  |   |   | No. of Lamps |            | Type     |    |    |               |                     |
|  | I     | F | H |              |            | S        | E* | O* |               |                     |
|  |       |   |   |              |            |          |    |    |               |                     |
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\* Provide Supporting Documentation for total watts for lamp and ballast.

**REVIEWER NOTES - For Department Use Only**

**LIGHTING SUMMARY**

**L-1 - Part 3 of 4**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

**MANDATORY CONTROLS (s. Comm 63.50)**

(Optional if included on plans - Use as many sheets as necessary)

| Control Location<br>(Room #) | Control Identification | Control Type<br>(Occupancy Sens.,<br>Daylight, etc.) | Space Controlled | Note to Field |
|------------------------------|------------------------|--|------------------|---------------|
|                              |                        |  |                  |               |
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**REVIEWER NOTES - For Department Use Only**

**LIGHTING SUMMARY**

**L-1 - Part 4 of 4**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

**CONTROLS FOR CREDIT (s. Comm Table 63.45)**

(Optional if included on plans - Use as many sheets as necessary)

| Control Location<br>(Room # or Dwg.#) | Control Identification | Control Type<br>(Occupant, Daylight, Dimming, etc.) | Luminaires Controlled |             | Note to Field |
|---------------------------------------|------------------------|---|-----------------------|-------------|---------------|
|                                       |                        |   | Type                  | # of Lumin. |               |
|                                       |                        |   |                       |             |               |
|                                       |                        |   |                       |             |               |
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**REVIEWER NOTES - For Department Use Only**



**EXTERIOR LIGHTING POWER WORKSHEET L-2**



|                                     |                                    |
|-------------------------------------|------------------------------------|
| Transaction ID #                    | Submitter's Name                   |
| Owner's Name                        | Date                               |
| Building Location (Number & Street) | City      Village      Township of |

**EXTERIOR LIGHTING POWER ALLOWANCE - ELPA (s. Comm 63.43)**

| A<br>Area Description                                      | B<br>Allowance (Table 63.43)          | C<br>Area or Lineal Feet in Proposed Design | D<br>ELPA (B•C) |
|--|---------------------------------------|---|-----------------|
| Exit (with or without canopy)                              | 25 W/lf of door opening               |   |                 |
| Entrance (without canopy)                                  | 30 W/lf of door opening               |   |                 |
| High Traffic Entrance (with canopy)                        | 10 W/ft <sup>2</sup> of canopied area |   |                 |
| Light Traffic Entrance (with canopy)                       | 4 W/ft <sup>2</sup> of canopied area  |   |                 |
| Loading Area   | 0.40 W/ft <sup>2</sup>                |   |                 |
| Loading Door   | 20 W/lf of door opening               |   |                 |
| Building Exterior Surfaces or Storage and Nonmanufacturing | 0.25 W/ft <sup>2</sup> of illuminated |   |                 |
| Casual Use Areas (gardens, etc.)                           | 0.10 W/ft <sup>2</sup>                |   |                 |
| Private Driveways or Walkways                              | 0.10 W/ft <sup>2</sup>                |   |                 |
| Public Driveways or Walkways                               | 0.15 W/ft <sup>2</sup>                |   |                 |
| Private Parking Lots                                       | 0.12 W/ft <sup>2</sup>                |   |                 |
| Public Parking Lots  | 0.18 W/ft <sup>2</sup>                |   |                 |
| <b>Total ELPA</b>  |                                       |   |                 |

**INSTALLED EXTERIOR LIGHTING POWER - ELP (s. Comm 63.42)**

| A<br>Fixture Type          | B<br>Number of Luminaires Installed | C<br>Watts per Luminaire (including ballast) | D<br>Installed Watts (B•C) |
|----------------------------|-------------------------------------|--|----------------------------|
|                            |                                     |  |                            |
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|                            |                                     |  |                            |
| <b>Total Installed ELP</b> |                                     |  |                            |

**INSTALLED INTERIOR LIGHTING POWER WORKSHEET L-3**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

**INSTALLED INTERIOR LIGHTING POWER (s. Comm 63.45)**

(Use as many sheets as necessary)

| <b>A</b>   | <b>B</b>                     | <b>C</b>                    | <b>D</b>                                       | <b>E</b>                 | <b>F</b>  | <b>G</b>                     | <b>H</b>                    |
|--|------------------------------|-----------------------------|--|--------------------------|---|------------------------------|-----------------------------|
| <b>Luminaire Name or ID No.</b>  | <b>Luminaire Description</b> | <b>Number of Luminaires</b> | <b>Watts per Luminaire (including ballast)</b> | <b>Total Watts (C•D)</b> | <b>LPAF for Automatic Controls (Table 63.45)</b>  | <b>Control Credit (E•F)*</b> | <b>Adjusted Watts (E-G)</b> |
|  |                              |                             |  |                          |   |                              |                             |
|  |                              |                             |  |                          |   |                              |                             |
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|  |                              |                             |  |                          |   |                              |                             |
|  |                              |                             |  |                          |   |                              |                             |
| <b>Total for this Sheet</b><br><b>Total for all Sheets</b><br>(if control credits not taken) |                              |                             |  |                          | <b>Total for this Sheet</b><br><b>Total for all Sheets</b><br>(Adjusted with control credits) |                              |                             |

\*Note: If control credits are taken, Form L-1, Part 3 must be completed or controls must be indicated on the plans.

**COMPLETE BUILDING/AREA CATEGORY METHOD WORKSHEET L-4**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

**INTERIOR LIGHTING POWER ALLOWANCE (ILPA) (s.Comm 63.47 or 63.48)**  
 (Choose *one* method or use the Activity Method and Form L-5)

Complete Building Method

| Building Type of Use From Table 63.47 | Watts/ft <sup>2</sup> | Complete Bldg. Area | Allowed Watts |
|---------------------------------------|-----------------------|---------------------|---------------|
|                                       |                       |                     |               |

Area Category Method

| Primary Function From Table 63.48 | Watts/ft <sup>2</sup> | Area (ft sq.) | Allowed Watts |
|-----------------------------------|-----------------------|---------------|---------------|
|                                   |                       |               |               |
|                                   |                       |               |               |
|                                   |                       |               |               |
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|                                   |                       |               |               |
|                                   |                       |               |               |
| <b>Totals</b>                     |                       |               |               |

ft<sup>2</sup> Area      Watts

**ACTIVITY METHOD WORKSHEET L-5**



|                                     |  |                  |         |             |
|-------------------------------------|--|------------------|---------|-------------|
| Transaction ID #                    |  | Submitter's Name |         |             |
| Owner's Name                        |  | Date             |         |             |
| Building Location (Number & Street) |  | City             | Village | Township of |

**INTERIOR LIGHTING POWER ALLOWANCE (ILPA) (s. Comm 63.49)**  
 (Use as many sheets as necessary)

| A                         | B                         | C   | D    | E                           | F                                   | G               | H                           | I                       |
|---------------------------|---------------------------|---|------|-----------------------------|-------------------------------------|-----------------|-----------------------------|-------------------------|
| Room<br>Number<br>or Name | Ceiling<br>Height<br>(ft) | Area/Activity<br>Description<br>(Table 63.49) | Note | UPD<br>(W/ft <sup>2</sup> ) | Floor<br>Area<br>(ft <sup>2</sup> ) | Area<br>Factor* | # of<br>Identical<br>Spaces | LPB<br>(W)<br>(E•F•G•H) |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
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|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |
|                           |                           |   |      |                             |                                     |                 |                             |                         |

\* Note b: Office Categories 2 & 3 AF shall not exceed 1.00  
 Note d: Office Category 1 AF shall not exceed 1.55  
 Area Factors less than 1.0, equal 1.0  
 Area Factors greater than 1.8 shall equal 1.8

|                                   |  |
|-----------------------------------|--|
| <b>Sheet Total ILPA</b>           |  |
| <b>Total ILPA from all sheets</b> |  |

#### IV. HVAC SYSTEMS PLAN CHECK DOCUMENTS

This section describes the forms and procedures for documenting compliance of Heating, Ventilation and Air Conditioning (HVAC) systems with the energy efficiency requirements of the code. It does not describe the details of the requirements; these are presented in the code. Determination of compliance will be based on the actual code section. The following discussion is addressed to the designer preparing construction documents and compliance statements, and to the plan reviewers who examine those documents for compliance with the code.

Note: These forms cannot be used to demonstrate compliance with the Ch. Comm 64 ventilation requirements. That information must be provided separately.

The use of each form is briefly described below. The complete instructions for each form are presented in the following subsections.

##### **H-1: HVAC Systems Summary.**

This information is required for every project involving heating, ventilation and air conditioning equipment & systems.

##### **H-2: HVAC Prescriptive Worksheet.**

This information is applicable to projects that demonstrate compliance through a prescriptive means by following the requirements of Subchapter IV. It is not applicable to projects that demonstrate compliance through the System Analysis Design method of ss. Comm 63.70-72.

##### **H-3: HVAC Equipment Summary.**

This information is required for every project.

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## HVAC SYSTEMS SUMMARY H-1

This worksheet is applicable to all projects

### Project Information

This information asks for the project name and address and those people responsible for the HVAC design and compliance forms. The project name and address must match the information given on the building envelope forms. Check the box as indicated if the System Analysis Design method will be used to show compliance.

### Basic Requirements Check List

All of the boxes in this column must be filled with either a check or "X" to indicate affirmation or "N/A" to indicate that the item or issue is not applicable.

### Worksheet

If using the System Analysis Design method, the HVAC Prescriptive worksheet (H-2) does not need to be completed. Fill in the box with a check or "X" if it is included.

### Special Considerations

Fill in these boxes with a check or "X" where applicable.

## HVAC PRESCRIPTIVE WORKSHEET H-2

This worksheet provides detailed information on zone controls and economizer controls. It is not required if the System Analysis Design method is used.

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the HVAC Systems Summary (H-1) form.

### Prescriptive Requirements

Each of the requirements is organized in a similar fashion. A major check box certifies compliance with each requirement. Each one of these is followed by a series of minor check boxes that are used to identify exceptions to that requirement. All of the major check boxes must be filled in with either a check, "X," or "N/A." In addition, a check or "X" should be placed in each applicable exception box. On the line adjacent to these exception descriptions, identify the systems or equipment to which the exception applies.

## HVAC EQUIPMENT SUMMARY H-3

### Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the HVAC Equipment Summary (H-1) form.

### Equipment Efficiency Information

Each piece of HVAC equipment that has efficiency requirements under ASHRAE 90.1 should be listed here. See Code Appendix A63.20 for reprinted standards.

- System ID Number: List the system identification number or zone identification number or other descriptor.
- Unit Type and Category: List the unit type and category from the appropriate table.
- Table Number: Give the table number, Table A63.20-1 through A63.20-15 of the Code Appendix, on which the equipment and its required efficiency are listed.
- Rated Output (Btu/h): This is the unit capacity (heating or cooling as appropriate) at rated conditions. The rating conditions should match those from the reference column of the corresponding table.
- Unit Efficiency: For each unit, list the efficiency of the selected unit at rated conditions on the left and the required minimum efficiency from the corresponding table on the right. Under "Rating Units" place "EER," "IPLV," "ET," etc., as applicable.



**HVAC SYSTEMS WORKSHEET**

**H-1**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

Check here if using System Analysis Design (see Comm 63.70-72)

|                                      | Basic Requirements Checklist   | Additional Data                   |
|--------------------------------------|--|-----------------------------------|
| <b>Design</b>                        | <input type="checkbox"/> Load calculations involve the use of the minimum interior temperatures of Table Comm 64.05 for heating and Comm 63.23(2) for cooling as well as meet or exceed the minimum heating or maximum cooling outdoor design temperatures given in code. Comm 63.23(3)<br><input type="checkbox"/> Cooling pull-down/heating pick-up loads were either calculated or did not exceed 10%/30% of design load. Comm 63.23 (7)<br><input type="checkbox"/> Equipment is properly sized. Comm 63.24<br><input type="checkbox"/> Process loads are served by separate systems from comfort conditioning loads. Comm 63.25<br><input type="checkbox"/> HVAC fan and pumping system motors meet efficiency standards. Comm 63.32  | HVAC Prescriptive Worksheet (H-2) |
| <b>Controls</b>                      | <input type="checkbox"/> Temperature controls are provided as required: one for each HVAC system and individual controls for each thermal zone. Comm 63.26<br><input type="checkbox"/> Thermostatic controls meet the setpoint adjustment requirements: heating down to 55°F, cooling setpoints up to 85°F, and deadbands of 5°F minimum. Comm 63.26<br><input type="checkbox"/> Systems do not reheat, recool or mix air. Comm 63.27*<br><input type="checkbox"/> Variable volume systems have minimum stops adjusted as required. Comm 63.27*<br><input type="checkbox"/> Each system that does not need to operate continuously is provided with either automatic time or setback/setup controls. Comm 63.27 (3)<br><input type="checkbox"/> Ventilation supply systems and exhaust systems are provided with either gravity or motorized dampers as required to limit infiltration during off hours. Comm 64.19 (5)<br><input type="checkbox"/> Combustion air dampers provided per Comm 64.09 (2).<br><input type="checkbox"/> A humidistat shall be provided if a system is equipped with a means for adding moisture to maintain specific humidity levels in a zone or zones. Comm 63.28<br><input type="checkbox"/> Fan cooling systems employ air or water economizer controls. Comm 63.31*<br><input type="checkbox"/> Heat pumps with supplementary heaters have controls to prevent heater operation when heating load can be met by heat pump. Comm 63.22 |                                   |
| <b>Completion &amp; Construction</b> | <input type="checkbox"/> Pipe insulation meets the requirements of Comm Table 63.29-1. Duct insulation meets the requirements of Table 63.29-2. Comm 63.29<br><input type="checkbox"/> The plans or specifications spell out the requirements for leakage testing ductwork. Comm 64.34<br><input type="checkbox"/> Low and medium pressure supply ductwork which is located outside of the conditioned space is sealed in accordance with SMACNA Seal Class C. Comm 64.34<br><input type="checkbox"/> Complying air and water system balancing procedures are spelled out on the plans or in the specifications. Comm 64.53<br><input type="checkbox"/> Testing, adjusting and calibration of control systems is spelled out on the plans or in the specifications. Comm 64.43 and Comm 64.53<br><input type="checkbox"/> Plans or specifications require that equipment is provided with operation and maintenance manuals and system schematics. Comm 64.52  |                                   |

**Special Considerations:**     Heat recovery utilized     Continuous system operation required  
 \* If the ASHRAE 90.1 Energy Cost Budget method is used for system analysis design, these items do not have to be met prescriptively. Complete documentation must be provided.

The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)].

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**HVAC PRESCRIPTIVE WORKSHEET**

**H-2**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

**Zone Controls - Constant Volume Systems Comm 63.27**

Systems have controls which prevent simultaneous heating and cooling including: reheat, recool, mixing of heated and cooled airstreams, and simultaneous heating and cooling by separate systems within a zone.

System or Zone Number or ID

**Exceptions**

- 75% of reheat energy is from site-recovered or solar energy (provide documentation).
- System serves zones with process-driven humidity requirements.
- Multiple reheat systems serving multiple zones with controls or dual duct and multizone systems with controls to reset supply temperatures per Paragraphs (f), (g), or (n).
- Zones with a peak supply of 150 cfm or less or multizone systems with reheating or recooling limited to 5,000 cfm or 20%, whichever is less.

**Zone Controls - Variable Volume Systems Comm 63.27**

Before reheating or mixing of airstreams occur, zone controls must reduce the air supply to a minimum volume which is no greater than the largest of the following: (1) 30% of the peak supply volume, (2) the minimum required to meet ventilation requirements of Comm 64.05, or (3) 0.4 cfm/ft<sup>2</sup> of zone conditioned floor area.

System or Zone Number or ID

**Exceptions**

- There is no reheating or mixing of airstreams in these zones.
- Pressurization requirements prevent such reduction of airflow (provide documentation).
- 75% of reheat energy is from site-recovered or solar energy (provide documentation).
- System serves zones with process-driven humidity requirements.
- Zones with a peak supply of 150 cfm or less or multizone systems with reheating or recooling limited to 5,000 cfm or 20%, whichever is less.

**Economizer Controls Comm 63.31**

Fan-cooling systems are equipped with complying air or water economizers.

System Number or ID

**Exceptions**

- System capacity is less than either 2,000 cfm or 62,000 Btuh total cooling for a split system or less than 55,000 Btuh for all other types.
- Economizers would not save energy (provide documentation).
- Benefit of air economizer would be offset by increased energy use for humidity control.

**HVAC EQUIPMENT SUMMARY H-3**



|                                     |                  |         |             |
|-------------------------------------|------------------|---------|-------------|
| Transaction ID #                    | Submitter's Name |         |             |
| Owner's Name                        | Date             |         |             |
| Building Location (Number & Street) | City             | Village | Township of |

| System ID Number | Unit Type and Category From Tables A63.20-1 to 15 of Ch. 63 Appendix | Table Number | Rated Output (Btu/hr) | Unit Efficiency |       |               |
|------------------|--|--------------|-----------------------|-----------------|-------|---------------|
|                  |  |              |                       | Rating Units    | Rated | Min. Required |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |
|                  |  |              |                       |                 |       | ≥             |

Note: Where more than one requirement is made for a single piece of equipment (such as full-load and part-load ratings), provide information on subsequent lines

**A-63.05 (13)** Daylit Area is the space on the floor that is the larger of (a) or (b);

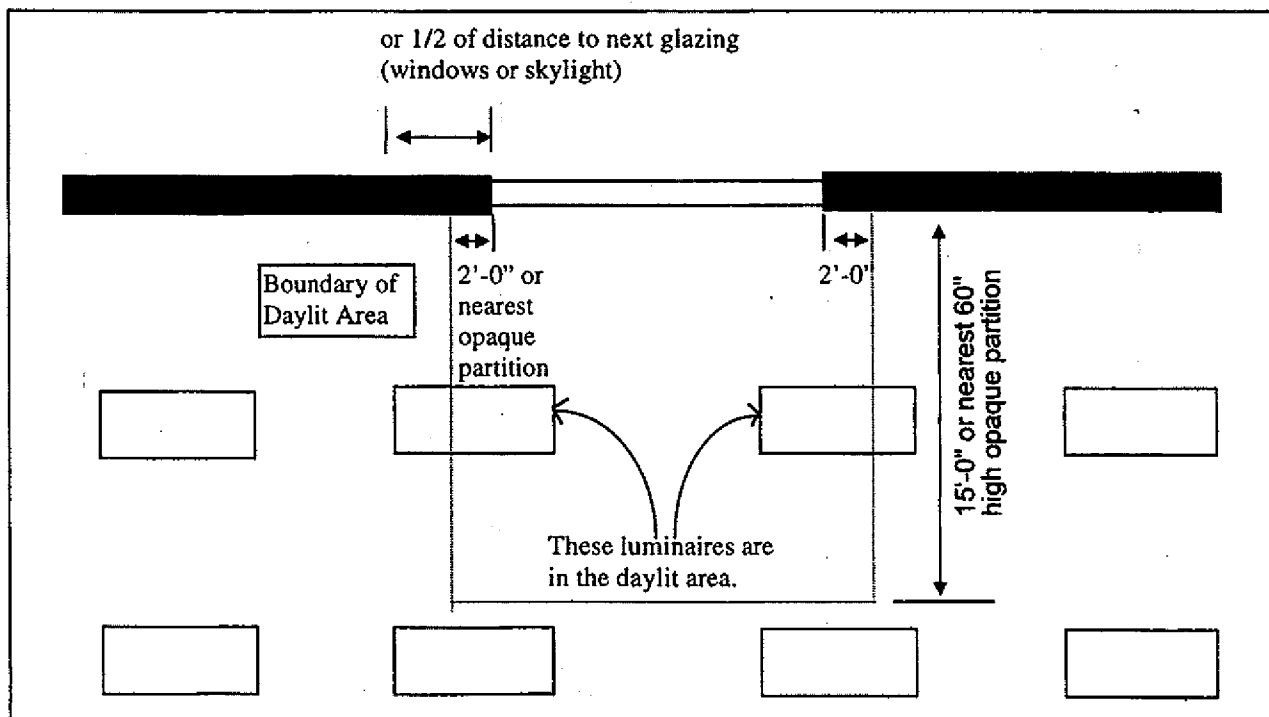
(a) 1. For areas daylit by vertical glazing, the daylit area has a length of 15 feet, or the distance on the floor, perpendicular to the glazing, to the nearest 60-inch or higher opaque partition, whichever is less; and a width of the window plus either 2 feet on each side, the distance to an opaque partition, or one-half the distance to the closest skylight or vertical glazing, whichever is least.

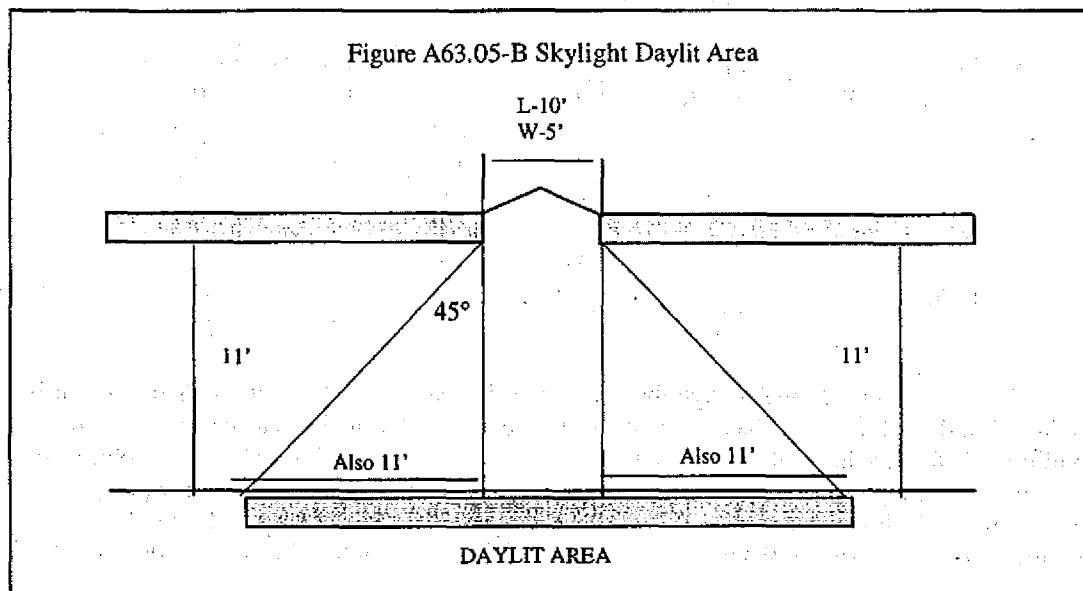
2. For areas daylit by horizontal glazing, the daylit area is the footprint of the skylight plus, in each of the lateral and longitudinal dimensions of the skylight, the lesser of the floor-to-ceiling height, the distance to the nearest 60-inch or higher opaque partition, or one-half the horizontal distance to the edge of the closest skylight or vertical glazing.

(b) The daylit area calculated using a method acceptable to the department. Such methods include DOE 2.1D and E, Superlite, Quicklite and other computer-based models that determine the daylit area based on modeling the features of the space.

Figures A63.05-A and A63.05-B illustrate the determination of daylit areas. The dimensions given in Figure A63.05-B are for demonstration only and will vary with each space.

Figure A63.05-A Window Daylit Area





A63.12 Section 8.4.8 of ASHRAE Standard 90.1 requires the following criteria to be met for exemption of skylights:

- 1) The U-value of the opaque portion of the roof must be less than the criteria given in Figure 63.15;
- 2) Automatic daylighting controls are required;
- 3) The skylight U-value must be less than 0.70 Btu/hr°F;
- 4) The skylight curb U-value must be less than 0.21 Btu/hr°F;
- 5) The air leakage must be less than 0.5 cfm/ft<sup>2</sup> of skylight;
- 6) The maximum area of the skylight will depend on the visible light transmittance and whether shading is provided for the skylight.

**Table A63.12**  
**Maximum Percent Skylight Area**

| Visible Light Transmission (VLT) | Light Level (fc) | Range of Lighting Power (W/ft <sup>2</sup> ) |           |           |           |       |
|----------------------------------|------------------|--|-----------|-----------|-----------|-------|
|                                  |                  | <1.00  | 1.01-1.50 | 1.51-2.00 | 2.01-2.50 | >2.50 |
| 0.75                             | 30               | 2.3  | 3.4       | 4.5       | 5.6       | 5.6   |
|                                  | 50               | 2.5  | 4.0       | 5.5       | 7.0       | 7.0   |
|                                  | 70               | 2.8  | 4.6       | 6.4       | 8.2       | 8.2   |
| 0.50                             | 30               | 3.6  | 5.1       | 6.6       | 8.1       | 8.1   |
|                                  | 50               | 3.9  | 6.0       | 8.1       | 10.2      | 10.2  |
|                                  | 70               | 4.2  | 6.9       | 9.6       | 12.3      | 12.3  |

The maximum allowable skylight area may be increased by 50 percent if shading devices are installed that block more than 50 percent of the solar gain during the peak cooling design condition. If this credit is taken, calculations on data must be prepared that show that solar gains are reduced by 50 percent. Exterior shading devices such as fixed louvers on opaque parapet walls will qualify if all direct solar radiation is eliminated during the peak design condition. Integral, interior or movable exterior shading devices will qualify if they cut the shading coefficient in half when closed.

This summary is provided for general information only. For exact compliance criteria, see the ASHRAE 90.1 Standard.

A63.15 (3)(b) Heat Capacity (HC) of an assembly is the amount of heat necessary to raise the temperature of all the components of a unit area in the assembly one degree F. It is calculated as the sum of the average thickness times the density times the specific heat for each component, and is expressed in Btu per square foot per degree F.

Heat capacity describes the thermal mass of an assembly. It is used in the prescriptive envelope requirements for walls and floors, where the U-value criterion is tied to the heat capacity of the assembly.

For a single layer, homogeneous wall or floor, such as poured concrete walls with no applied finish materials, heat capacity can be calculated by multiplying the weight of the wall (pounds per square foot) times the specific heat. For instance, a 6-inch concrete wall (specific heat = 0.20 Btu/lb°F) with a weight of 70 pounds per square foot would have an HC of 70 x 0.20 or 14 Btu/sf°F. The wall weight is calculated from the density (pounds per square foot); density divided by 12 and multiplied by the thickness (inches) gives the wall weight (pounds per square foot).

For assemblies made up of many layers, HC may be calculated separately for each layer and summed.

The following Table A63.15-1 lists the thermal properties of typical, thermally massive construction materials.

The heat capacity of unit masonry walls, such as those made of concrete block or brick, are too complicated to calculate by this method. Tables A63.15-2 and A63.15-3 include HC calculated for a large variety of masonry wall assemblies. These tables also give the U-value (U) and the total R-value (Rt) for the wall, including interior and exterior air films.

#### A63.15-1 Thermal Mass Properties

| Matter                        | Conductivity<br>Btu. in<br>hr.sf.°F | Density<br>(lbs/cf) | Specific Heat<br>(Btu/lb°F) |
|-------------------------------|-------------------------------------|---------------------|-----------------------------|
| Adobe                         | 0.33                                | 120                 | 0.20                        |
| Heavy Concrete                | 0.98                                | 140                 | 0.20                        |
| Lightweight Concrete          | 0.36                                | 85                  | 0.20                        |
| Gypsum                        | 0.09                                | 50                  | 0.26                        |
| Masonry Veneer                | 0.62                                | 127                 | 0.20                        |
| Masonry Infill                | 0.44                                | 120                 | 0.20                        |
| Concrete Masonry Unit         | 0.59                                | 105                 | 0.20                        |
| Grouted Concrete Masonry Unit | 1.00                                | 134                 | 0.20                        |
| Stucco                        | 0.47                                | 105                 | 0.20                        |
| Tile in Mortar                | 0.67                                | 120                 | 0.20                        |
| Solid Wood (fir)              | 0.07                                | 32                  | 0.33                        |

From: ASHRAE Handbook of Fundamentals, Table 4, Chapter 22

**Table A63.15-2 Properties of Hollow Unit  
Masonry Walls**

| Thickness/Material Type |           |                | Core Treatment |                                     |           |
|-------------------------|-----------|----------------|----------------|-------------------------------------|-----------|
|                         |           |                | Solid Grout    | Partly Grouted with UngROUTED Cells |           |
|                         |           |                |                | Empty                               | Insulated |
| 12"                     | LW CMU    | U              | 0.51           | 0.43                                | 0.30      |
|                         |           | R <sub>t</sub> | 2.0            | 2.3                                 | 3.3       |
|                         |           | HC             | 23.0           | 14.8                                | 14.8      |
|                         | MW CMU    | U              | 0.54           | 0.46                                | 0.33      |
|                         |           | R <sub>t</sub> | 1.9            | 2.2                                 | 3.0       |
|                         |           | HC             | 23.9           | 15.6                                | 15.6      |
|                         | NW CMU    | U              | 0.57           | 0.49                                | 0.36      |
|                         |           | R <sub>t</sub> | 1.8            | 2.0                                 | 2.8       |
|                         |           | HC             | 24.8           | 16.5                                | 16.5      |
| 10"                     | LW CMU    | U              | 0.55           | 0.46                                | 0.34      |
|                         |           | R <sub>t</sub> | 1.8            | 2.2                                 | 2.9       |
|                         |           | HC             | 18.9           | 12.6                                | 12.6      |
|                         | MW CMU    | U              | 0.59           | 0.49                                | 0.37      |
|                         |           | R <sub>t</sub> | 1.7            | 2.1                                 | 2.7       |
|                         |           | HC             | 19.7           | 13.4                                | 13.4      |
|                         | NW CMU    | U              | 0.62           | 0.52                                | 0.41      |
|                         |           | R <sub>t</sub> | 1.6            | 1.9                                 | 2.4       |
|                         |           | HC             | 20.5           | 14.2                                | 14.2      |
| 8"                      | LW CMU    | U              | 0.62           | 0.50                                | 0.37      |
|                         |           | R <sub>t</sub> | 1.6            | 2.0                                 | 2.7       |
|                         |           | HC             | 15.1           | 9.9                                 | 9.9       |
|                         | MW CMU    | U              | 0.65           | 0.53                                | 0.41      |
|                         |           | R <sub>t</sub> | 1.5            | 1.9                                 | 2.4       |
|                         |           | HC             | 15.7           | 10.5                                | 10.5      |
|                         | NW CMU    | U              | 0.69           | 0.56                                | 0.44      |
|                         |           | R <sub>t</sub> | 1.4            | 1.8                                 | 2.3       |
|                         |           | HC             | 16.3           | 11.1                                | 11.1      |
|                         | Clay Unit | U              | 0.57           | 0.47                                | 0.39      |
|                         |           | R <sub>t</sub> | 1.8            | 2.1                                 | 2.6       |
|                         |           | HC             | 15.1           | 11.4                                | 11.4      |
| 6"                      | LW CMU    | U              | 0.68           | 0.54                                | 0.44      |
|                         |           | R <sub>t</sub> | 1.5            | 1.9                                 | 2.3       |
|                         |           | HC             | 10.9           | 7.9                                 | 7.9       |
|                         | MW CMU    | U              | 0.72           | 0.58                                | 0.48      |
|                         |           | R <sub>t</sub> | 1.4            | 1.7                                 | 2.1       |
|                         |           | HC             | 11.4           | 8.4                                 | 8.4       |
|                         | NW CMU    | U              | 0.76           | 0.61                                | 0.52      |
|                         |           | R <sub>t</sub> | 1.3            | 1.6                                 | 1.9       |
|                         |           | HC             | 11.9           | 8.9                                 | 8.9       |
|                         | Clay Unit | U              | 0.65           | 0.52                                | 0.45      |
|                         |           | R <sub>t</sub> | 1.5            | 1.9                                 | 2.2       |
|                         |           | HC             | 11.1           | 8.6                                 | 8.6       |



**Notes:**

LW CMU is a Light Weight Concrete Masonry Unit per ASTM C 90, calculated at 105 PCF density.

MW CMU is a Medium Weight concrete Masonry Unit per ASTM C 90, calculated at 115 PCF density.

NW CMU is a Normal Weight Concrete Masonry Unit per ASTM C 90, calculated at 125 PCF density.

Clay Unit is a hollow clay unit per ASTM C 652, calculated at 130 PCF density.

Values include thermal resistance of interior air film ( $R = 0.68$ ) and exterior air film ( $R = 0.17$ ).

Calculations based on Energy Calculations and Data, CMACN, 1986.

Grouted Cells at 32" x 48" in partly grouted walls

[Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada (CMACN).]

**Table A63.15-3 Properties of Solid Unit  
Masonry and Solid Concrete Walls**

| Type                               | Layer Thickness in Inches |      |       |       |       |       |       |       |       |       |
|------------------------------------|---------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                    | 3                         | 4    | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    |
| LW CMU U<br>R <sub>t</sub><br>HC   | na                        | 0.71 | 0.64  | na    | na    | na    | na    | na    | na    | na    |
|                                    | na                        | 1.4  | 1.6   | na    | na    | na    | na    | na    | na    | na    |
|                                    | na                        | 7.00 | 8.75  | na    | na    | na    | na    | na    | na    | na    |
| MW CMU U<br>R <sub>t</sub><br>HC   | na                        | 0.76 | 0.70  | na    | na    | na    | na    | na    | na    | na    |
|                                    | na                        | 1.3  | 1.4   | na    | na    | na    | na    | na    | na    | na    |
|                                    | na                        | 7.67 | 9.58  | na    | na    | na    | na    | na    | na    | na    |
| NW CMU U<br>R <sub>t</sub><br>HC   | 0.89                      | 0.82 | 0.76  | na    | na    | na    | na    | na    | na    | na    |
|                                    | 1.1                       | 1.2  | 1.3   | na    | na    | na    | na    | na    | na    | na    |
|                                    | 6.25                      | 8.33 | 10.42 | na    | na    | na    | na    | na    | na    | na    |
| ClayUnit U<br>R <sub>t</sub><br>HC | 0.80                      | 0.72 | 0.66  | na    | na    | na    | na    | na    | na    | na    |
|                                    | 1.3                       | 1.4  | 1.5   | na    | na    | na    | na    | na    | na    | na    |
|                                    | 6.30                      | 8.40 | 10.43 | na    | na    | na    | na    | na    | na    | na    |
| Concrete U<br>R <sub>t</sub><br>HC | 0.96                      | 0.91 | 0.86  | 0.82  | 0.78  | 0.74  | 0.71  | 0.68  | 0.65  | 0.63  |
|                                    | 1.0                       | 1.1  | 1.2   | 1.2   | 1.3   | 1.4   | 1.4   | 1.5   | 1.5   | 1.6   |
|                                    | 7.20                      | 9.60 | 12.00 | 14.40 | 16.80 | 19.20 | 21.60 | 24.00 | 26.40 | 28.80 |

Notes:

LW CMU is a Light Weight Concrete Masonry Unit per ASTM C 90 or 55, calculated at 105 PCF density.

MW CMU is a Medium Weight concrete Masonry Unit per ASTM C 90 or 55, calculated at 115 PCF density.

NW CMU is a Normal Weight Concrete Masonry Unit per ASTM C 90 or 55, calculated at 125 PCF density.

Clay Brick is a clay unit per ASTM C 62, calculated at 130 PCF density.

Concrete is structural poured or precast concrete, calculated at 144 PCF density.

Calculations based on Energy Calculations and Data, CMAACN, 1986.

Values include thermal resistance of interior air film (R = 0.68) and exterior air film (R = 0.17).

[Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada (CMAACN).]

## A-63.18 (2)(a) 3.

Default U-Values for Wood and Steel Swinging Doors Btu/(h-ft<sup>2</sup>-°F) - Part I

| Nominal Thickness (Inches)      | Description  | No. Storm Door | Wood Storm Door <sup>c</sup> | Metal Storm Door <sup>d</sup> |
|---------------------------------|--|----------------|------------------------------|-------------------------------|
| <b>Wood Doors<sup>a,b</sup></b> |  |                |                              |                               |
| 1 3/8                           | Panel door with 7/16" panels <sup>e</sup>  | 0.57           | 0.33                         | 0.37                          |
| 1 3/8                           | Hollow-core flush door   | 0.47           | 0.30                         | 0.32                          |
| 1 3/8                           | Solid-core flush door  | 0.39           | 0.26                         | 0.28                          |
| 1 3/4                           | Panel door with 7/16" panels <sup>e</sup>  | 0.54           | 0.32                         | 0.36                          |
| 1 3/4                           | Hollow-core flush door   | 0.46           | 0.29                         | 0.32                          |
| 1 3/4                           | Panel door with 1 1/8" panels <sup>e</sup>   | 0.39           | 0.26                         | 0.28                          |
| 1 3/4                           | Solid-core flush door  | 0.33           | 0.25                         | 0.28                          |
| 2 1/4                           | Solid-core flush door  | 0.27           | 0.20                         | 0.21                          |
| <b>Steel Doors<sup>b</sup></b>  |  |                |                              |                               |
| 1 3/4                           | Fiberglass or mineral wool core with steel stiffeners, no thermal break <sup>f</sup>       | 0.60           | na                           | na                            |
| 1 3/4                           | Paper honeycomb core without thermal break <sup>f</sup>                                    | 0.56           | na                           | na                            |
| 1 3/4                           | Solid urethane foam core without thermal break <sup>f</sup>                                | 0.40           | na                           | na                            |
| 1 3/4                           | Solid fire-rated mineral fiberboard core without thermal break <sup>f</sup>                | 0.38           | na                           | na                            |
| 1 3/4                           | Polystyrene core without thermal break (18 gage Commercial steel) <sup>f</sup>             | 0.35           | na                           | na                            |
| 1 3/4                           | Polyurethane core without thermal break (18 gage Commercial steel) <sup>f</sup>            | 0.29           | na                           | na                            |
| 1 3/4                           | Polyurethane core without thermal break (24 gage Commercial steel) <sup>f</sup>            | 0.29           | na                           | na                            |
| 1 3/4                           | Polyurethane core with thermal break and perimeter (24 gage Commercial steel) <sup>f</sup> | 0.20           | na                           | na                            |
| 1 3/4                           | Solid urethane foam core with thermal break <sup>a</sup>                                   | 0.19           | 0.16                         | 0.17                          |

Note: All U-Values for exterior doors in this table are for doors with no glazing, except for the storm doors which are in addition to the main exterior door. Any glazing area in exterior doors shall be included with the appropriate glass type and analyzed as fenestration. Interpolation and moderate extrapolation are permitted for door thicknesses other than those specified. In order to take credit for a thermal break, the door must have a thermal break in both the door slab and the frame.

<sup>a</sup> Values are based on a nominal 32" by 80" door size with no glazing.

<sup>b</sup> U-values include the thermal resistance of air films. Outside air-conditions: 15 mph wind speed, 0°F air temperature; inside air conditions: natural convection, 70°F air temperature.

<sup>c</sup> Values for wood storm door are for approximately 50% glass area.

<sup>d</sup> Values for metal storm door are for any percent glass area.

<sup>e</sup> 55% panel area.

<sup>f</sup> ASTM C 236 hotbox data on a nominal 3' x 7' door size with no glazing.

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**Default U-Values for Sliding and Roll-Up Doors Btu/h-ft<sup>2</sup>-°F) - Part II**

| Door Description   | Overall U-Factor                                |
|--|---|
| Uninsulated, single-layer  | 1.15  |
| Nominal 2" thick with 1 3/4" polyurethane foam core and vinyl thermal breaks and section joint seals   | 0.14  |
| Nominal 3" thick with 2 7/8" expanded polystyrene core and continuous vinyl extrusion to form a thermal break and weather-tight seal along section joint | 0.12  |
| Other doors  | Use value from most similar swinging door above |

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Note: See s. Comm 51.06 for thermal barrier requirements for foam plastic insulation.

A63.20 Tables A63.20-1 through 10 specify the ASHRAE 90.1-1989 efficiency standards for equipment not covered by federal efficiency standards, but are covered by s. Comm 63.20.

**Table A63.20-1**  
**Standard Rating Conditions and Minimum Performance,**  
**Unitary Air Conditioners and Heat Pumps**  
**--Air-Cooled, Electrically Operated, <135,000 Btu/h Cooling Capacity--**  
**Except Packaged Terminal and Room Air Conditioners**

| Reference Standards <sup>a</sup>  | Category  | Sub-Category & Rating Condition<br>(Outdoor Temp. °F) | Minimum Performance <sup>c</sup> |
|---|---|---|----------------------------------|
| ARI 210/240-89  | <65,000 Btu/h<br>Cooling Capacity<br>Cooling Mode <sup>b</sup>                  | <u>Seasonal Rating</u><br>Split System                | 10.0 SEER                        |
|   |   | Single Package  | 9.7 SEER                         |
|   | ≥65,000 and <135,000<br>Btu/h<br>Cooling Mode                                   | Standard Rating (95°F db)                             | 8.9 EER                          |
|   |   | Integrated Part Load Value (80°F db)                  | 8.3 IPLV                         |
| <65,000 Btu/h<br>Cooling Capacity<br>Heating Mode (Heat<br>Pump) <sup>b</sup> | <u>Seasonal Rating</u><br>Split System  | 6.8 HSPF  |                                  |
|   | Single Package  | 6.6 HSPF  |                                  |
| ≥65,000 and <135,000<br>Btu/h Cooling Capacity<br>Heating Mode                | <u>Split System &amp; Single Package</u><br>High Temp. Rating (47°F db/43°F wb) | 3.0 COP   |                                  |
|   | Low Temp. Rating (17°F db/15°F wb)  | 2.0 COP   |                                  |

<sup>a</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>b</sup> Exception: the following equipment is not covered by s. Comm 63.20, but is covered by the National Appliance Energy Conservation Act (NAECA) of 1987 (Public Law 100-12): central air conditioners other than packaged terminal air conditioners which are powered by single phase electric current, air cooled, rated below 65,000 Btu per hour, not contained within the same cabinet as a furnace, the rated capacity of which is above 225,000 Btu per hour, and is a heat pump or a cooling unit only; and Heat pumps other than packaged terminal heat pumps which consist of one or more assemblies, powered by single-phase electric current, rated below 65,000 Btu per hour, utilizing an indoor conditioning coil, compressor, and refrigerant-to-outdoor air heat exchanger to provide air heating, and may also provide air cooling, dehumidifying, humidifying circulating, and air cleaning.

<sup>c</sup> COP = Coefficient of Performance, EER = Energy Efficiency Ratio, IPLV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-2

**Standard Rating Conditions and Minimum Performance, Unitary Air Conditioners and Heat Pumps--Evaporatively Cooled, Electrically Operated, Cooling Mode <135,000 Btu/h Cooling Capacity--Except Packaged Terminal and Room Air Conditioners**

| Reference Standards <sup>a</sup> | Category                       | Rating Condition °F                                 |               | Minimum Performance <sup>b</sup> |
|----------------------------------|--------------------------------|---|---------------|----------------------------------|
|                                  |                                | Indoor Temp.  | Outdoor Temp. |                                  |
| ARI 210/240-89                   | <65,000 Btu/h Cooling Capacity | <u>Standard Rating</u><br>95°F db/75°F wb           |               | 9.3 EER                          |
|                                  |                                | <u>Integrated Part Load Value (80°F db/67°F wb)</u> |               | 8.5 IPLV                         |
| CTI 201 (86)                     | <65,000 Btu/h                  | <u>Standard Rating</u><br>95°F db/75°F wb           |               | 10.5 EER                         |
|                                  | ≥65,000 but <135,000 Btu/h     | <u>Standard Rating</u><br>95°F db/75°F wb           |               | 10.5 EER                         |
|                                  | ≥65,000 but <135,000 Btu/h     | <u>Integrated Part Load Value (80°F db/67°F wb)</u> |               | 9.7 IPLV                         |

<sup>a</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>b</sup> EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-3

**Standard Rating Conditions and Minimum Performance, Water-Cooled Air Conditioners and Heat Pumps -- Electrically Operated and Cooling Mode <135,000 Btu/h Cooling Capacity**

| Reference Standards <sup>a</sup>  | Category                                    | Rating Condition °F                     |                      | Minimum Performance <sup>b</sup> |
|---|---|---|----------------------|----------------------------------|
|   |   | Indoor Air Temp.                        | Entering Water Temp. |                                  |
| Water-Source Heat Pump  | <65,000 Btu/h Cooling Capacity              | <u>Standard Rating</u><br>85            |                      | 9.3 EER                          |
|   |   | <u>Low Temperature Rating</u><br>75     |                      | 10.2 EER                         |
| ARI 320-86<br>CTI 201 (86)  | ≥65,000 but <135,000 Btu/h Cooling Capacity | <u>Standard Rating</u><br>85            |                      | 10.5 EER                         |
| Groundwater Source Heat Pumps<br>ARI 325-85                             | <135,000 Btu/h Cooling Capacity             | <u>Standard Rating</u><br>70            |                      | 11.0 EER                         |
|   |   | <u>Low Temperature Rating</u><br>50     |                      | 11.5 EER                         |
| Water-Cooled Unitary Air Conditioners<br>ARI 210/240-89<br>CTI 201 (86) | <65,000 Btu/h Cooling Capacity              | <u>Standard Rating</u><br>85            |                      | 9.3 EER                          |
|   |   | <u>Integrated Part Load Value</u><br>75 |                      | 8.3 IPLV                         |
|   | ≥65,000 <135,000 Btu/h Cooling Capacity     | <u>Standard Rating</u><br>85            |                      | 10.5 EER                         |

<sup>a</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>b</sup> EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

**Table A63.20-4**  
**Standard Rating Conditions and Minimum Performance, Packaged Terminal Air**  
**Conditioners and Heat Pumps--Air-Cooled, Electrically Operated<sup>a</sup>**

| Reference Standards <sup>c</sup> | Category<br>PTACs & PTAC<br>Heat Pumps | Sub-Category & Rating Conditions<br>(Outdoor Temp. °F) | Efficiency<br>Rating | Minimum<br>Performance <sup>b</sup> |
|----------------------------------|--|--|----------------------|-------------------------------------|
| ARI 310-90                       | Cooling Mode                           | Standard Rating (95°F db)                              | EER                  | 10.0 - (0.16 x<br>Cap./1000)        |
|                                  |  | Low Temp. Rating (82°F db)                             | EER                  | 12.2 - (0.20 x<br>Cap./1000)        |
| ARI 380-90                       | Heating Mode                           | Standard Rating (47°F db/43°F wb)                      | COP                  | 2.9 - (0.026 x<br>Cap./1000)        |

<sup>a</sup> For multicapacity equipment, the minimum performance shall apply to each capacity step provided. Multicapacity refers to manufacturer published ratings for more than one capacity mode allowed by the product's controls.

<sup>b</sup> Cap. means the rated cooling capacity of the product in Btu/h in accordance with the cited ARI Standard. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation. COP = Coefficient of Performance, EER = Energy Efficiency Ratio. See reference documents for detailed definitions.

<sup>c</sup> For detailed references, see ASHRAE Standard 90.1.

**Table A63.20-5**  
**Standard Rating Conditions and Minimum Performance,**  
**Water-Source and Groundwater-Source Heat Pumps**  
**--Electrically Operated, <135,000 Btu/h Cooling Capacity**

| Reference Standards <sup>c</sup>                         | Rating Condition °F <sup>a</sup>                               | Minimum<br>Performance <sup>d</sup> |
|--|--|-------------------------------------|
| Water-Source<br>Heat Pumps<br>ARI 320-86<br>CTI 201-(86) | <u>Standard Rating</u><br>70°F Entering Water <sup>b</sup>     | 3.8 COP                             |
| Groundwater-Source<br>Heat Pumps<br>ARI 325-85           | 1. High Temperature Rating<br>70°F Entering Water <sup>b</sup> | 3.4 COP                             |
|  | 2. Low Temperature Rating<br>50°F Entering Water <sup>b</sup>  | 3.0 COP                             |

<sup>a</sup> Air entering indoor section 70°F db/60°F wb (max.)

<sup>b</sup> Water flow rate per manufacturer's specifications.

<sup>c</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>d</sup> COP = Coefficient of Performance. See reference documents for detailed definitions.

**Table A63.20-6**  
**Standard Rating Conditions and Minimum Performance,**  
**Large Unitary Air Conditioners and Heat Pumps--**  
**Electrically Operated >135,000 Btu/h Cooling Capacity**

| Category<br>Reference Standards <sup>c</sup>  | Efficiency Rating <sup>d</sup> | Minimum Performance    |                        |
|---|--------------------------------|------------------------|------------------------|
|   |                                | ≤760,000 Btu/h:<br>8.5 | >760,000 Btu/h:<br>8.2 |
| Air Conditioners <sup>a</sup><br>Air Cooled<br>ARI 360-86                             | EER                            |                        |                        |
|   | IPLV                           | 7.5                    |                        |
| Air Conditioners <sup>a</sup><br>Water/Evaporatively Cooled<br>ARI 360-86 CTI 201-86  | EER                            | 9.6                    |                        |
|   | IPLV                           | 9.0                    |                        |
| Heat Pumps <sup>a</sup><br><br>Air Cooled-Cooling<br>Air Cooled-Heating<br>ARI 340-86 | EER                            | <760,000 Btu/h:<br>8.5 | ≥760,000 Btu/h:<br>8.2 |
|   | IPLV                           | 7.5                    |                        |
|   | COP (47°F)                     | 2.9                    |                        |
|   | COP (17°F)                     | 2.0                    |                        |
| Condensing Units <sup>b</sup><br>Air Cooled ARI 365-87                                | EER                            | 9.9                    |                        |
|   | IPLV                           | 11.0                   |                        |
| Condensing Units <sup>b</sup><br>Water/Evaporatively Cooled<br>ARI 365-87 CTI 201-86  | EER                            | 12.9                   |                        |
|   | IPLV                           | 12.9                   |                        |

<sup>a</sup> For units that have a heating section, deduct 0.2 from all required EERs and IPLVs

<sup>b</sup> Condensing unit requirements are based on single-number ratings defined in paragraph 5.1.3.2 of ARI Standard 365.

<sup>c</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>d</sup> COP = Coefficient of Performance, EER = Energy Efficiency Ratio, IPLV = Integrated Part Load Value. See reference documents for detailed definitions.



**Table A63.20-7**  
**Standard Rating Conditions and Minimum Performance,**  
**Water Chilling Packages -- Water and Air Cooled and Electrically Operated**

| Reference Standards <sup>b</sup> | Category                     | Efficiency Rating <sup>c</sup> | Minimum Performance |
|----------------------------------|------------------------------|--------------------------------|---------------------|
| ARI 550-90                       | Water-Cooled                 |                                |                     |
|                                  | ≥300 Tons                    | COP                            | 5.2 <sup>a</sup>    |
|                                  |                              | IPLV                           | 5.3 <sup>a</sup>    |
|                                  | ≥150 Tons but <300 Tons      | COP                            | 4.2                 |
|                                  |                              | IPLV                           | 4.5                 |
|                                  | <150 Tons                    | COP                            | 3.8                 |
| IPLV                             |                              | 3.9                            |                     |
| ARI 590-86                       | Air-Cooled With Condenser    |                                |                     |
| CTI 201-86                       | ≥150 Tons                    | COP                            | 2.5                 |
|                                  |                              | IPLV                           | 2.5                 |
| <150 Tons                        | COP                          | 2.7                            |                     |
|                                  | IPLV                         | 2.8                            |                     |
|                                  | Air-Cooled Without Condenser |                                |                     |
|                                  | All Capacities               | COP                            | 3.1                 |
|                                  |                              | IPLV                           | 3.2                 |

<sup>a</sup> Where R-22, or CFC refrigerants with ozone depletion factors less than or equal to those for R-22 is used, these requirements are reduced to 4.7 COP and 4.8 IPLV.

<sup>b</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>c</sup> COP = Coefficient of Performance, EER = Energy Efficiency Ratio, IPLV = Integrated Part Load Value. See reference documents for detailed definitions.

**Table A63.20-8**  
**Standard Rating Conditions and Minimum Performance,**  
**Gas- and Oil-Fired Boilers**

| Reference <sup>b</sup>   | Category                                  | Rating Condition                                    | Minimum Performance <sup>c</sup> |
|--|---|---|----------------------------------|
| ANSI Z21.13-87<br>H.I. Htg. Boiler Std. 86<br>ASME PTC 4.1-64<br>U.L. 795-73 | Gas-Fired<br>≥300,000 Btu/h               | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>c</sub> 80%               |
|  |   | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>c</sub> 80%               |
| U.L. 726-90<br>H.I. Htg. Boiler Std. 86<br>ASME PTC 4.1-64                   | Oil-Fired<br>≥300,000 Btu/h               | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>c</sub> 83%               |
|  |   | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>c</sub> 83%               |
| H.I. Htg. Boiler Std. 86<br>ASME PTC 4.1-64                                  | Oil-Fired<br>(Residual)<br>≥300,000 Btu/h | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>c</sub> 83%               |
|  |   | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>c</sub> 83%               |

<sup>a</sup> Provided and allowed by the controls.

<sup>b</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>c</sup>E<sub>c</sub> = Combustion efficiency, 100%-flue losses.

**Table A63.20-9**  
**Standard Rating Conditions and Minimum Performance,**  
**Warm Air Furnaces and Combination Warm Air**  
**Furnaces/Air Conditioning Units**

| Reference <sup>b</sup> | Category                                 | Rating Condition                                    | Minimum Performance <sup>c</sup> |
|------------------------|--|---|----------------------------------|
| ANSI Z21.47-90         | Gas-Fired<br>≥225,000 Btu/h              | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 80%               |
|                        |  | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 78%               |
| U.L. 727-86            | Oil-Fired <sup>d</sup><br>≥225,000 Btu/h | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 81%               |
|                        |  | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 81%               |

<sup>a</sup> Provided and allowed by the controls.

<sup>b</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>c</sup>E<sub>t</sub> = Thermal efficiency, 100%-flue losses. See referenced document for detailed definition.

**Table A63.20-10  
Warm Air Duct Furnaces and Unit Heaters**

| Reference <sup>b</sup> | Category                   | Rating Condition                                    | Minimum Performance <sup>c</sup> |
|------------------------|----------------------------|---|----------------------------------|
| ANSI Z83.9-90          | Duct Furnaces<br>Gas-Fired | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 78%               |
|                        |                            | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 75%               |
| ANSI Z83.8-90          | Unit Heaters<br>Gas-Fired  | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 78%               |
|                        |                            | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 74%               |
| U.L. 731-88            | Unit Heaters<br>Oil-Fired  | 1. Max. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 81%               |
|                        |                            | 2. Min. Rated Capacity <sup>a</sup><br>Steady-State | E <sub>t</sub> 81%               |

<sup>a</sup> Provided and allowed by the controls.

<sup>b</sup> For detailed references, see ASHRAE Standard 90.1.

<sup>c</sup>E<sub>t</sub> = Thermal efficiency, 100%-flue losses. See reference document for detailed definition.

Equipment efficiencies for the following appliances are established under federal Department of Energy rules 10 cfr Part 430 - Energy Conservation Program for Consumer Products and are not contained in this code:

Central air conditioners other than packaged terminal air conditioners which are powered by single phase electric current, air cooled, rated below 65,000 Btu per hour, not contained within the same cabinet as a furnace, the rated capacity of which is above 225,000 Btu per hour, and is a heat pump or a cooling unit only.

Furnaces which utilize only single-phase electric current, or single-phase electric current or DC current in conjunction with natural gas, propane, or home heating oil, and which comply with the following:

- (a) Are designed to be the principal heating sources for the living space of a residence;
- (b) Are not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu per hour;
- (c) Are electric central furnaces, electric boilers, forced-air central furnaces; gravity central furnaces, or low pressure steam or hot water boilers, and
- (d) Have a heat input rate of less than 300,000 Btu per hour for electric boilers and low pressure steam or hot water boilers and less than 225,000 Btu per hour for forced-air central furnaces, gravity central furnaces, and electric central furnaces, gravity central furnaces, and electric central furnaces.

Heat pumps other than packaged terminal heat pumps which consist of one or more assemblies, powered by single-phase electric current, rated below 65,000 Btu per hour, utilizing an indoor conditioning coil, compressor, and refrigerant-to-outdoor air heat exchanger to provide air heating, and may also provide air cooling, dehumidifying, humidifying circulating, and air cleaning.

Direct heating equipment which is self-contained, and provides heat directly to the space proximate to the heater by gravity or fan circulation without duct connections.

The Department of Energy rules, section 430.31, requires the following efficiencies for heating and cooling equipment and water heaters.

**Table A63.20-11**  
**Room Air Conditioners**

| Product Class |   | Energy Efficiency Ratio |
|---------------|---|-------------------------|
| 1.            | Without reverse cycle and with louvered sides less than 6,000 Btu     | 8.0                     |
| 2.            | Without reverse cycle and with louvered sides 6,000 to 7,999 Btu      | 8.5                     |
| 3.            | Without reverse cycle and with louvered sides 8,000 to 13,999 Btu     | 9.0                     |
| 4.            | Without reverse cycle and with louvered sides 14,000 to 19,999 Btu    | 8.8                     |
| 5.            | Without reverse cycle and with louvered sides 20,000 and more Btu     | 8.2                     |
| 6.            | Without reverse cycle and without louvered sides less than 6,000 Btu  | 8.0                     |
| 7.            | Without reverse cycle and without louvered sides 6,000 to 7,999 Btu   | 8.5                     |
| 8.            | Without reverse cycle and without louvered sides 8,000 to 13,999 Btu  | 8.5                     |
| 9.            | Without reverse cycle and without louvered sides 14,000 to 19,999 Btu | 8.5                     |
| 10.           | Without reverse cycle and without louvered sides 20,000 and more Btu  | 8.2                     |
| 11.           | With reverse cycle and with louvered sides                            | 8.5                     |
| 12.           | With reverse cycle and without louvered sides                         | 8.0                     |

**Table A63.20-12**  
**Central Air Conditioners and**  
**Central Heat Pumps**

| Product Class             | Seasonal Energy Efficiency Ratio | Heating Seasonal Performance Factor |
|---------------------------|----------------------------------|-------------------------------------|
| 1. Split systems          | 10.0                             | 6.8                                 |
| 2. Single package systems | 9.7                              | 6.6                                 |

**Table A63.20-13**  
**Water Heaters**

| Product Class            | Energy Factor   |
|--------------------------|---|
| 1. Gas water heater      | $0.62 - (.0019 \times \text{rated storage volume in gallons})$  |
| 2. Oil water heater      | $0.59 - (.0019 \times \text{rated storage volume in gallons})$  |
| 3. Electric water heater | $0.93 - (.00132 \times \text{rated volume storage in gallons})$ |

Note: Rated storage volume = the water storage capacity of a water heater, in gallons, as specified by the manufacturer.

**Table A63.20-14**  
**Furnaces**

| Product Class  | AFUE <sup>1</sup><br>(percent) |
|--|--------------------------------|
| 1. Furnaces (excluding classes noted below) (percent)  | 78                             |
| 2. Mobile home furnaces (percent)  | 75                             |
| 3. Small furnaces (other than furnaces designed solely for installation in mobile homes) having an input rate of less than 45,000 Btu/hr |                                |
| (A) Weatherized (outdoor)  | 78                             |
| (B) Nonweatherized (indoor)  | 78                             |
| 4. Boilers (excluding gas steam) (percent)   | 80                             |
| 5. Gas steam boilers (percent)   | 75                             |

<sup>1</sup> Annual Fuel Utilization Efficiency, as determined in s. 430.22 (n)(2) of the DOE rules.

**Table A63.20-15**  
**Direct Heating Equipment**

| Product Class  | Annual Fuel Utilization<br>Efficiency<br>(percent) |
|--|--|
| 1. Gas wall fan type up to 42,000 Btu/hour                             | 73   |
| 2. Gas wall fan type over 42,000 Btu/hour                              | 74   |
| 3. Gas wall gravity type up to 10,000 Btu/hour                         | 59   |
| 4. Gas wall gravity type over 10,000 Btu/hour up to<br>12,000 Btu/hour | 60   |
| 5. Gas wall gravity type over 12,000 Btu/hour up to<br>15,000 Btu/hour | 61   |
| 6. Gas wall gravity type over 15,000 Btu/hour up to<br>19,000 Btu/hour | 62   |
| 7. Gas wall gravity type over 19,000 Btu/hour up to<br>27,000 Btu/hour | 63   |
| 8. Gas wall gravity type over 27,000 Btu/hour up to<br>46,000 Btu/hour | 64   |
| 9. Gas wall gravity type over 46,000 Btu/hour                          | 65   |
| 10. Gas floor up to 37,000 Btu/hour                                    | 56   |
| 11. Gas floor over 37,000 Btu/hour                                     | 57   |
| 12. Gas room up to 18,000 Btu/hour                                     | 57   |
| 13. Gas room over 18,000 Btu/hour up to 20,000 Btu/hour                | 58   |
| 14. Gas room over 20,000 Btu/hour up to 27,000 Btu/hour                | 63   |
| 15. Gas room over 27,000 Btu/hour up to 46,000 Btu/hour                | 64   |
| 16. Gas room over 46,000 Btu/hour                                      | 65   |

**A-63.29 ALTERNATIVE HVAC PIPING INSULATION TYPES.** Insulation thicknesses in Table 63.29-1 are based on insulation with thermal conductivities within the range listed in Table 63.29-1 for each fluid operating temperature range, rated in accordance with ASTM C335-84 at the mean temperature listed in the table. For insulation that has a conductivity outside the range shown in Table 63.29-1 for the applicable fluid operating temperature range at the mean rating temperature shown (when rounded to the nearest 0.01 Btu in./ $(h \text{ } ^\circ\text{F ft}^2)$ ), the minimum thicknesses shall be determined in accordance with the equation given below:

$$T = PR[(1 + t/PR)^{K/k} - 1]$$

where:

T = minimum insulation thickness for material with conductivity K, in.

PR = pipe actual outside radius, in.

t = insulation thickness from Table 63.29-1 in.

K = conductivity of alternate material at the mean rating temperature indicated in Table 63.29-1 for the applicable fluid temperature range, Btu in./ $(h \text{ ft}^2 \text{ } ^\circ\text{F})$

k = the lower value of the conductivity range listed in Table 63.29-1 for the applicable fluid temperature range, Btu in./ $(h \text{ ft}^2 \text{ } ^\circ\text{F})$



**Table A63.45-1**  
**Typical Lighting Power for Magnetically Ballasted Fluorescent Lamp-Ballast Systems (watts)**

|                                | 4 Lamps<br>2 Ballasts                           |          | 3 Lamps<br>2 Ballasts |          | 3 Lamps<br>Tandem-Wired<br>Ballasts |          | 2 Lamps<br>1 Ballast |          |
|--------------------------------|---|----------|-----------------------|----------|-------------------------------------|----------|----------------------|----------|
|                                | ANSI  | Enclosed | ANSI                  | Enclosed | ANSI                                | Enclosed | ANSI                 | Enclosed |
|                                | <b>Standard Magnetic Energy Saving Ballasts</b> |          |                       |          |                                     |          |                      |          |
| 31-watt FB31T8                 |   |          | 105                   | 97       | 104                                 | 96       | 69                   | 64       |
| 32-watt F32T8                  | 140   | 129      | 106                   | 98       | 105                                 | 97       | 70                   | 65       |
| 34-watt F40T12/ES              | 144   | 137      | 112                   | 107      | 108                                 | 103      | 72                   | 68       |
| 40-watt F40T12                 | 176   | 160      | 134                   | 121      | 129                                 | 117      | 88                   | 80       |
| 40-watt FB40T12                |   |          | 134                   | 121      | 129                                 | 117      | 86                   | 78       |
| 40-watt F40T5 Twin Tube        |   |          | 130                   | 120      |                                     |          | 86                   | 79       |
| 60-watt F96T12/ES Slimline     |   |          |                       |          |                                     |          | 123                  |          |
| 75-watt F96T12 Slimline        |   |          |                       |          |                                     |          | 158                  |          |
| 95-watt F96T12/High Output/ES  |   |          |                       |          |                                     |          | 199                  |          |
| 110-watt F96T12/High Output/ES |   |          |                       |          |                                     |          | 237                  |          |

Notes: Data listed are for standard energy efficient magnetic ballasts.

Values listed for 3-lamp systems with 2 magnetic ballasts have 1 single-lamp ballast and 1 double-lamp ballast.

**Table A63.45-2**  
**Typical Lighting Power for Electronically Ballasted Rapid-Start Fluorescent Lamp-Ballast Systems**

| Lamp/Ballast<br>Combination | 4 Lamps<br>1 Ballast    |          | 3 Lamps<br>1 Ballast |          | 2 Lamps<br>1 Ballast |          | 1 Lamp<br>1 Ballast |          |
|-----------------------------|-------------------------|----------|----------------------|----------|----------------------|----------|---------------------|----------|
|                             | ANSI                    | Enclosed | ANSI                 | Enclosed | ANSI                 | Enclosed | ANSI                | Enclosed |
|                             | <b>265 mA T-8 Lamps</b> |          |                      |          |                      |          |                     |          |
| 17-watt F17T8               |                         |          |                      |          | 34                   | 33       | 16                  | 15       |
| 25-watt F25T8               |                         |          | 66                   | 63       | 46                   | 44       | 23                  | 22       |
| 32-watt F32T8               | 120                     | 116      | 90                   | 87       | 61                   | 59       | 31                  | 30       |
| 40-watt F40T8               |                         |          | 108                  |          | 73                   | 71       | 39                  |          |
| <b>T-12 and T-10 Lamps</b>  |                         |          |                      |          |                      |          |                     |          |
| 25-watt F30T12/ES           |                         |          | 77                   |          | 49                   | 47       | 27                  | 25       |
| 30-watt F30T12              |                         |          | 87                   |          | 59                   | 57       | 32                  | 30       |
| 34-watt F40T12/ES           | 117                     |          | 90                   | 87       | 62                   | 60       | 31                  | 30       |
| 40-watt F40T10              |                         |          | 109                  | 106      | 73                   | 71       | 39                  | 38       |
| 40-watt F40F12              | 140                     |          | 106                  | 103      | 72                   | 70       | 38                  | 36       |
| 40-watt FB40T12             |                         |          | 100                  | 93       | 67                   | 62       |                     |          |
| 85-watt F72T12 High Output  |                         |          |                      |          | 164                  |          | 82                  |          |
| 95-watt F96T12/HO/ES        |                         |          |                      |          | 170                  |          |                     |          |
| 110-watt F96T12/HO          |                         |          |                      |          | 201                  |          |                     |          |
| <b>Twin Tube Biax Lamps</b> |                         |          |                      |          |                      |          |                     |          |
| 36-watt FT36T5 Twin Tube    |                         |          | 106                  |          | 72                   |          | 37                  |          |
| 39-watt FT39T5 Twin Tube    |                         |          | 104                  |          | 70                   |          | 37                  |          |
| 40-watt FT40T5 Twin Tube    |                         |          |                      | 69       | 67                   |          | 37                  |          |
| 50-watt FT50T5 Twin Tube    |                         |          | 125                  |          | 106                  |          | 54                  |          |

Notes: Data listed represents averages of rapid-start products available in 1994 from established manufacturers of electronic ballasts.

Actual input wattages for these system may be tuned by using specific products and will differ from these values.

Systems shown have minimum 0.85 ballast factor.

ANSI values listed for fluorescent systems assume open air operation of lamps where there is no solid lens between the lamp and the lighted space. Open suspended fixtures and heat extract type recessed troffers will have similar input values.

Input wattage values for enclosed lamps are generally less than they are under ANSI conditions. It is important to note that while input wattage is reduced in enclosed fixtures, so is light output.

**Table A63.45-3**  
**Typical Lighting Power for Electronically Ballasted Instant-Start Fluorescent Lamp-Ballast Systems**  
**(watts)**

| Lamp/Ballast<br>Combination | 4 Lamps<br>1 Ballast |          | 3 Lamps<br>1 Ballast |          | 2 Lamps<br>1 Ballast |          | 1 Lamp<br>1 Ballast |          |
|-----------------------------|----------------------|----------|----------------------|----------|----------------------|----------|---------------------|----------|
|                             | ANSI                 | Enclosed | ANSI                 | Enclosed | ANSI                 | Enclosed | ANSI                | Enclosed |
| <b>265 mA T-8 Lamps</b>     |                      |          |                      |          |                      |          |                     |          |
| 17-watt F17T8               | 62                   | 60       | 50                   | 49       | 34                   | 32       | 18                  | 17       |
| 25-watt F25T8               | 87                   | 85       | 68                   | 67       | 48                   | 46       | 28                  | 27       |
| 31-watt FB31T8              |                      |          | 88                   | 79       | 61                   | 55       | 31                  | 30       |
| 32-watt F32T8               | 110                  | 104      | 89                   | 88       | 61                   | 57       | 33                  | 31       |
| 36-watt F36T8               | 150                  |          | 112                  |          |                      | 78       |                     |          |
| 55-watt F96T8               |                      |          |                      |          |                      | 110      |                     |          |
| <b>T-12 Slimline Lamps</b>  |                      |          |                      |          |                      |          |                     |          |
| 55-watt F72T12              |                      |          |                      |          | 109                  |          |                     |          |
| 60-watt F96T12 Slimline/ES  |                      |          |                      |          | 110                  |          | 72                  |          |
| 75-watt F96T12 Slimline     |                      |          |                      |          | 135                  |          | 85                  |          |
| <b>Twin Tube Biax Lamps</b> |                      |          |                      |          |                      |          |                     |          |
| 39-watt FT39T5              |                      |          |                      |          | 64                   |          | 42                  |          |
| 40-watt FT40T5              |                      |          | 103                  |          | 72                   |          | 43                  |          |
| 55-watt FT55T5 Twin Tube    |                      |          |                      |          |                      | 115      |                     |          |

Notes: Data listed represents averages of rapid-start products available in 1994 from established manufacturers of electronic ballasts. Actual input wattages for these system may be tuned by using specific products and will differ from these values. Systems shown have minimum 0.85 ballast factor.

**Table A63.45-4**  
**Typical Lighting Power for Electronically Ballasted Low-Wattage Reduced-Output**  
**Fluorescent Lamp-Ballast Systems (watts)**

| Lamp/Ballast<br>Combination | 4 Lamps       |                   | 3 Lamps       |                   | 2 Lamps       |                   | 1 Lamp        |                   |
|-----------------------------|---------------|-------------------|---------------|-------------------|---------------|-------------------|---------------|-------------------|
|                             | 1 Ballast     |                   | 1 Ballast     |                   | 1 Ballast     |                   | 1 Ballast     |                   |
|                             | ANSI<br>Watts | Ballast<br>Factor | ANSI<br>Watts | Ballast<br>Factor | ANSI<br>Watts | Ballast<br>Factor | ANSI<br>Watts | Ballast<br>Factor |
| 17-watt F17T8               | 54(RS)        | 0.77              |               |                   | 27(RS)        | 0.77              | 14(RS)        | 0.77              |
| 25-watt F25T8               | 80(IS)        | 0.82              |               |                   | 41(RS)        | 0.77              | 21(RS)        | 0.77              |
|                             | 79(RS)        | 0.77              |               |                   |               |                   |               |                   |
| 32-watt F32T8               | 99(IS)        | 0.79              | 79(IS)        | 0.82              | 54(IS)        | 0.82              | 28(RS)        | 0.77              |
|                             | 101(RS)       | 0.77              | 78(RS)        | 0.75              | 55(RS)        | 0.79              |               |                   |
| 34-watt F40T12/ES           | 117           | 0.83              | 85            | 0.83              | 61            | 0.83              | 31            | 0.82              |
| 39-watt F39T5 Twin Tube     |               |                   | 73(IS)        | 0.63              | 52(IS)        | 0.64              |               |                   |
| 40-watt F40T5 Twin Tube     |               |                   |               |                   | 60(RS)        | 0.7               |               |                   |
| 40-watt F40T8               |               |                   | 69(IS)        | 0.8               | 66(IS)        | 0.82              |               |                   |
|                             |               |                   |               |                   | 69(RS)        | 0.80              |               |                   |
| 40-watt F40T12              |               |                   | 85            | 0                 | 61            | 0.73              | 57            |                   |
| 40-watt F40T10              |               |                   |               |                   | 72            | 0.84              | 37            | 0.84              |
| 59-watt F96T8               |               |                   |               |                   | 105           | 0.83              |               |                   |
| 85-watt F72T12/HO           |               |                   |               |                   | 160           | 0.80              |               |                   |
| 110-watt F96T12             |               |                   |               |                   |               | 190               | 0.8           |                   |

Notes: All systems with ballast factor of <0.85

RS = rapid start operation

IS = instant start operation

Ballast factor listed is typical for the average input wattage given for all available products. Note that reducing the ballast factor decreases light output in addition to reducing input wattage.

**Table 63.45-5  
Typical Lighting Power for Compact Fluorescent Lamps**

| Lamp Type            | Ballast Type                  | Input Watts |
|----------------------|-------------------------------|-------------|
| 5-watt Twin Tube     | Reactor preheat               | 9           |
| 7-watt Twin Tube     | Reactor preheat               | 11          |
| 9-watt Twin Tube     | Reactor preheat               | 13          |
| 13-watt Twin Tube    | Reactor preheat               | 17          |
| 9-watt Quad Tube     | Reactor preheat               | 13          |
| 13-watt Quad Tube    | Reactor preheat               | 17          |
| 10-watt Quad Tube    | Autotransformer preheat       | 16          |
|                      | Reactor preheat               | 13          |
| 13-watt Quad Tube    | Autotransformer preheat       | 18          |
|                      | Reactor preheat               | 16          |
| 15-watt Quad Tube    | Reactor preheat               | 20          |
| 18-watt Quad Tube    | Autotransformer preheat       | 25          |
|                      | Reactor preheat               | 22          |
| 18-20-watt Twin Tube | 370 mA preheat or rapid start | 22          |
| 18-watt Twin Tube    | 270 MA rapid start            | 23          |
|                      | 265 mA electronic IS          | 17          |
| 20-watt Quad Tube    | Reactor preheat               | 27          |
| 24-27-watt Twin Tube | 340 mA rapid start            | 32          |
|                      | 265 mA electronic IS          | 21          |
| 26-watt Quad Tube    | Autotransformer preheat       | 37          |
|                      | Reactor preheat HPF           | 33          |
|                      | Electronic HPF                | 23          |
| 27-watt Quad Tube    | Reactor preheat               | 34          |

**Table A63.45-6  
Typical Lighting Power for High-Intensity Discharge Lamps**

| Lamp Watts                        | Ballast Watts | Fixture Input Watts |
|-----------------------------------|---------------|---------------------|
| <b>Mercury Vapor Lamps</b>        |               |                     |
| 75                                | 15            | 90                  |
| 100                               | 18            | 118                 |
| 175                               | 25            | 200                 |
| 250                               | 35            | 285                 |
| 400                               | 50            | 450                 |
| 1,000                             | 75            | 1,075               |
| <b>Metal Halide Lamps</b>         |               |                     |
| 32                                | 6             | 38                  |
| 50                                | 13            | 63                  |
| 70                                | 18            | 88                  |
| 100                               | 25            | 125                 |
| 175                               | 35            | 210                 |
| 250                               | 42            | 292                 |
| 400                               | 55            | 455                 |
| 1,000                             | 70            | 1,070               |
| <b>High Pressure Sodium Lamps</b> |               |                     |
| 35                                | 8             | 43                  |
| 50                                | 13            | 63                  |
| 70                                | 18            | 88                  |
| 100                               | 30            | 130                 |
| 150                               | 38            | 188                 |
| 250                               | 50            | 300                 |
| 400                               | 65            | 465                 |
| 1,000                             | 90            | 1,090               |

Notes: Source: Pacific Gas & Electric

Figures listed represent average values taken from Osram-Sylvania, Philips, and General Electric lamp catalogs.

**A-64.20 EQUIPMENT RATINGS AND SAFETY CONTROLS.** The department recognizes the following reference standards for the testing and installation of heating and ventilating equipment:

- (1) American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018:
  - (a) GAS WATER HEATERS, Vol. I, ANSI Z21.10.1
  - (b) GAS WATER HEATERS, Vol. III, ANSI Z21.10.3
  - (c) GAS-FIRED ROOM HEATERS, Vol. I, ANSI Z21.11.1;
  - (d) GAS-FIRED LOW PRESSURE STEAM AND HOT WATER BOILERS, ANSI Z21.13;
  - (e) GAS UNIT HEATERS, ANSI Z21.16;
  - (f) DOMESTIC GAS CONVERSION BURNERS, ANSI Z21.17;
  - (g) GAS APPLIANCE PRESSURE REGULATORS, ANSI Z21.18;
  - (h) AUTOMATIC GAS IGNITION SYSTEMS AND COMPONENTS, ANSI Z21.20;
  - (i) AUTOMATIC GAS VALVES, ANSI Z21.21;
  - (j) RELIEF VALVES AND AUTOMATIC GAS SHUTOFF DEVICES FOR HOT WATER SYSTEMS, ANSZ21.22;
  - (k) GAS APPLIANCE THERMOSTATS, ANSI Z21.23;
  - (l) GAS-FIRED DUCT FURNACES, ANSI Z21.34;
  - (m) GAS FILTERS ON APPLIANCES, ANSI Z21.35;
  - (n) GAS-FIRED GRAVITY AND FAN TYPE DIRECT VENT WALL FURNACES, ANSI Z21.44;
  - (o) GAS-FIRED GRAVITY AND FORCED AIR CENTRAL FURNACES, ANSI Z21.47;
  - (p) GAS-FIRED GRAVITY AND FAN TYPE FLOOR FURNACES, ANSI Z21.48;
  - (q) GAS-FIRED GRAVITY AND FAN TYPE VENTED WALL FURNACES, ANSI Z21.49;
  - (r) VENTED DECORATIVE GAS APPLIANCES, ANSI Z21.50;
  - (s) GAS-FIRED SINGLE FIREBOX BOILERS, ANSI Z21.52;
  - (t) GAS-FIRED HIGH PRESSURE STEAM AND HOT WATER BOILERS (Inputs not over 400,000 Btu/hour), ANSI Z21.59;
  - (u) DECORATIVE GAS APPLIANCES FOR INSTALLATION IN VENTED FIREPLACES, ANSZ21.60;
  - (v) DIRECT VENT CENTRAL FURNACES, ANSI Z21.64;
  - (w) DIRECT GAS-FIRED MAKE-UP AIR HEATERS, ANSI Z83.4;
  - (x) GAS-FIRED HEAVY DUTY FORCED AIR HEATERS, ANSI Z83.5;
  - (y) GAS-FIRED INFRARED HEATERS, ANSI Z83.6;
  - (z) GAS UNIT HEATERS, ANSI Z83.8;
  - (aa) GAS-FIRED DUCT FURNACES, ANSI Z83.9;
  - (bb) DIRECT GAS-FIRED DOOR HEATERS, ANSI 283.17; and
  - (cc) DIRECT GAS-FIRED INDUSTRIAL AIR HEATERS, ANSI Z83.18.
- (2) Canadian Standards Association, Certification Division, Rexdale, Ontario Canada, M9W 1R3;
  - (a) Solid-Fuel Fired Appliances for Residential Use, CSAB 366M.
- (3) Energy Testing Laboratory of Maine, South Maine Vocational Technical Institute, South Portland, Maine 04106.
  - (a) Testing for Safety—Requirements and Test Procedures for Solid-Fuel Burning Central Heating Appliances and Combination Oil- and Solid-Fuel Burning Central Heating Appliances, ETLM Standard #78-1.
- (4) International Conference of Building Officials, Inc., 5360 South Workman Mill Road, Whittier, California 90601:
  - (a) Research Committee Acceptance Criteria for Fireplace Heat Exchangers.
- (5) Underwriters' Laboratories, Inc., 333 Pfingsten Road, Northbrook, Illinois 60062:
  - (a) CHIMNEYS, FACTORY-BUILT, RESIDENTIAL TYPE AND BUILDING HEATING APPLIANCES, UL 103;
  - (b) FACTORY BUILT FIREPLACES, UL 127;
  - (c) OIL BURNERS, UL 296;
  - (d) CONTROLS, PRIMARY SAFETY FOR GAS- AND OIL-FIRED APPLIANCES, UL 372;
  - (e) SOLID-FUEL FIRED CENTRAL FURNACES, UL 391;
  - (f) GAS VENTS, UL 441;

- (g) HEATING APPLIANCES, ELECTRIC, UL 499;
- (h) HEAT PUMPS, UL 559;
- (i) TYPE L LOW-TEMPERATURE VENTING SYSTEMS, UL 641;
- (j) OIL-FIRED BOILER ASSEMBLIES, UL 726;
- (k) OIL-FIRED CENTRAL FURNACES, UL 727;
- (l) OIL-FIRED FLOOR FURNACES, UL 729;
- (m) OIL-FIRED WALL FURNACES, UL 730;
- (n) OIL-FIRED UNIT HEATERS, UL 731;
- (o) HEATERS, AIR AND DIRECT-FIRED HEATERS, OIL-FIRED, UL 733;
- (p) FIREPLACE STOVES, UL 737;
- (q) COMMERCIAL-INDUSTRIAL GAS HEATING EQUIPMENT (Inputs over 400,000 Btu/hour), UL 795;
- (r) HEATERS, ELECTRIC, FOR USE IN HAZARDOUS LOCATIONS; Class I, Groups A, B, C and D, and Class II, Groups E, F and G, UL 823;
- (s) ELECTRIC BOILERS, UL 834;
- (t) HEATERS, ELECTRIC DRY BATH, UL 875;
- (u) FAN COIL UNITS AND ROOM FAN HEATER UNITS, UL 883;
- (v) OIL-BURNING STOVES, UL 896;
- (w) HEATERS, ELECTRIC AIR, UL 1025;
- (x) HEATING EQUIPMENT, ELECTRIC BASEBOARD, UL 1042;
- (y) HEATING EQUIPMENT, ELECTRIC CENTRAL AIR, UL 1096; and
- (z) ROOM HEATERS, SOLID-FUEL TYPE, UL 1482.

The table on the following page is a tabular summary of UL 296 and UL 795.e.

TABULAR SUMMARY UL STANDARD 296 AND UL STANDARD 795

| FUNCTION/BURNER INPUTS                    | OIL BURNERS UL 296            |                             |                             |                        | COMMERCIAL/INDUSTRIAL GAS UL 795 |                             |                              |                       |                       |
|---|-------------------------------|-----------------------------|-----------------------------|------------------------|----------------------------------|-----------------------------|------------------------------|-----------------------|-----------------------|
|   | 3 GPH                         | 7 GPH                       | 20 GPH                      | Over 20 GPH            | Mechanical Draft Burners         |                             |                              |                       | ATM Draft             |
|   | 400,000 Btu or less           | 1 million Btu or less       | 3 million Btu or less       | 3 million Btu          | Over 400,000 to 2,500,000        | Over 2,500,000 to 5,000,000 | Over 5,000,000 to 12,500,000 | Over 12,500,000       |                       |
| Prefurge timing                           | --                            | --                          | --                          | --                     | 6                                | 4                           | 4                            | 4                     | 90 sec <sup>3</sup>   |
| Air changes                               | --                            | --                          | --                          | --                     | 4                                | 4                           | 4                            | 4                     | --                    |
| Interlock Controls (Recycle)              | Yes                           | Yes                         | Yes                         | Yes                    | Yes                              | Yes                         | Yes                          | Yes                   | Yes                   |
| Proven combustion air                     | 8                             | 8                           | 8                           | 8                      | Yes                              | Yes                         | Yes                          | Yes                   | --                    |
| Valve seal overtravel <sup>9</sup>        | --                            | --                          | --                          | --                     | --                               | Optional                    | Yes                          | Yes                   | 13                    |
| Low gas pressure                          | --                            | --                          | --                          | --                     | --                               | Yes <sup>20</sup>           | Yes <sup>20</sup>            | Yes <sup>20</sup>     | 13                    |
| High gas pressure                         | --                            | --                          | --                          | --                     | --                               | Yes <sup>20</sup>           | Yes <sup>20</sup>            | Yes <sup>20</sup>     | 13                    |
| Low fire start                            | 11                            | 11                          | 11                          | 11                     | 11                               | 11                          | 11                           | 11                    | 13                    |
| High limit (press. or temp.)              | Yes                           | Yes                         | Yes                         | Yes                    | Yes                              | Yes                         | Yes                          | Yes                   | Yes                   |
| Low water cutoff                          | Boilers <sup>21</sup>         | Boilers <sup>21</sup>       | Boilers <sup>21</sup>       | Boilers <sup>21</sup>  | Boilers                          | Boilers                     | Boilers                      | Boilers               | 13                    |
| Pilot - Intermittent                      | Optional                      | Optional                    | Optional                    | --                     | Optional                         | Optional                    | Optional                     | Optional              | 12                    |
| Pilot - Interrupted                       | 19                            | 19                          | 19                          | Yes <sup>5</sup>       | Optional                         | Optional <sup>2</sup>       | Optional <sup>2</sup>        | Optional <sup>2</sup> | 2, 10                 |
| Direct spark ignition                     | Yes                           | Yes                         | Yes                         | 5                      | --                               | --                          | --                           | --                    | --                    |
| System & sequence approved safety control | Yes                           | Yes                         | Yes                         | Yes                    | Yes                              | Yes                         | Yes                          | Yes                   | Yes                   |
| Approved safety shutoff valves (SSOV)     | IN                            | BURNER                      | DESIGN                      | --                     | Yes <sup>14</sup>                | Yes <sup>14</sup>           | Yes <sup>14</sup>            | Yes <sup>14</sup>     | Yes <sup>13, 14</sup> |
| No vent valve                             | --                            | --                          | --                          | --                     | --                               | --                          | --                           | Yes                   | 13                    |
| Pilot valve                               | 18                            | 18                          | 18                          | Yes                    | Yes <sup>5</sup>                 | Yes                         | Yes                          | Yes                   | Yes                   |
| Proved pilot                              | Optional                      | Optional                    | Optional                    | Yes                    | Yes                              | Yes                         | Yes                          | Yes                   | Yes                   |
| Trial for pilot                           | 17                            | 17                          | 17                          | 15 sec                 | 15 sec                           | 10 sec                      | 10 sec                       | 10 sec                | 13                    |
| Trial for main flame                      | 90 sec <sup>2, 17</sup>       | 30 sec <sup>2, 17</sup>     | 15 sec <sup>2, 17</sup>     | 10/30 sec <sup>7</sup> | 15 sec <sup>22</sup>             | 10 sec                      | 10 sec                       | 10 sec                | 13                    |
| Flame failure response time               | 90 sec <sup>17</sup>          | 4 sec max <sup>15, 17</sup> | 4 sec max <sup>15, 17</sup> | 4 sec max              | 4 sec max                        | 4 sec max                   | 4 sec max                    | 2 sec max             | 13                    |
| Valve closing time (max.)                 | 23                            | 23                          | 23                          | 23                     | 5 sec max                        | 1 sec max                   | 1 sec max                    | 1 sec max             | 13                    |
| Supervise main flame                      | 17                            | 17                          | 17                          | Yes                    | --                               | Yes <sup>2</sup>            | Yes <sup>2</sup>             | Yes <sup>2</sup>      | 2, 10                 |
| Action on flame failure                   | Recycle optional <sup>1</sup> | 1                           | 1                           | Lockout or recycle     | Lockout or recycle <sup>6</sup>  | Lockout                     | Lockout                      | Lockout               | 13                    |
| Action on limit open                      | Close SSOV                    | Close SSOV                  | Close SSOV                  | Close SSOV             | Close SSOV                       | Close SSOV                  | Close SSOV                   | Close SSOV            | 13                    |

See following page for footnotes.



**FOOTNOTES TO TABULAR SUMMARY UL STANDARD 296 AND UL STANDARD 795:**

SSOV=Safety shutoff valve

<sup>1</sup>May relight if ignition is re-energized within 0.8 sec. See 15 and 16.

<sup>2</sup>Where intermittent pilot is desired, it is allowable to switch from pilot detector to main flame detector if main flame detector responds to main flame only.

<sup>3</sup>Without shutters, no prepurge required.

<sup>4</sup>Options (whichever is chosen, a minimum of 4 air changes must be provided):

- 30 sec at high fire rate; OR
- 60 sec at 1/2 high fire rate; OR
- 90 sec at 1/3 high fire rate.

<sup>5</sup>With 2-stage lightoff, direct ignition is permitted if first stage is 20 gph or less (requirements for 20 gph or less apply). Pilot is required if igniting more than 20 gph.

<sup>6</sup>Lockout on interrupted pilot applications; recycle on intermittent pilot applications.

<sup>7</sup>10 sec for distillate fuel (No. 1 or No. 2); 30 sec for residual fuel (No. 4, 5, 6).

<sup>8</sup>Conventional type pressure burner—none needed. Needed for applications with combustion air supply separate from oil supply.

<sup>9</sup>Valve seal overtravel switch can be wired into either the start circuit or pre-ignition interlock circuit (if provided).

<sup>10</sup>Interrupted pilot over 2.5 million Btuh if modulating or high/low firing rate. Otherwise over 5 million Btuh.

<sup>11</sup>If low fire start is not proved, UL will test for smooth lightoff at high fire.

<sup>12</sup>Intermittent up to 5 million Btuh unless firing rate control is over 2,500,000 Btuh.

<sup>13</sup>Requirements same as mechanical draft burners.

<sup>14</sup>See Table 1 at end of footnotes for main gas valves.

<sup>15</sup>Up to 15 sec is permitted if intermittent ignition is employed, or if the ignition system is re-energized in not more than 0.8 sec after flame is extinguished.

<sup>16</sup>Up to 30 sec is permitted if intermittent ignition is employed, or if the ignition system is re-energized in not more than 0.8 sec after flame is extinguished.

<sup>17</sup>If proved pilot igniter is used, timings for over 20 gal flame safeguard control may be applied.

<sup>18</sup>Required for electrically ignited, gas-piloted systems.

<sup>19</sup>Interrupted pilot may be required if using flame safeguard control with a proved pilot. Otherwise, interrupted pilot is optional.

<sup>21</sup>Safety shutdown by this limit can be accomplished either by manual reset limits or in the programmer limit circuit.

<sup>21</sup>Required on boilers fired by oil burners—not a requirement of UL 296.

<sup>22</sup>If intermittent pilot is used, no main burner flame-establishing period is required.

<sup>23</sup>If a separate oil valve is used, it must close within 5 sec max when de-energized

**TABLE 1—AUTOMATIC MAIN GAS SAFETY SHUT-OFF VALVES (SSOV) FOR MECHANICAL OR ATMOSPHERIC BURNERS—UL 795 REQUIREMENTS, EFFECTIVE OCTOBER 1, 1974**

|                        | 400,000 to<br>2,500,000 BTUH   | Over 2,500,000 to<br>5,000,000 BTUH  | Over 5,000,000 to<br>12,500,000 BTUH   | Over 12,500,000<br>BTUH  |
|------------------------|--|--|--|--|
| Main Valve Requirement | One valve rated for safety shutoff services(SSOV). Closing time 5 sec. | Two SSOV's in series, or one SSOV of the type incorporating a valve seal overtravel interlock. Closing time 1 sec max. | Two SSOV's in series, one of which incorporates a valve seal overtravel interlock. Closing time 1 sec max. | Two SSOV's in series, one of which incorporates a valve seal overtravel interlock. When fuel gas has specific gravity of less than 1.0, include a N.O. 3/4 inch or larger electrically operated valve in a vent line between the two SSOV's. |

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