

**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.

**A-50.10 to 50.25 FORMS.** The forms on the following 10 pages (SBD-2; SBD-8, SBD-8A and SB-8-B; SBD-118; SBD-198; SBD-224; SBD-5686; and SBD-9720) are referred to in ss. ILHR 50.18, 50.25, 50.12, 50.14, 50.18, 50.12 and 50.10, respectively. Copies of these forms are

available from the Division of Safety and Buildings, P.O. Box 7969, Madison, Wisconsin 53707.

**A-50.21 CERTIFIED MUNICIPALITIES.** The following municipalities have been certified by the department to review plans and conduct inspections under s. ILHR 50.21. These lists are current as of the date of printing this code. Additions and deletions may occur during the effective period of this code. For information regarding the current status of a municipality, call 608-267-7586.

**FIRST CLASS CITIES**

Milwaukee

**COUNTIES**

Eau Claire

**CITIES**

Antigo	Glendale	Middleton	Stevens Point
Appleton	Green Bay	Muskego	Sun Prairie
Augusta	Greenfield	Neenah	Superior
Beloit	Janesville	New Berlin	Two Rivers
Brookfield	Kaukauna	New Richmond	Waukesha
Burlington	Kenosha	Oak Creek	Waupun
Cudahy	La Crosse	Oconomowoc	Wausau
Delafield	Lake Geneva	Oshkosh	Wauwatosa
Eau Claire	Madison	Racine	West Allis
Fond du Lac	Manitowoc	Rhineland	West Bend
Fort Atkinson	Marshfield	Seymour	Wisconsin
Franklin	Mequon	Sheboygan	Rapids

**VILLAGES**

Clinton	Grafton	Johnson Creek	Sussex
Dousman	Hartland	Plover	Walworth
Elm Grove	Hortonville	Shicton	Waterford
Fall Creek			

**TOWNS**

Bloomfield (Walworth)	Grand Rapids (Wood)	Plover (Portage)
Delavan (Walworth)	Hull (Portage)	Sugar Creek (Walworth)
Geneva (Walworth)	LaGrange (Walworth)	Waterford (Racine)
Grand Chute (Outagamie)	Norway (Racine)	Waukesha (Waukesha)

Wisconsin Department of Industry,  
Labor & Human Relations

**INSPECTION REPORT AND ORDERS**

Safety and Buildings Division  
P.O. Box 7969, Madison, WI 53707

An inspection of the occupancy shown below discloses violations of orders of the Dept. of Industry, Labor and Human Relations promulgated under authority of Chapter 101, Wis. Stats. SEE REVERSE SIDE FOR APPLICABLE WISCONSIN STATUTES. Report when orders are completed. Avoid delay. Forfeiture for unresolved violations are \$10.00 to \$100.00 each day for each violation. Keep the Department informed.

"Failure of an employer to reasonably enforce compliance by employees with such statute or order of the Department shall constitute failure by the employer to comply with such statute or order." (s. 102.57, Wis. Stats.)

Inspection Date	Plan/Report Number	File Number	Page
		Inspection Type	
		Located At (number and street address)	
		City	County
		Violations Explained To	
		Compliance Date	

Note	Item	Orders and Requirements	✓ Done	X Not Done
		<b>SAMPLE</b>		

Deputy Name	Deputy's Office Hours and Telephone Number
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SBD-2 (R. 09/90)

Wisconsin Department of Industry,  
Labor and Human Relations

**PETITION FOR VARIANCE  
APPLICATION**

Safety and Buildings Division  
P.O. Box 7969  
Madison, Wisconsin 53707  
(608) 266-1542

Please type or print.

OFFICE USE ONLY	Amount Paid	Receipt Number	Petition No.	Exemption
Owner/Petitioner's Name	Building Or Project		Agent, Architect or Engineering Firm	
Company	Tenant's Name, if Any		Street Address	
Street Address	Location - Street Address		City, State, Zip Code	
City, State, Zip Code	City, County		Telephone Number (    )	
Telephone Number	Plan Number, if Known		Contact Person's Name	

1. The rule being petitioned reads as follows (cite specific rule number and language; one rule per application):

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2. The rule being petitioned cannot be entirely satisfied because:

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**SAMPLE**

3. The following alternative(s) and supporting information are proposed as a means of providing an equivalent degree of health, safety or welfare as addressed by the rule:

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Note: Please attach any pictures, plans, sketches or required position statements.

**VERIFICATION BY OWNER - PETITION IS VALID ONLY IF NOTARIZED WITH AFFIXED SEAL AND ACCOMPANIED BY REVIEW FEE**  
See Section ILHR 2.52 for complete fee information

Note: Petitioner must be the owner of the building or project. Tenants, agents, designers, contractors, attorneys, etc., shall not sign petition unless Power of Attorney is submitted with the Petition For Variance Application

\_\_\_\_\_, being duly sworn, I state as petitioner that I have read the foregoing petition and I believe it is true and that I have significant ownership rights to the subject building or project.

Petitioner's Signature:	Subscribed And Sworn To Before Me This Date:	Notary Public	My Commission Expires On:
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Wisconsin Department of Industry,  
Labor and Human Relations

## POSITION STATEMENT

Safety and Buildings Division  
P.O. Box 7969  
Madison, Wisconsin 53707

**Instructions:** This form is to be completed by the fire department chief or designee and sent promptly to the address shown above. Please print or type all responses.

Owner's Name	Building Occupancy Or Facility Description	Agent, Architect or Engineering Firm
Company	Tenant's Name, If Any	Street Address
Street Address	Location - Street Address	City, State, Zip Code
City, State, Zip Code	City, County	Telephone Number ( )
Telephone Number	Plan Number, If Known	Contact Person's Name

1. I have read the application for variance of rule ILHR \_\_\_\_\_
2. I recommend (check appropriate box):  Approval  Conditional Approval  Denial  No Comment \*
3. Explanation For Recommendation:

SAMPLE

\* If desired, Fire Departments may indicate "No Comment" on non-fire safety issues such as sanitation, energy conservation, barrier free environments, etc.

4.  I find no conflict with local rules and regulations.  
 I find the petition is in conflict with local rules and regulations.

Explanation:

Fire Department Name And Address:

Name Of Fire Chief Or Designee (type or print):

Telephone Number

Signature Of Fire Chief Or Designee:

Date Signed:

**POSITION STATEMENT**  
To Be Completed By:  
Dept. of H&SS  
Division of Health  
SB-8-B (R. 10/84)

Wisconsin Department of Industry, Labor and Human Relations  
**DIVISION OF SAFETY & BUILDINGS**  
P.O. Box 7969, Madison, Wi. 53707

Name of Owner of Building		Title			
Street		City	State	Zip	Phone No.
Building Identification		Street & No. (Bldg Location)		City & County	
Architect or Engineer		Street & No.		City & State	
1. I have read the Petition for Modification of Rule: IND.					
2. I recommend (check appropriate box)		Denial	Approval	Conditional Approval	No Comment
3. Our files or inspection indicate that this building is <input type="checkbox"/> fire-resistive-type 1 or 2 (see Ind. 51.03(1) or (2)). is not <input type="checkbox"/>					
4. Explanation for Recommendation: NOTE - If the answer to Item 3 is NO, and your recommendation is approval, an explanation is required.					
<b>SAMPLE</b>					
5. <input type="checkbox"/> I find no conflict with H & SS Rules and Regulations <input type="checkbox"/> I find that the petition is in conflict with H & SS Rules and Regulations as set forth below EXPLANATION:					
Signature and Title					Date

Please complete and submit PROMPTLY to  
DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS  
at the address shown above.

BUILDING/STRUCTURE/HVAC PLANS APPROVAL APPLICATION

- Complete Both Sides -

Wisconsin Department of Industry, Labor & Human Relations Safety & Buildings Division Bureau of Buildings & Structures

Scheduling Information - complete when calling to schedule review:

E-File \_\_\_\_\_ Plan No. \_\_\_\_\_

INSTRUCTIONS: Fill in all applicable data. Caution: Failure to complete the form entirely may cause additional delay. Submittal of this Plans Approval Application is required for each building. Submit this form with at least 4 sets of plans which include details and data as required by ILHR 50.12. Plans may be submitted to any of the plan review offices listed on the reverse side. Projects are scheduled for review. Please call the selected office prior to submittal. Any components submitted independently from the building plans must be submitted to the office which did the project's initial review.

1. Owner Information 2. Project Information 3. Building or Structure Designer Information 4. Building History 5. Construction Class Requested 6. HVAC Designer Information 7. Building Information 8. Submittal Request 9. Supervising Professional Information 10. Related Business Systems - Please call the respective Program for clarification and plan submittal requirements.

SAMPLE

12. Calculation of Fees

Area: The area of a floor is the area bounded by the exterior surface of the building walls or the outside face of columns where there is no wall. Area includes all floor levels such as subbasements, basements, ground floors, mezzanines, balconies, lofts, all stories and all roofed areas including porches and garages, except for cantilevered canopies on the building wall. Use the roof area for free standing canopies. Total area is the summation of all floor areas.

Attach a separate sheet if necessary for the calculations below:

Floor Level (specify)	Length	X	Width	=	Area
_____	_____	X	_____	=	_____
_____	_____	X	_____	=	_____
_____	_____	X	_____	=	_____
_____	_____	X	_____	=	_____
_____	_____	X	_____	=	_____
			<b>Total Area</b>	<b>=</b>	_____

- Project NOT located in certified municipality (go to Fee Schedule Table 2.31-1).
- Project located in certified municipality (go to Fee Schedule Table 2.31-2).  
(See Fee Schedule for list of certified municipalities.)

<input type="checkbox"/> Building and HVAC	Fee	\$	_____
<input type="checkbox"/> Building Only	Fee	\$	_____
<input type="checkbox"/> HVAC Only	Fee	\$	_____
<input type="checkbox"/> Revision To Previously Approved Plan	Fee	\$	_____
<input type="checkbox"/> Permission To Start	Fee	\$	_____
<input type="checkbox"/> Pre-July 1992 Building Components	Fee	\$	_____
<input type="checkbox"/> Other	Fee	\$	_____
<b>Total Fee</b>		<b>=</b>	<b>\$</b> _____

SAMPLE

13. OWNER'S STATEMENT (ILHR 50.11): I request that plans be reviewed for compliance with the code requirements set forth in Chapters ILHR 50-64 of the rules of the department. I recognize that I am responsible for compliance with all code requirements and any conditions of plan approval. If this building exceeds 50,000 cubic feet in total volume, I will retain a supervising professional as required by ILHR 50.10 throughout construction to project completion and the filing of a Compliance Statement by the supervising professional prior to occupancy.

Owner's Signature: \_\_\_\_\_ Original Name & Title \_\_\_\_\_ Print

14. DESIGNER'S STATEMENT: DESIGN (ILHR 50.07-50.09) if this building, following construction of this project, contains more than 50,000 cubic feet in total volume, plans are required to be prepared, signed, sealed and dated by a Wisconsin registered engineer or architect (ILHR 50.07(2)). Signatures and seals shall be original.

The department expects, and requires, that the project designer review individual component submittals for compliance with the general design concept. The project designer, and department, will rely on the seal of the component designers for compliance with the codes as they apply to their designs.

Total cubic foot volume of the building upon completion of this project:  Less Than 50,000  50,000 or Greater

Design loads have been indicated on the plans. \_\_\_\_\_  Yes  N/A  
 Firewall schematic plan has been included. \_\_\_\_\_  Yes  N/A  
 All applicable items required by ILHR 50.12 have been included. \_\_\_\_\_  Yes  N/A

I certify that the submitted plans were prepared under my supervision, are accurate, and to the best of my knowledge comply with the applicable codes of the Department of Industry, Labor and Human Relations.

Original Signature of Building Designer ( Building Submittal )	Date Signed	Original Signature of HVAC Designer	Date Signed
Original Signature of Building Designer ( Component Submittal )	Date Signed	Name of Component Fabricator	

15. SUPERVISING PROFESSIONAL'S STATEMENT: (ILHR 50.10) I have been retained by the owner as the supervising professional per ILHR 50.10 for the performance or supervision of reasonable on-the-site observations to determine if the construction is in substantial compliance with the approved plans and specifications. Upon completion of construction, I will file a written statement with the department certifying that, to the best of my knowledge and belief, construction has or has not been performed in substantial compliance with the approved plans and specifications.

Original Signature of Professional Supervising The Building	Date Signed	Original Signature of Professional Supervising The HVAC	Date Signed
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Hayward Office  
209 W. 1st Street  
Rt 8, Box 8072  
Hayward, WI 54843  
Phone (715) 634-4870  
Fax (715) 634-5150

La Crosse Office  
2226 Rose Street  
La Crosse, WI 54603  
Phone (608) 785-9334  
Fax (608) 785-9330

Madison Office  
201 E. Washington Ave.  
P.O. Box 7969  
Madison, WI 53707  
Phone (608) 266-8735  
Fax (608) 267-9566

Shawano Office  
1340 E. Green Bay Street  
Shawano, WI 54166  
Phone (715) 524-3626  
Fax (715) 524-3633

Waukesha Office  
401 Pilot Court, Suite C  
Waukesha, WI 53188  
Phone (414) 548-8600  
Fax (414) 548-8614

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

Wisconsin Department of Industry,  
Labor and Human Relations

**PERMISSION TO START CONSTRUCTION**

Safety and Buildings Division

**NOTE: This permission is applicable only to projects  
having below grade foundation work.**

**Additional fees are required. Contact one of the locations listed below for more information.**

**HAYWARD OFFICE**  
Route 8  
P.O. Box 8072  
Hayward, WI 54843  
Tele: (715) 634-4870  
FAX: (715) 634-5150

**LA CROSSE OFFICE**  
2226 Rose Street  
La Crosse, WI 54603  
Tele: (608) 785-9334  
FAX: (608) 785-9330

**MADISON OFFICE**  
201 E. Washington Ave.  
PO. Box 7969  
Madison, WI 53707  
Tele: (608) 266-8735  
FAX: (608) 267-9566

**SHAWANO OFFICE**  
1053A E. Green Bay Street  
P.O. Box 434  
Shawano, WI 54166  
Tele: (715) 524-3626  
FAX: (715) 524-3633

**WAUKESHA OFFICE**  
401 Pilot Court  
Waukesha, WI 53188  
Tele: (414) 548-8600  
FAX: (414) 548-8614

**Project Location:**

Street: \_\_\_\_\_ E-File: \_\_\_\_\_

City: \_\_\_\_\_ Plan Number: \_\_\_\_\_

County: \_\_\_\_\_ Date Plans Rec'd: \_\_\_\_\_

Occupancy: \_\_\_\_\_

**SAMPLE**

We, the undersigned, request to begin footing and foundation work prior to approval of the plans in accordance with ILHR 50.14.

Plans have been submitted to the Department of Industry, Labor and Human Relations, Safety and Buildings Division, and all information requested by Code ILHR 50.12 or ILHR 50.13 has been included with the submittal.

We have reviewed the specific code requirements for the building or structure and its use, as set forth in ILHR 50-64, and, where applicable, have shown compliance on the drawings.

We agree to make any changes required after the plans have been reviewed and to remove or replace non-code complying parts of the foundation and/or footings.

We agree to proceed with the footings and foundation only and will not continue with the remainder of the building or structure until approval has been received.

We understand that, prior to the start of construction, a Building Permit must be obtained from the local authorities having jurisdiction in accordance with their laws and ordinances.

We understand that if this project is in an unsewered area, a sanitary permit must be obtained prior to the issuance of a local building permit (ss 101.12 (3) (h)).

Owner's Signature: _____ (Original Signature in Ink)	Designer's Signature: _____ (Original Signature in Ink)
Date Signed: _____	Date Signed: _____
Owner's Name: _____	Designer's Name: _____
Street: _____	Street: _____
City: _____ State: _____ Zip: _____	City: _____ State: _____ Zip: _____

Department Action:  Approved  Not Approved

Review Comments:

Reviewed By: \_\_\_\_\_ Today's Date \_\_\_\_\_



Wisconsin Department of Industry  
Labor & Human Relations

**INSPECTION PROGRESS REPORT**

Safety and Buildings Division  
P.O. Box 7969, Madison, WI 53707

RE:	File Number	Plan No.
	E-	
	Inspection Date:	Person Contacted
	No. 1.	
	2.	
	3.	
	Bldg. Final	
	H & V Final	
	Other Final	
	TO:	Compliance Date:
Office Instruction (Check one):		Supervisory Review
<input type="checkbox"/> Voluntary Compliance <input type="checkbox"/> Process SB-2 <input type="checkbox"/> Violations explained to owner		

INSPECTION <input checked="" type="checkbox"/> Order Corrected <input checked="" type="checkbox"/> Order Not Corrected	<b>INSPECTION FINDINGS</b>
1    2    3    Final	Items listed below should be corrected before the next inspection or final inspection. These items are violations of the Building Code sections noted.

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SAMPLE

Owner's Name and Address (if different from above):	Deputy's Name:  Deputy's Signature:  Deputy's Office Hours and Telephone Number:
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DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS  
SAFETY & BUILDINGS DIVISION  
BUREAU OF BUILDINGS AND STRUCTURES  
201 E. WASHINGTON AVE.  
P.O. Box 7969  
MADISON, WISCONSIN 53707

FILE NO. E- \_\_\_\_\_  
PLAN NO. \_\_\_\_\_  
VOLUME \_\_\_\_\_

**PLAN EXAMINATION LETTER**

DATE: \_\_\_\_\_

Note: This Preprinted Plan Review letter is being used at the discretion of the plan examiner to expedite the plan review. This form serves as the review correspondence.

Occupancy  
Tenant  
Owner  
Location  
Municipality  
County

Supervising Professional  
\_\_\_\_\_

Plans have been reviewed for compliance with the important code requirements in Chapters ILHR 50 through 64 of the rules of the Department.

The \_\_\_\_\_ plans are:

CONDITIONALLY APPROVED       WITHHELD       NOT APPROVED

If the plans are stamped "CONDITIONALLY APPROVED" construction may proceed, but all items that are required to be changed by this letter must be corrected before commencing that part of the work.

You are advised that the owner as defined in Chapter 101.01(2)(i) of the Wisconsin State Statutes is responsible for all code requirements not specifically cited.

The building will be inspected during and after construction. The owner shall notify the state building inspector and the local building inspector before taking possession of the building.

ILHR 50.15 EVIDENCE OF APPROVAL. The architect, professional engineer, designer, builder or owner shall keep at the building, one set of plans bearing the stamp of approval.

This plan has not been reviewed for compliance with Chapters ILHR 82 through 86, the Plumbing Rules of the Department.

THIS BUILDING HAS BEEN CLASSIFIED AS NO. \_\_\_\_\_ CONSTRUCTION.     SPRINKLERED     UNLIMITED AREA

COMMENTS:

Plans for the following shall be submitted to this office and approved prior to construction of that component.

Trusses     Precast Concrete     Heat & Vent Systems     Illumination     \_\_\_\_\_

Area Code

State Inspector - Region \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_

Local Inspector - \_\_\_\_\_

BY: \_\_\_\_\_  
PLAN EXAMINER  
Phone \_\_\_\_\_

# Compliance Statement

This form is required to be submitted by the architect, engineer, or HVAC designer (supervising professional) observing construction of projects within buildings with total volumes exceeding 50,000 cubic feet and construction of antennas, towers and bleachers (ILHR 50.10). Failure to submit this form may result in penalties as specified in ILHR 50.26 and/or local ordinances.

**General Instructions:** Prior to the initial occupancy of new buildings or additions and the final occupancy of altered existing buildings, submit this completed and signed form to:

The municipal building inspection office and  
DILHR, Safety and Buildings, P. O. Box 7969, Madison, WI 53707

**1. PROJECT INFORMATION:** (Use the DILHR or municipal project label, or type or print the information.)

	Owner Information	Project Information
L	Name	Building Occupancy Chapter(s) & Use
A	Company Name	Tenant Name (if any)
B	Number and Street	Building Location (number & street)
E	City	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Town of
L	State and Zip Code	County of
H	Plan or Reference Number	Property Identification Number
E	Name and Registration Number of the Building Supervising Professional	Building Project #
R	Name and Registration Number of the HVAC Supervising Professional	HVAC Project #
E		

**2. PURPOSE OF THIS STATEMENT:** (Check Box A, B, or C to indicate purpose and complete any other applicable boxes and information. Attach additional pages if necessary.)

- Building and HVAC     
  Building Only     
  HVAC Only  
 Partial Completion

Description of Portion Completed

**A)  Statement of Substantial Compliance**

To the best of my knowledge, belief, and based on onsite observation, construction of the following building and/or HVAC items applicable to this project have been completed in substantial compliance with the approved plans and specifications.

**BUILDING ITEMS**

1. Structural system including submittal and erection of all building components (trusses, precast, metal building, etc.)
2. Fire protection systems (sprinklers, alarms, smoke detectors, fire extinguishers)
3. Exits including exit and directional lights
4. Shaft and stairway enclosures
5. Fire-resistive construction, enclosure of hazards, fire walls, labeled doors, class of construction
6. Sanitation system (toilets, sinks, drinking facilities)
7. Barrier-free access and circulation
8. All conditions of building plan approval and applicable variances

**HVAC ITEMS**

1. HVAC system including final test (ILHR 64.53)
2. All conditions of HVAC plan approval and applicable variances

The following items are not in compliance and must be addressed: \_\_\_\_\_

**B)  Statement of Noncompliance**

Due to the following listed violations, this project is not ready for occupancy: \_\_\_\_\_

**C)  Supervising Professional Withdrawn From Project      Date Withdrawn**

(Use A or B above to indicate project status as of this date.)

**3. SIGNATURES:**

Building Supervising Professional	Date	HVAC Supervising Professional	Date
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ILHR 50-64 Appendix A

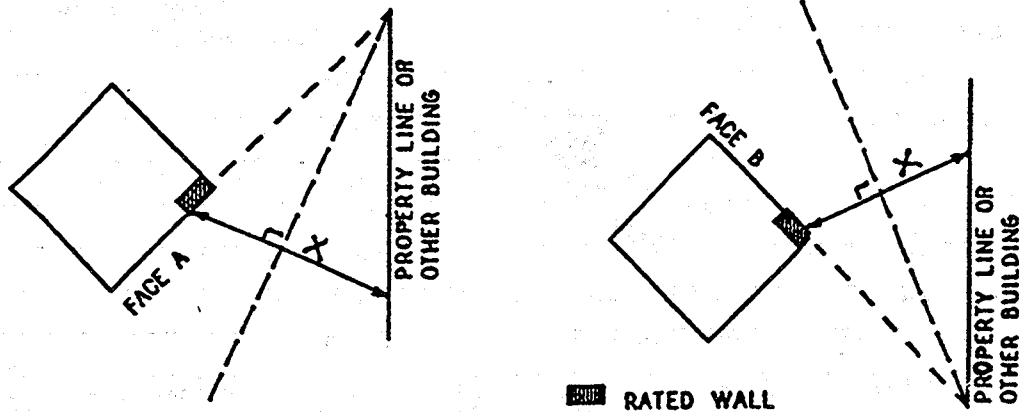
**A-51.01 (12) BUILDING.** The intent was to consider permanent awnings as part of a building.

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

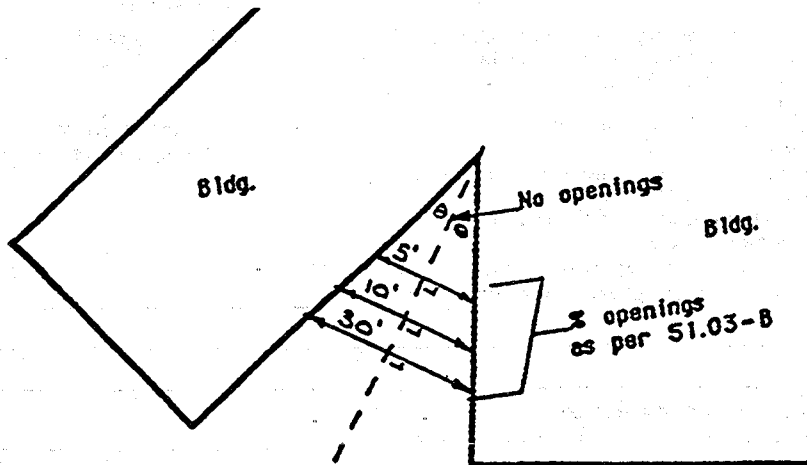
**A-51.01 (67a) HABITABLE ROOM.** It is the intent that rooms designated as recreation, study, den, family room, office, etc. and providing the only space for living and/or sleeping are considered habitable rooms.

**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).

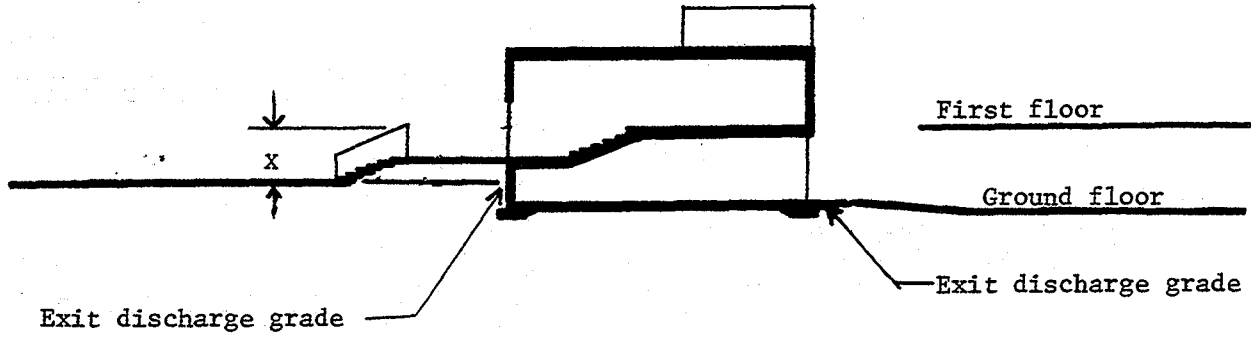
**A-51.01 (144) WALL (DIVISION).**

(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. ILHR 50.07, 50.10 and 50.12.

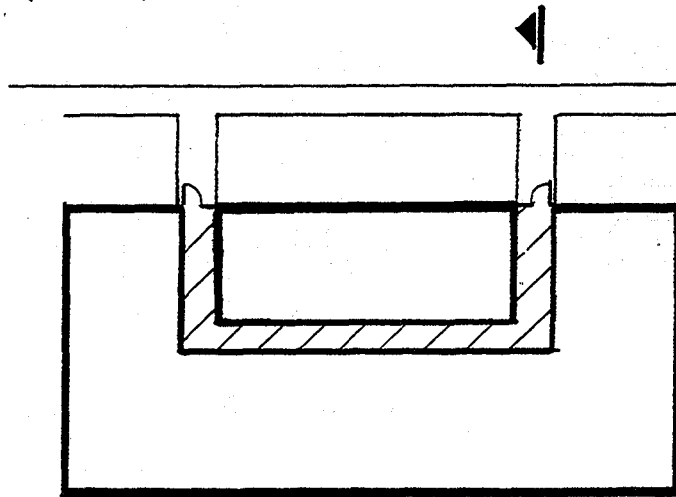
(b) *Fire division wall* is intended to relate to construction that provides separation between portions of a building to satisfy allowable floor area limitations, separation between 2 classes of construction, or separation of hazardous occupancies. For other separations, see "occupancy separations" and isolation of hazards sections of this code.

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

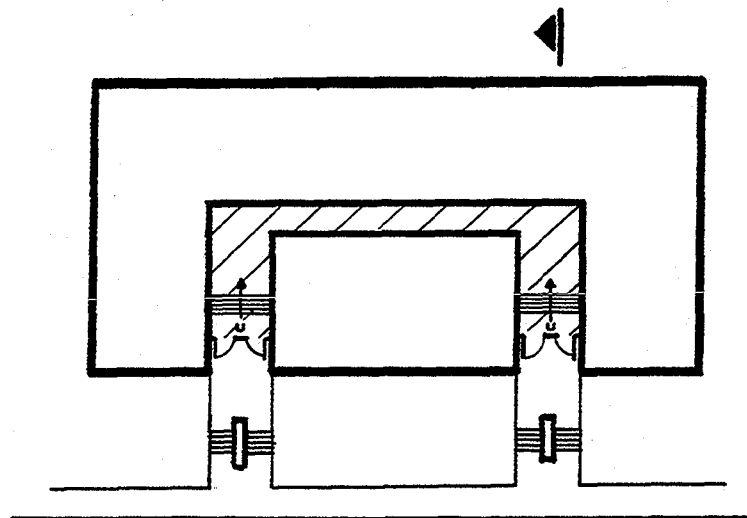
A-51.02 (14) DETERMINATION OF NUMBER OF STORIES. to this rule and the definition of s. ILHR 51.01 (121) Stories, Number of.  
The following illustrations are provided to give visual aid



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.

Required Hourly Rating for Wall Achieved by Masonry Component

Note:

Masonry wall must be laterally supported by horizontal structural components only (i.e., floor, floor/ceiling or roof/ceiling assemblies). Optional furring/insulation system, if used, cannot be used to provide required lateral support for masonry wall.

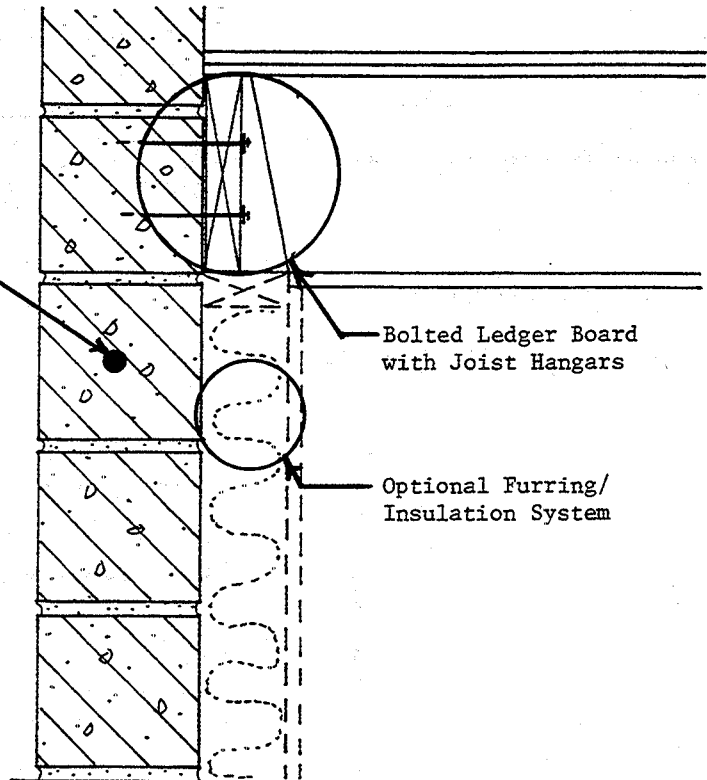
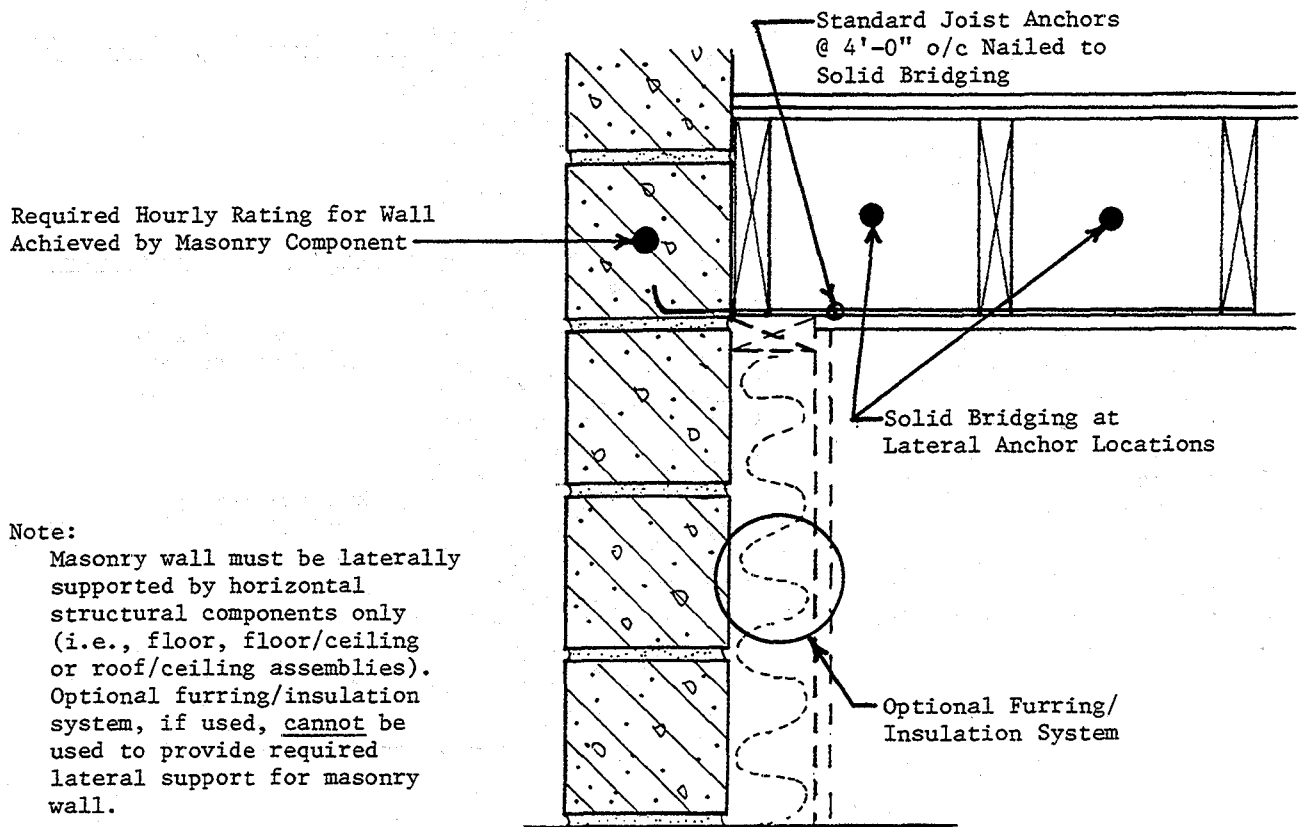


FIGURE 1  
Single Wythe Masonry Wall  
(Bearing Condition)



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

Required Hourly Rating for Wall Achieved by Masonry Component

Note:

Masonry wall must be laterally supported by horizontal structural components only (i.e., floor, floor/ceiling or roof/ceiling assemblies). Optional furring/insulation system, if used, cannot be used to provide required lateral support for masonry wall.

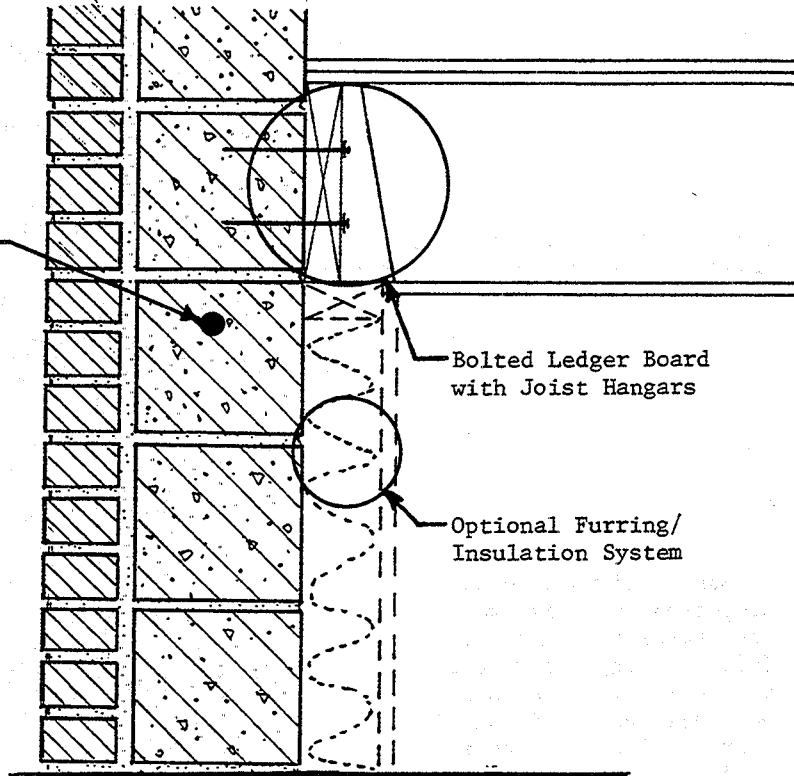
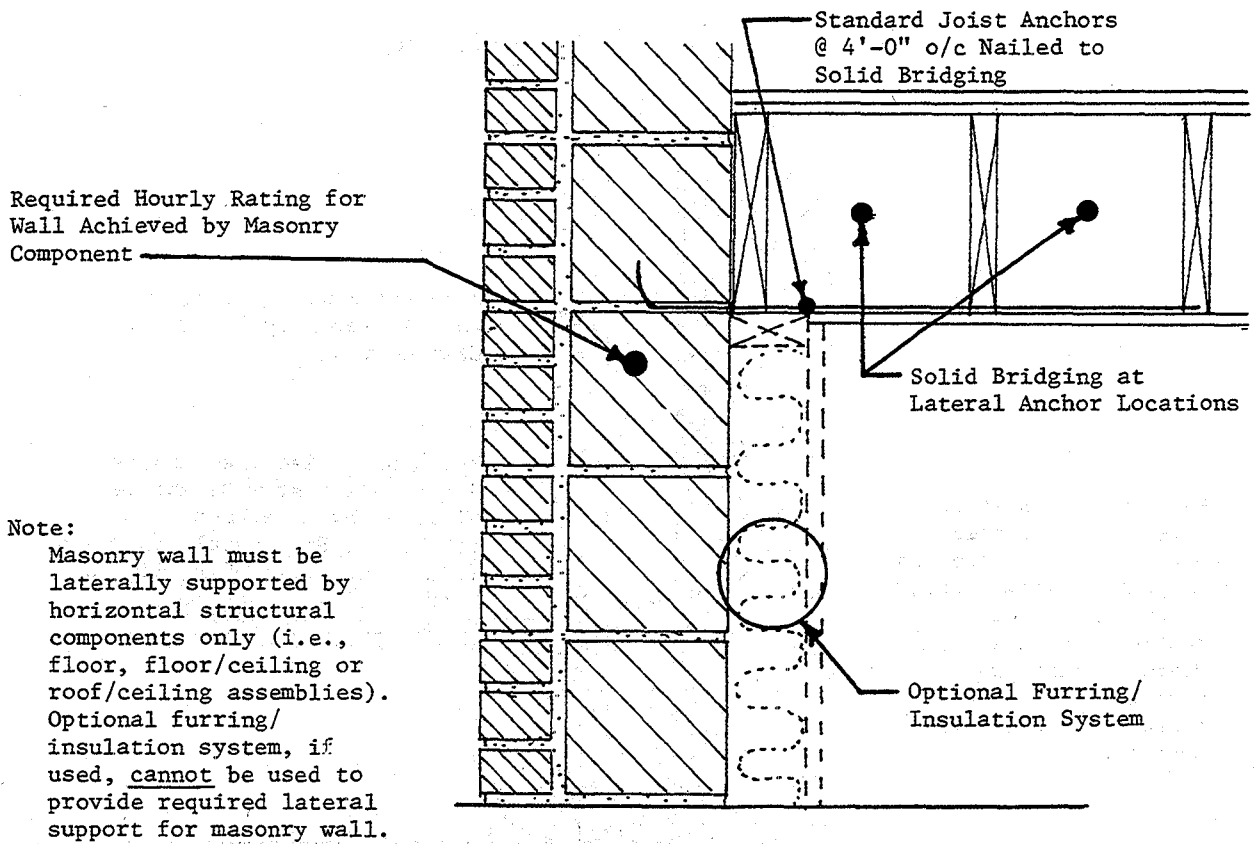


FIGURE 3  
Multi-Wythe Masonry Wall  
(Bearing Condition)





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

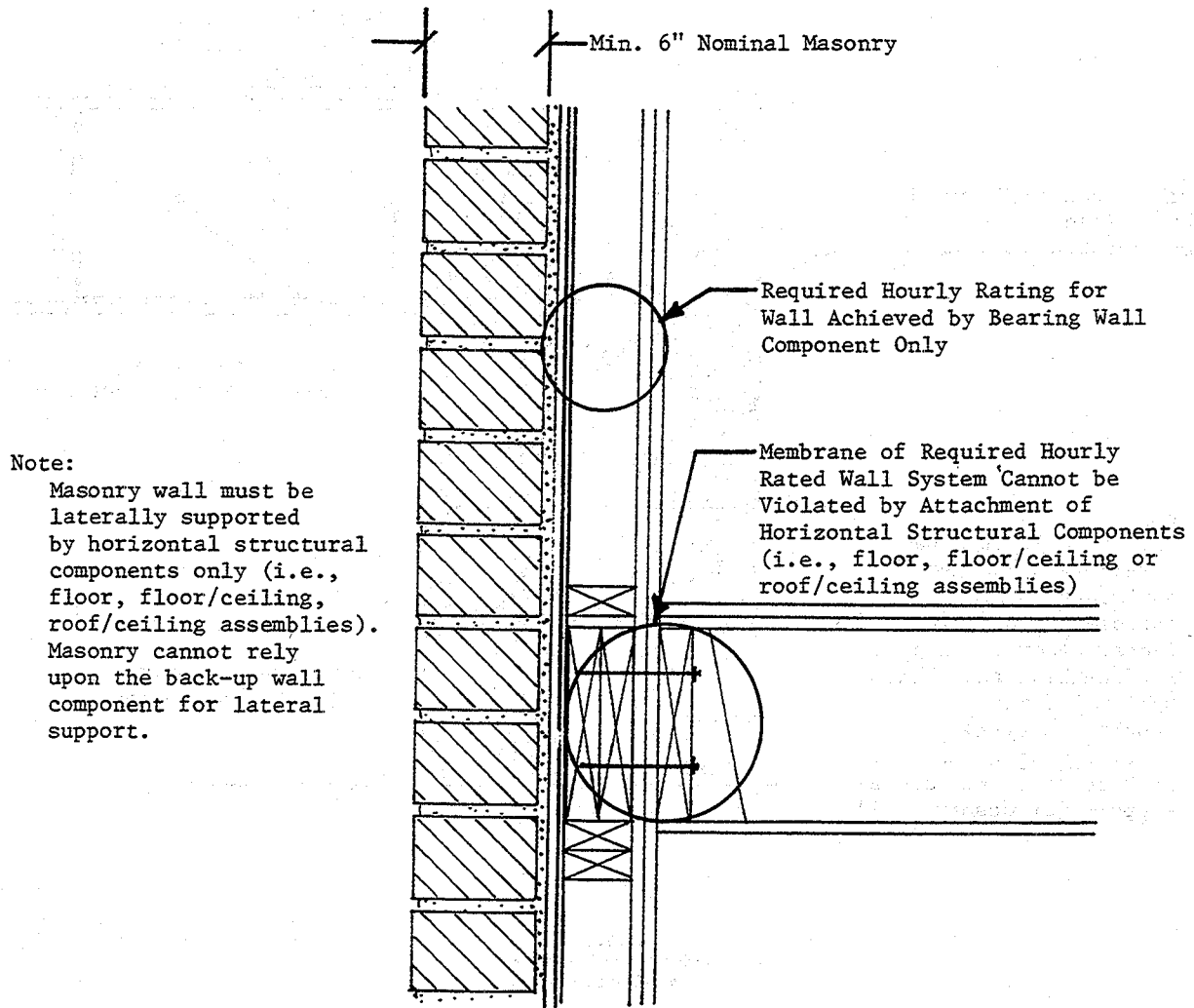


FIGURE 5A  
Combination Masonry/Frame Wall  
(Bearing and Non-Bearing Condition)

Note:

Masonry wall must be laterally supported by horizontal structural components only (i.e., floor, floor/ceiling or roof/ceiling assemblies). Masonry cannot rely upon the back-up wall component for lateral support.

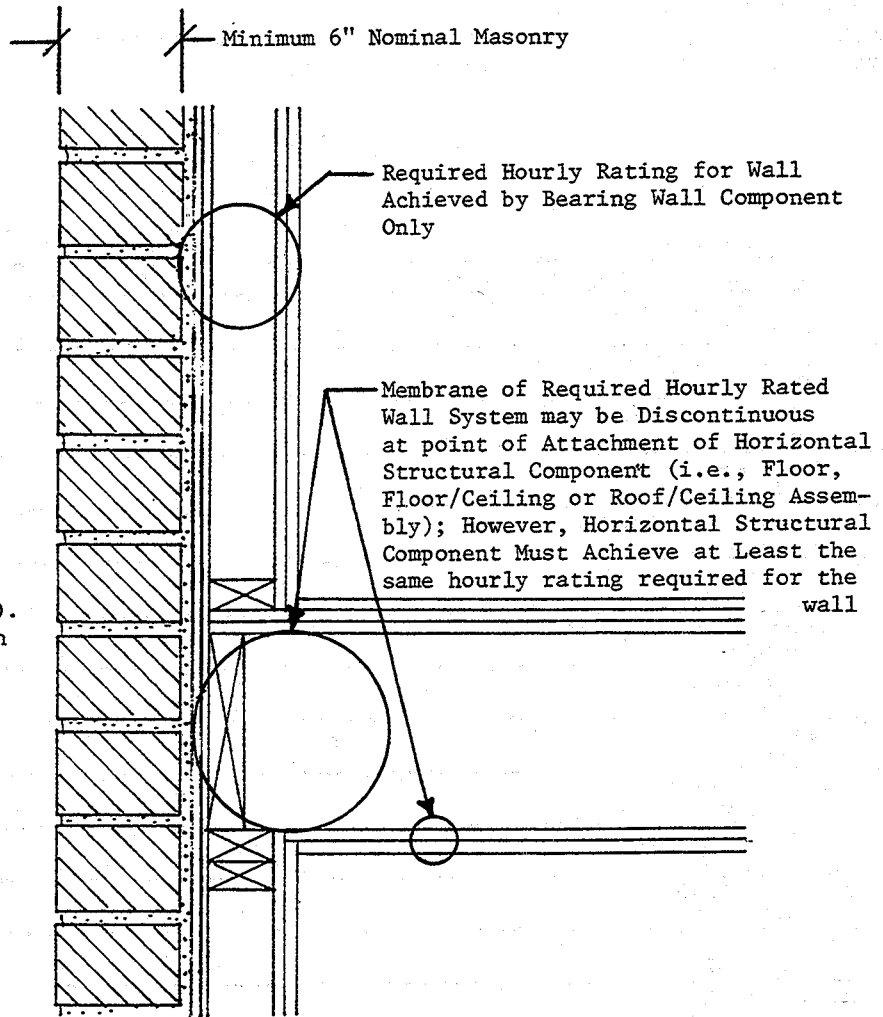


FIGURE 5B  
Combination Masonry/Frame Wall  
(Bearing and Non-Bearing Condition)

**A-51.044 APPROVED TESTING LABORATORIES.** The following laboratories have been approved by the department under s. ILHR 50.19. This list is current as of the date of printing this code. Additions and deletions may occur dur-

ing the effective period of this code. For information regarding the current status of a testing laboratory, call 608-266-1542.

**TABLE A-51.044  
APPROVED TESTING LABORATORIES**

Name of Recognized Laboratory	ASTM STANDARD TEST						
	E-84	E-108	E-119	E-136	E-152	E-163	E-648
1. Applied Research Laboratories, Inc., Miami, FL	X	X	X	X	X	X	X
2. Commercial Testing Co., Inc., Dalton, GA	X	--	X	X	X	--	X
3. Construction Technologies, Laboratories, Skokie, IL	--	--	X	--	--	--	--
4. Factory Mutual Research Corp., Norwood, MA	X	X	X	X	X	X	X
5. Forest Product Laboratories, Madison, WI*	--	--	X	--	X	--	X
6. Hardwood Plywood Mfgs. Assoc., Reston, VA	X	--	--	--	--	--	X
7. Northwest Testing Lab., Inc., Portland, OR	--	--	X	--	X	X	--
8. Omega Point Laboratories, Inc. San Antonio, TX	X	X	X	X	X	X	X
9. PFS Corporation Madison, WI	X	--	X	--	X	--	--
10. Radco Carson, CA	X	--	--	--	--	--	--
11. Southwest Research Inst., San Antonio, TX	X	X	X	X	X	X	X
12. Underwriters Lab., Inc., Northbrook, IL	X	X	X	X	X	X	X
13. Univ. of Calif. — Berkeley, Richmond, CA	--	X	X	--	--	--	--
14. U.S. Testing Co. Fairfield, NJ	X	X	--	X	--	--	X
15. U.S. Testing Co. Los Angeles, CA	X	X	--	X	--	--	X
16. VTEC, Inc., Bronx, NY	X	X	X	X	--	--	X
17. Warnock Hersey Intl-Inc., Pittsburg, CA	X	X	X	--	X	X	--

\* Reference based on research and development data. Facility is not available for conducting routine rating tests.

**A-51.15 (6) EXAMPLE TO DETERMINE TOTAL AGGREGATE EXIT WIDTH.**

5	300
4	400
3	500
2	200
1	600
B <sub>1</sub>	100
B <sub>2</sub>	300
B <sub>3</sub>	400

Type No. 1 sprinklered construction.

Aggregate exit width required from a floor into the stairwell is 30 inches per 100 people on that floor; i.e.,

5th floor to stairwell =  $3 \times 30 = 90''$

4th floor to stairwell =  $4 \times 30 = 120''$

3rd floor to stairwell =  $5 \times 30 = 150''$

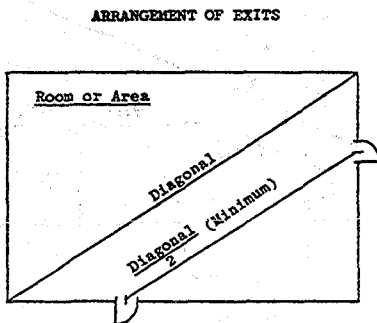
etc.

Total stair width required:

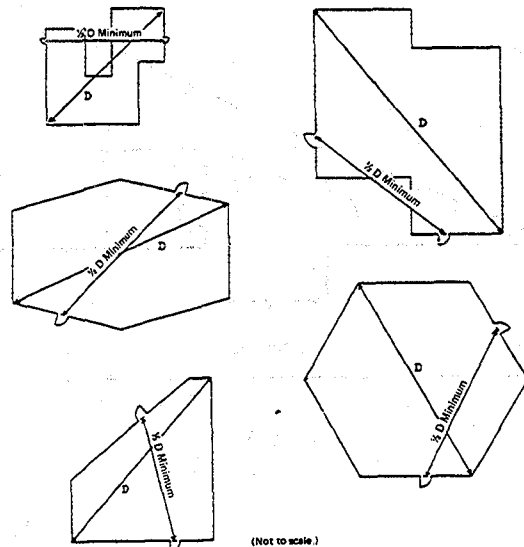
- 5th to 4th - 300 persons (100%)  $\times$  30"/100 persons = 90"
- 4th to 3rd - [400 persons (100%) + 300 persons (50%)] 30"/100 persons = 165"
- 3rd to 2nd - [500 persons (100%) + 400 persons (50%) + 300 persons (25%)] 30"/100 persons = 232.5"
- 2nd to 1st - [200 persons (100%) + 500 persons (50%) + 400 persons (25%)] 30"/100 persons = 165" (Use 232.5")
- 1st to exterior - [600 persons (100%) + (200 persons + 100 persons) (50%) + (500 persons + 300 persons) (25%)] 30"/100 persons = 285"
- B<sub>1</sub> to 1st - [100 persons (100%) + 300 persons (50%) + 400 persons (25%)] 30"/100 persons = 105" (Use 150")
- B<sub>2</sub> to B<sub>1</sub> - [300 persons (100%) + 400 persons (50%)] 30"/100 persons = 150"
- B<sub>3</sub> to B<sub>2</sub> - 400 persons (100%)  $\times$  30"/100 persons = 120"

Stair width required from B<sub>1</sub> to 1 is 150" as stair cannot decrease in width along path to exit [ILHR 51.16 (2) (c)].

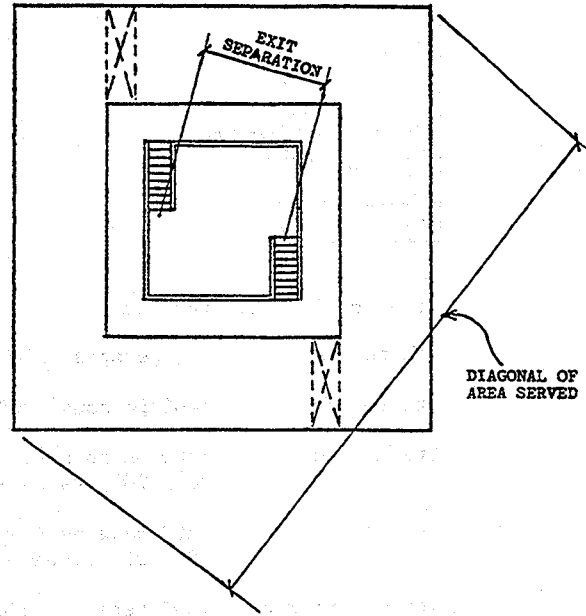
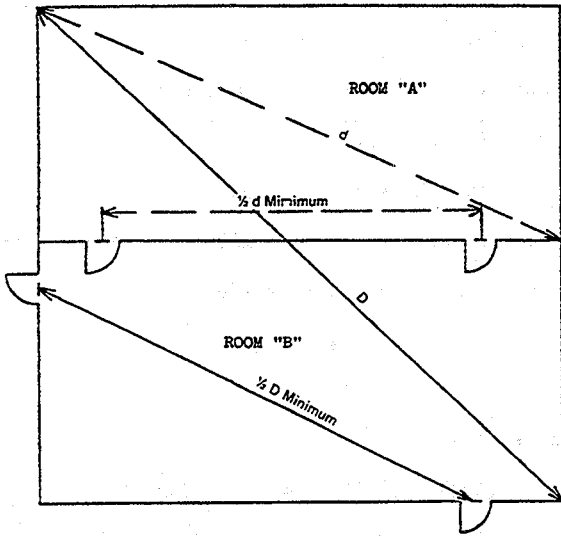
**A-51.151 EXIT DISTRIBUTION.** The following diagrams are provided to aid building designers in determining proper exit distribution:



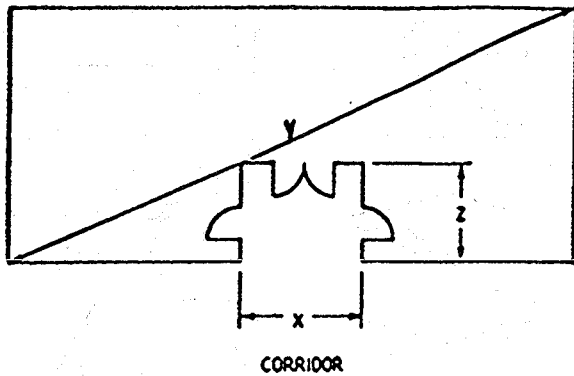
Minimum Distance = One-half of Diagonal



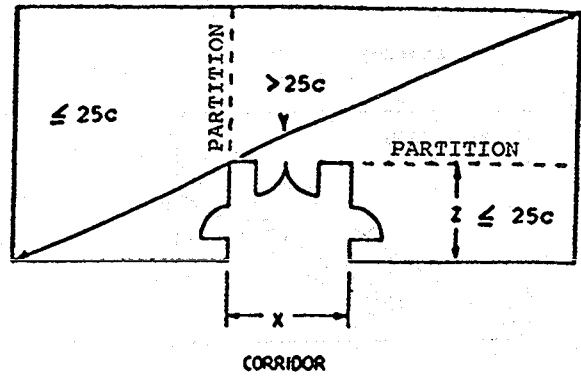
(Not to scale)



**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 preplanned 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 non-conductor 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 storage, 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) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) 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 dis- tance to extin- guisher	75 ft.	75 ft.	75 ft.

\*Two 2 ½ 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; schoolrooms; 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 ILHR 16, Wisconsin State Electrical Code, Volume 2, requires the installation of standby emergency power for certain occupancies; the following is a reprint of s. ILHR 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**

<i>Column A</i> Occupancy	<i>Column B</i> 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 .....	2,000 square 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 .....	200 beds
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

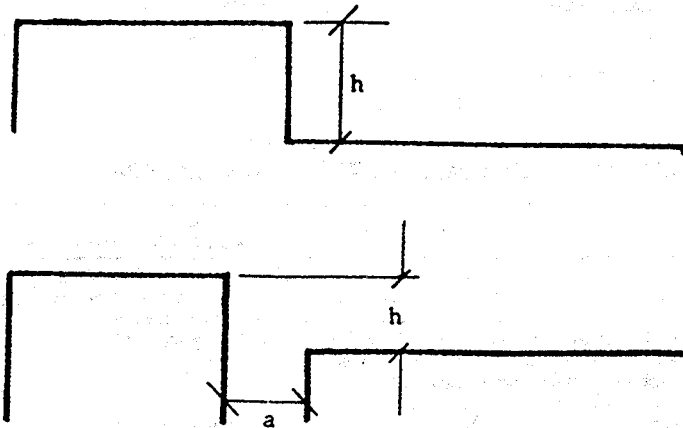
A-52.60 (1) Water closets. The following is a reprint of s. ILHR 84.20 (5) (m) 7. from the plumbing code:

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.

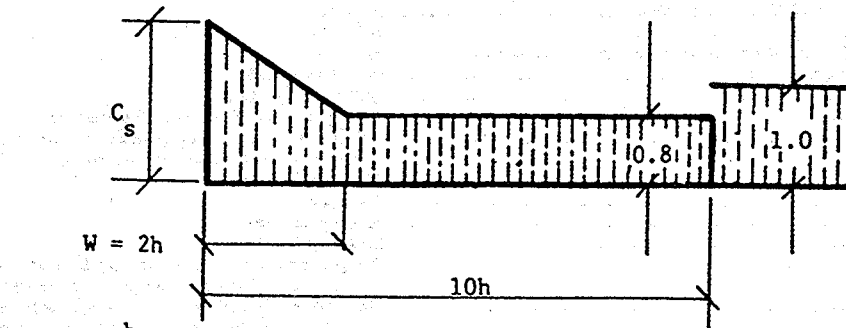
A-53.11 (4) (c) Increase in roof loads. The following design provisions may be used to determine the increase in roof loads as required by this section.

## 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.

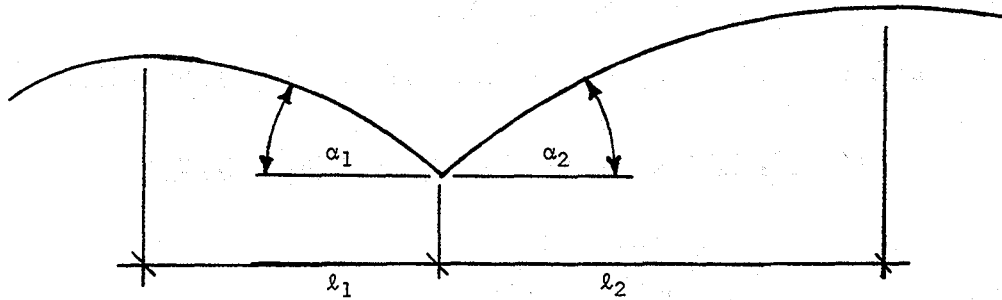
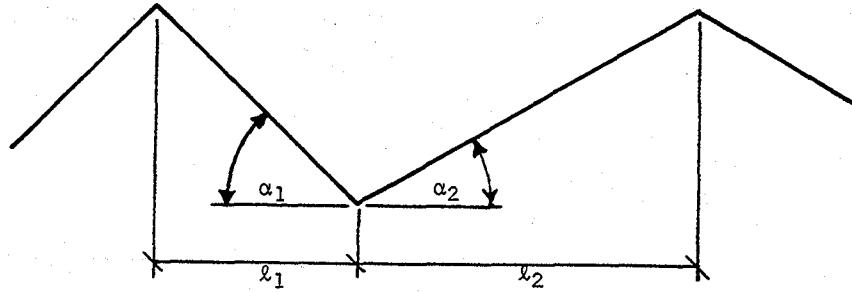
$a$  = distance between buildings  $< 15$  ft.

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

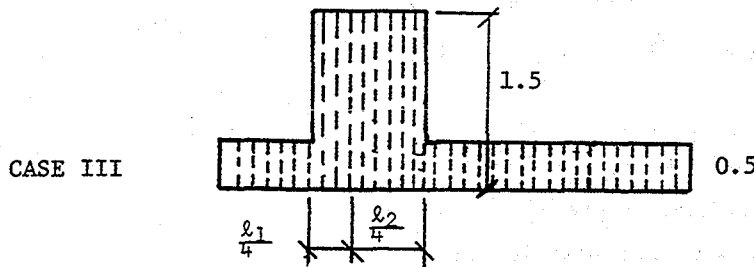
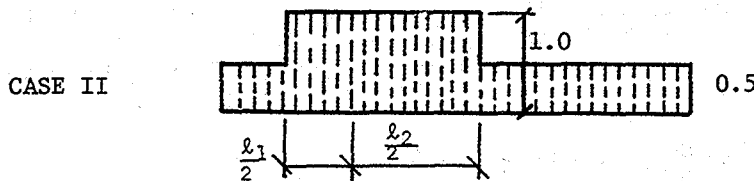
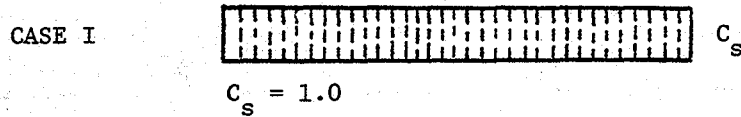
\*An upper limit of 3 times the basic roof load has been suggested. It should be noted, however, that higher loads have been observed where an upper roof was very long (measured perpendicularly to the step between the upper and lower roofs). On the other hand, for relatively short upper roofs (say less 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

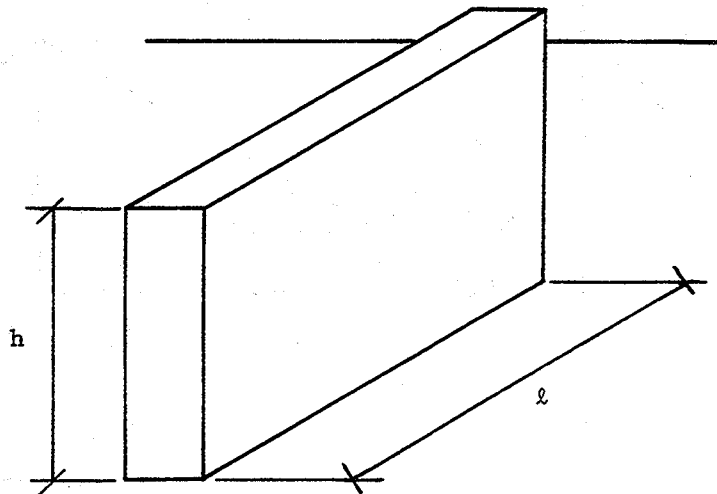


SNOW LOAD DISTRIBUTIONS AND COEFFICIENTS, LIMITATIONS



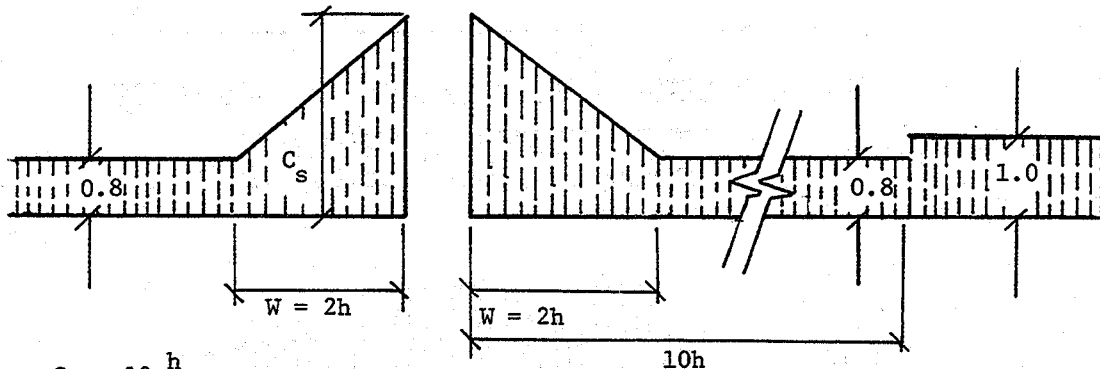
For both  $\alpha_1$  and  $\alpha_2 \leq 10^\circ$  use Case I only; otherwise use Case I, II and III

## 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  $l < \frac{g}{6}$  use  $C_s = 1.0$

$$W = 2h$$

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

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

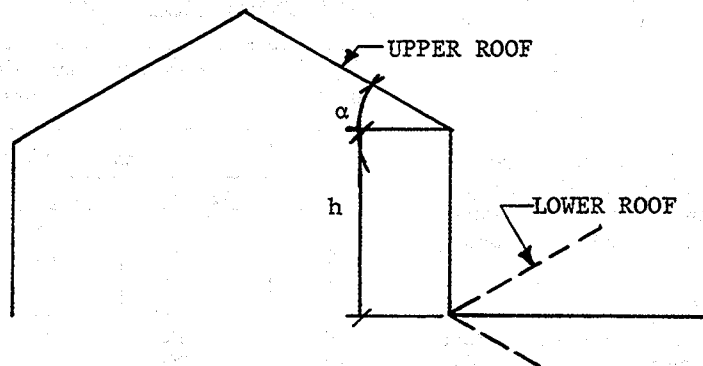
$h$  = height of projection in ft.

$g$  = roof live load in psf

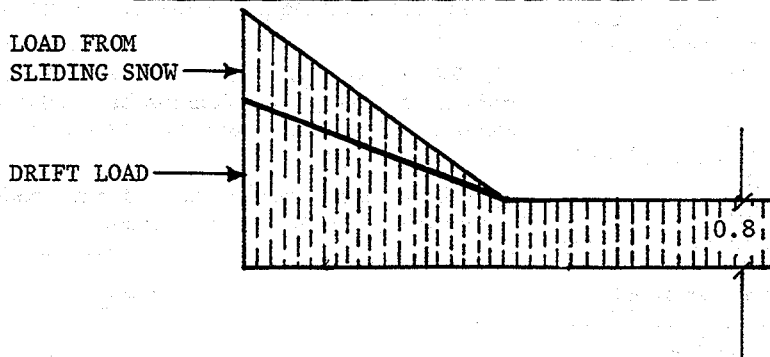
$w$  = width of snow drift in ft.

$l$  = length of projection in ft.

## ROOF SHAPES



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. ILHR 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. ILHR 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 semicontinuous 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 SERVING ROOF AREAS**

Pipe Diameters (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

Note: 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 Diameters (in 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.





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 ILHR 57.07 (3) permits the steps, stairs and ramps within individual living units to conform with s. ILHR 21.04 of the Uniform Dwelling Code. The following is a reprint of the applicable portions of that section:

**ILHR 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 3½ 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 plat-

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form 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-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 ILHR 63 & 64 PLAN CHECK WORKSHEETS

SECTION I. ENERGY/HVAC FORM INDEX

SECTION II. BUILDING ENVELOPE

SECTION III. LIGHTING

SECTION IV. HVAC

SBD-10373 (R.11/96)

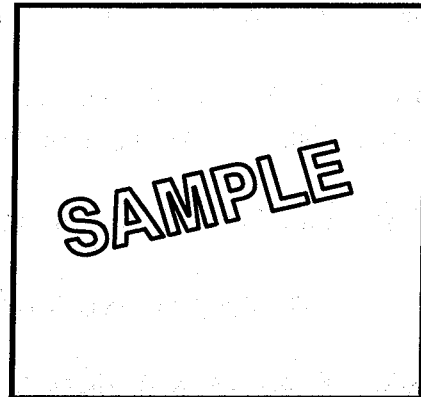
**INDEX** **I-1**



Project Plan #	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

All constructions or installations under s. ILHR 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. ILHR 50.08.

The Division of Safety & Buildings was associated with the Department of Industry, Labor and Human Relations (DILHR). As of July 1, 1996, the Division has been relocated to the Department of Commerce (COMM). Code References involving the prefix ILHR will be changed to COMM upon approval of the Revisors Office. An exact date for this change to occur has not yet been established.



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**

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 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**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)].

SBD-10512 (N.11/96)

## 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-1: Building Envelope Summary.**

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

### **E-2: 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. ILHR 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-3: 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-4: Skylight Exemption Worksheet.**

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

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

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

## 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 or appropriate thermal performance calculations for factories and warehouses as listed in ILHR 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.

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. ILHR 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. ILHR 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 ILHR 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. ILHR 63.47, 63.48, or 63.49, or the actual installed lighting power density adjusted for controls under s. ILHR 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 ILHR 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. ILHR 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. ILHR 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**



Project Plan #	Submitter's Name		
Owner's Name	SAMPLE		
Building Location (Number & Street)			

**Compliance Approach**  
  Component Standards (See ILHR 63.15)  
  System Standards (See ILHR 63.16)  
  System Analysis Design (See ILHR 63.70-72)

Region \_\_\_\_\_ ACP Table \_\_\_\_\_  
 (See Fig. 63.15-2)

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

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

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**FENESTRATION WORKSHEET**

**E-2**



Project Plan #	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

**SAMPLE**

Fenestration Orientation: \_\_\_\_\_  
 For System Standards Method

**Area-Weighted Properties - ILHR 63.18**

Fenestration U-Value ( $U_{of}$ ) see ILHR 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 ILHR 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**



Project Plan #	Submitter's Name
Owner's Name <b>SAMPLE</b>	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

Exterior Wall Orientation: \_\_\_\_\_  
 For System Standards Method

**Area-Weighted Properties - ILHR 63.18**

Roofs see ILHR 63.18 (2)(a)

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

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

Walls Adjacent to Unconditioned Spaces see ILHR 63.18 (2)(a)

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

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

Above Grade Exterior Walls see ILHR 63.18 (2)(a)

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

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

Floors Over Unconditioned Spaces see ILHR 63.18 (2)(a)

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

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



**SKYLIGHT EXEMPTION WORKSHEET** **E-4**



Project Plan #	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

SAMPLE

Skylight Exemption Requirements <small>see ILHR 63.12</small>	Additional Data
<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.	
<input type="checkbox"/> Air leakage is less than 0.5 cfm/ft <sup>2</sup> of skylight.	<input type="checkbox"/> Calculation of allowed skylight percent.
<input type="checkbox"/> Automatic daylighting controls installed to reduce electric lighting by 50%.	<input type="checkbox"/> Sketch of shading devices.
<b>Special Consideration</b> <input type="checkbox"/> Shading devices used to block 50% of the solar gain during peak cooling conditions.	

	Design	Requirement
<b>Skylight Design Data</b>		
Skylight Area (SA)	_____	
Gross Roof Area (GRA)	_____	
Skylight-to-Roof Ratio (SA/GRA)	_____	≤ _____
Skylight U-value	_____	
Skylight VLT	_____	
Lighting Power Density (LPD/ft <sup>2</sup> )	_____	
Design lighting level (fc)	_____	

**OPAQUE ASSEMBLY TRADE-OFF WORKSHEET E-5**



Project Plan #	Submitter's Name	
Owner's Name	Date	
SAMPLE		
Building Location (Number & Street)	<input type="checkbox"/> City	<input type="checkbox"/> Village <input type="checkbox"/> Township of

**DESIGN**

**Design - Roofs** See ILHR 63.18 (2)(a)

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

Total Area→

**REQUIREMENT**

**Required - Roofs** See ILHR 63.15 (4)

Total Area	Required U-Value	U•Area
	X	=

**Design - Above Grade Exterior Walls**

See ILHR 63.18 (2)(a)

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

Total Area→

**Required - Above Grade Exterior Walls**

See ILHR 63.15 (4)

Total Area	Required U-Value	U•Area
	X	=

**Design - Walls Adjacent to Unconditioned Space**

See ILHR 63.18 (2)(a)

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

Total Area→

**Required - Walls Adjacent to Unconditioned Space**

See ILHR 63.15 (4)

Total Area	Required U-Value	U•Area
	X	=

**Design - Floors Over Unconditioned Space**

See ILHR 63.18 (2)(a)

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

Total Area→

**Required - Floors Over Unconditioned Space**

See ILHR 63.15 (4)

Total Area	Required U-Value	U•Area
	X	=

$$\sum \text{Total Design U•Area } \boxed{\phantom{0000}} \leq \sum \text{Total Required U•Area } \boxed{\phantom{0000}}$$

The Total Design U•Area must be less than or equal to the Total Required U•Area

### 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.

## 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. ILHR 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 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. ILHR 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 Automatic Controls (L-1) Part 3**

The Mandatory Automatic 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. ILHR 63.45 (2), the information should also be recorded on Part 4, 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.

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

The Control for Credit portion is similar to the Mandatory Automatic 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 ILHR Table 63.43.

Allowance: This is the allowance in either  $W/ft^2$  or watts of lineal feet. These allowances match those in ILHR 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. ILHR 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. ILHR 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. ILHR 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.

<u>Building Type of Use:</u>	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.
<u>Watts per Square Foot:</u>	Record the allowed lighting power density in watts per square foot for this building type taken from ILHR Table 63.47.
<u>Complete Building Area:</u>	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.
<u>Allowed Watts:</u>	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.

<u>Primary Function:</u>	This is taken from ILHR 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.
<u>Watts per Square Foot:</u>	Record the allowed lighting power density watts per square foot for this building type taken from ILHR Table 63.48.
<u>Area:</u>	Record the conditioned floor area (in square feet) of the primary function area measured from the inside of partitions.
<u>Allowed Watts:</u>	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. ILHR 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 the appropriate unit lighting power density (UPD) from Table 63.49.
- Column E: 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 F: Record the area factor from either s. ILHR 63.49, Figure 63.49, or an applicable footnote from Table 63.49.
- Column G: Record the number of similar spaces.
- Column H: Multiply the UPD from Column D by the floor Column E by the area factor from Column F by the number of similar rooms from Column G. Record the resultant lighting power budget in Column H. 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**



Project Plan #	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

SAMPLE

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

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

Basic Requirements	Prescriptive/Performance	Additional Data
<input type="checkbox"/> Exterior lighting not intended for 24-hour use controlled by photocell. ILHR 63.50 (6)	$\frac{\text{Installed ELP}}{\text{ELPA ILHR 63.43}} \leq \text{_____}$	Exterior Lighting Power Worksheet (L-2)
<input type="checkbox"/> Shut-off control in each space enclosed by ceiling-high partitions. ILHR 63.50 (1) <input type="checkbox"/> Controls to reduce lighting by 50%. ILHR 63.50 (2) <input type="checkbox"/> Controls to reduce lighting in daylit areas. ILHR 63.50 (3) <input type="checkbox"/> Shut-off controls. ILHR 63.50 (4) <input type="checkbox"/> Display lighting separately switched on circuits $\leq 20$ amps. ILHR 63.50 (5) <input type="checkbox"/> Hotel/motel guest rooms have master switches at the main door to turn off lights and receptacles. ILHR 63.50 (7)		
<input type="checkbox"/> Exit signs have installed wattage of 20 watts or less. ILHR 63.52 <input type="checkbox"/> Fluorescent lamps use multiple lamp ballasts with tandem wiring as required. ILHR 63.53	$\frac{\text{ILP}}{\text{ILPA ILHR 63.47, 63.48, or 63.49}} \leq \text{_____}$ <input type="checkbox"/> Lighting Power Control Credits Applied ILHR 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)  Interior Lighting Power Allowance Worksheet (L-4)  Activity Method Worksheet (L-5)

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

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



Project Plan #	Submitter's Name
Owner's Name <b>SAMPLE</b>	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

**INSTALLED LIGHTING SCHEDULE**

Luminaire Name or ID Number (e.g., Type 1, Type 2, etc.)	Lamps					Ballasts				Note to Field
	Type			No. of Lamps	Watts/Lamp	Type			No./Luminaire	
	I	F	H			S	E*	O*		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

\* Provide Supporting Documentation for total watts for lamp and ballast.

**REVIEWER NOTES - For Department Use Only**

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



Project Plan #	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

SAMPLE

**MANDATORY AUTOMATIC CONTROLS**

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

Control Location (Room #)	Control Identification	Control Type (Occupancy Sens., Daylight, etc.)	Space Controlled	Note to Field

**REVIEWER NOTES - For Department Use Only**



**EXTERIOR LIGHTING POWER WORKSHEET L-2**



Project Plan #	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

SAMPLE

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

A	B	C	D
Area Description	Allowance (Table 6-1)	Area or Lineal Feet in Proposed Design	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 Facades	0.25 W/ft <sup>2</sup> of illuminated surface		
Storage and Nonmanufacturing Work	0.20 W/ft <sup>2</sup>		
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. ILHR 63.42)**

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



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



Project Plan #	<b>SAMPLE</b>	Submitter's Name
Owner's Name		Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of	

**INTERIOR LIGHTING POWER ALLOWANCE (ILPA) (s.ILHR 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
Totals →			

ft<sup>2</sup> Area                  Watts





## 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. ILHR 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. ILHR 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 ASHARE 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**



Project Plan #	Submitter's Name
Owner's Name <b>SAMPLE</b>	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

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

Basic Requirements Checklist		Additional Data
<b>Design</b>	<input type="checkbox"/> Load calculations using htg/clg outside design temperatures given in code or no lower/greater than ASHRAE's 99%/2.5% values or annualized 0.2%/0.5% values. ILHR 63.23 (3)	HVAC Prescriptive Worksheet (H-2)
	<input type="checkbox"/> Cooling pull-down/heating pick-up loads were either calculated or did not exceed 10%/30% of design load. ILHR 63.23 (7)	
	<input type="checkbox"/> Equipment is properly sized. ILHR 63.24	
	<input type="checkbox"/> Process loads are served by separate systems from comfort conditioning loads. ILHR 63.25	
	<input type="checkbox"/> HVAC fan and pumping system motors meet efficiency standards. ILHR 63.32	
<b>Controls</b>	<input type="checkbox"/> Temperature controls are provided as required: one for each HVAC system and individual controls for each thermal zone. ILHR 63.26	
	<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. ILHR 63.26	
	<input type="checkbox"/> Systems do not reheat, recool or mix air. ILHR 63.27*	
	<input type="checkbox"/> Variable volume systems have minimum stops adjusted as required. ILHR 63.27*	
	<input type="checkbox"/> Each system that does not need to operate continuously is provided with either automatic time or setback/setup controls. ILHR 63.27 (3)	
	<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. ILHR 64.19 (5)	
	<input type="checkbox"/> Combustion air dampers provided per ILHR 64.09 (2)	
	<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. ILHR 63.28	
<b>Completion &amp; Construction</b>	<input type="checkbox"/> Fan cooling systems employ air or water economizer controls. ILHR 63.31*	
	<input type="checkbox"/> Heat pumps with supplementary heaters have controls to prevent heater operation when heating load can be met by heat pump. ILHR 63.22	
	<input type="checkbox"/> Pipe insulation meets the requirements of ILHR Table 63.29-1. Duct insulation meets the requirements of Table 63.29-2. ILHR 63.29	
	<input type="checkbox"/> The plans or specifications state the requirements for duct sealing. ILHR 64.34	
	<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. ILHR 64.34	
	<input type="checkbox"/> Complying air and water system balancing procedures are spelled out on the plans or in the specifications. ILHR 64.53	
<input type="checkbox"/> Testing, adjusting and calibration of control systems is spelled out on the plans or in the specifications. ILHR 64.43 and ILHR 64.53		
<input type="checkbox"/> Plans or specifications require that equipment is provided with operation and maintenance manuals and system schematics. ILHR 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**



Project Plan #	Submitter's Name
Owner's Name <b>SAMPLE</b>	Date
Building Location (Number & Street)	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Township of

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

Before reheating or mixing of airstreams, zone controls reduce air supply to a minimum which is no larger than all of the following: 30% of the peak zone airflow, 0.4 cfm/ft<sup>2</sup>, or minimum ventilation flow requirements of ILHR 64.05

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 ILHR 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.





A63.05 (14) Daylit Area is the space on the floor that is the larger of (a) or (b);

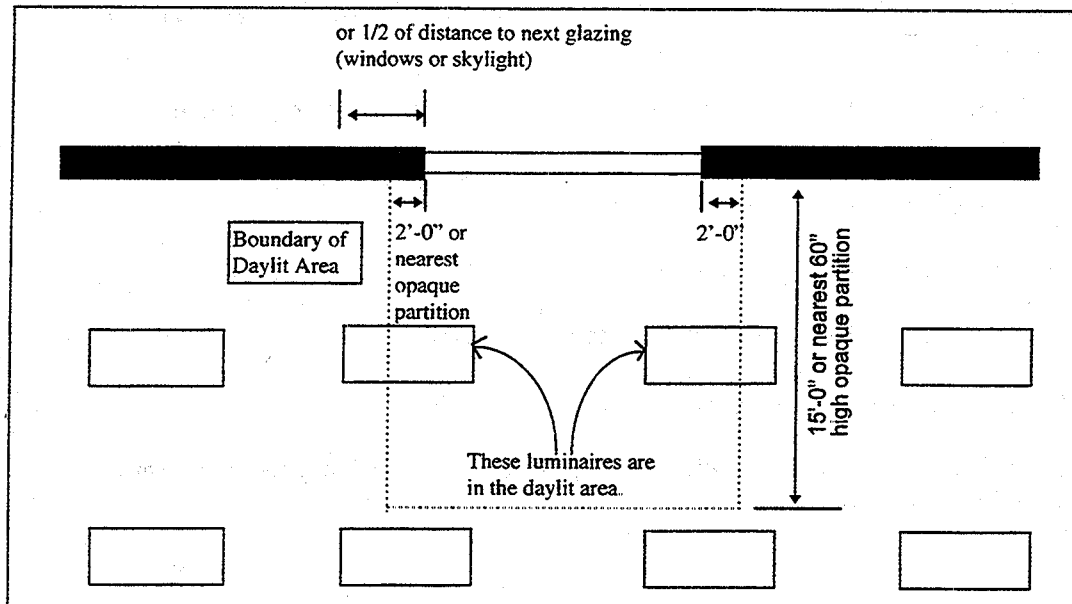
(a) 1. For areas daylit by vertical glazing, the daylit area has a length of 15 feet, or the distance on the floor, perpendicular to the glazing, to the nearest 60-inch or higher opaque partition, whichever is less; and a width of the window plus either 2 feet on each side, the distance to an opaque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

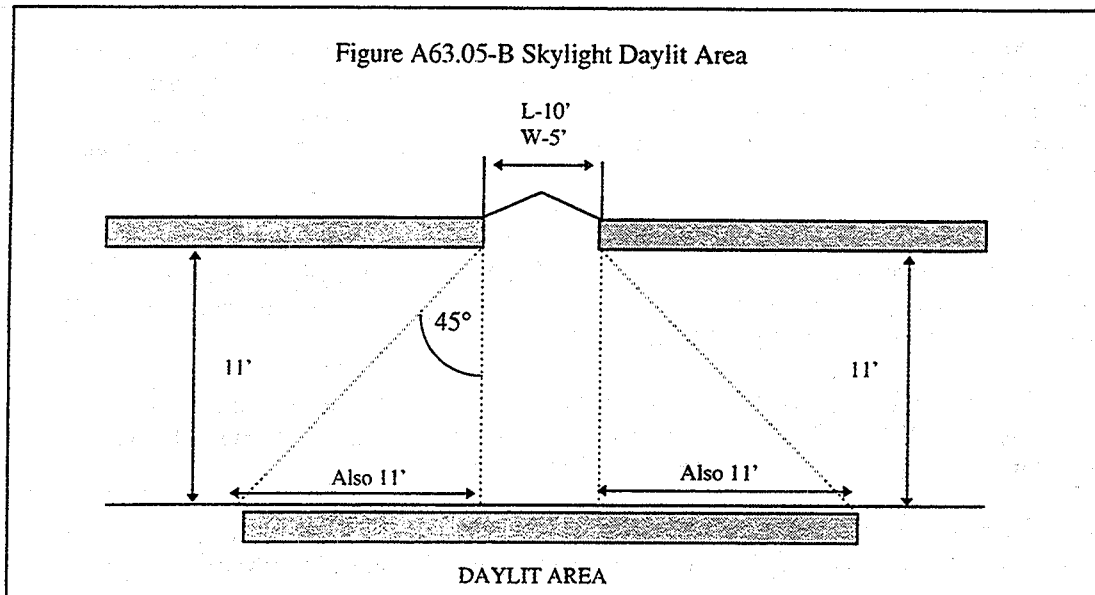
2. For areas daylit by horizontal glazing, the daylit area is the footprint of the skylight plus, in each of the lateral and longitudinal dimensions of the skylight, the lesser of the floor-to-ceiling height, the distance to the nearest 60-inch or higher opaque partition, or one-half the horizontal distance 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
.075	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
.050	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 Btu. in hr.sf. °F	Density (lbs/cf)	Specific Heat (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	3	4	5	6	7	8	9	10	11	12
LW CMU U	na	0.71	0.64	na	na	na	na	na	na	na
R <sub>t</sub>	na	1.4	1.6	na	na	na	na	na	na	na
HC	na	7.00	8.75	na	na	na	na	na	na	na
MW CMU U	na	0.76	0.70	na	na	na	na	na	na	na
R <sub>t</sub>	na	1.3	1.4	na	na	na	na	na	na	na
HC	na	7.67	9.58	na	na	na	na	na	na	na
NW CMU U	0.89	0.82	0.76	na	na	na	na	na	na	na
R <sub>t</sub>	1.1	1.2	1.3	na	na	na	na	na	na	na
HC	6.25	8.33	10.42	na	na	na	na	na	na	na
ClayUnit U	0.80	0.72	0.66	na	na	na	na	na	na	na
R <sub>t</sub>	1.3	1.4	1.5	na	na	na	na	na	na	na
HC	6.30	8.40	10.43	na	na	na	na	na	na	na
Concrete U	0.96	0.91	0.86	0.82	0.78	0.74	0.71	0.68	0.65	0.63
R <sub>t</sub>	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6
HC	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, CMACN, 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 (CMACN).]

A63.18 (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	0.29	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>	0.38	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.

#### 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

Note: See s. ILHR 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. ILHR 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*	Category	Sub-Category & Rating Condition (Outdoor Temp. °F)		Minimum Performance**
ARI 210-81 ARI 240-81 ARI 210/240-84	≤65,000 Btu/h Cooling Capacity Cooling Mode	3ø	Standard Rating (95°F db)	9.5 EER
			Split System & Single Package Integrated Part Load Value (80°F db) Split System & Single Package	
	≥65,000 <135,000 Btu/h Cooling Mode	All ø	Standard Rating (95°F db)	8.9 EER
			Integrated Part Load Value (80°F db)	8.3 IPLV
<65,000 Btu/h Cooling Capacity Heating Mode	3ø	Split System & Single Package High Temp. Rating (47°F db/43°F wb) Low Temp. Rating (17°F db/15°F wb)	3.0 COP 2.0 COP	
		≥65,000 <135,000 Btu/h Cooling Capacity Heating Mode	All ø	Split System & Single Package High Temp. Rating (47°F db/43°F wb) Low Temp. Rating (17°F db/15°F wb)

\* For detailed references, see ASHRAE Standard 90.1.

\*\* 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*	Category	Rating Condition °F		Minimum Performance**
		Indoor Temp.	Outdoor Temp.	
ARI 210-81	≤65,000 Btu/h Cooling Capacity	Standard Rating		9.3 EER
		80°F db/67°F wb	95°F db/75°F wb	
ARI 210/240-84	<65,000 Btu/h	Integrated Part Load Value (80°F db/67°F wb)		8.5 IPLV
	≥65,000 <135,000 Btu/h	Standard Rating		10.5 EER
CTI 201 (86)	≥65,000 <135,000 Btu/h	80°F db/67°F wb	95°F db/75°F wb	
		Integrated Part Load Value (80°F db/67°F wb)		9.7 IPLV

\* For detailed references, see ASHRAE Standard 90.1.

\*\* EER = Energy Efficiency Ratio, IPLV = 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**  
**--Cooling Mode <135,000 Btu/h Cooling Capacity, Electrically Operated**

Reference Standards*	Category	Rating Condition °F		Minimum Performance**
		Indoor Air	Entering Water	
Water-Source Heat Pumps	<65,000 Btu/h Cooling Capacity	<u>Standard Rating</u>		9.3 EER
		80°F db/67°F wb	85	
ARI 320-86 CTI 201 (86)	≥65,000 <135,000 Btu/h Cooling Capacity	<u>Low Temperature Rating</u>		10.2 EER
		80°F db/67°F wb	75	
Groundwater Cooled Heat Pumps	<135,000 Btu/h Cooling Capacity	<u>Standard Rating</u>		11.0 EER
			70	
ARI 325-85		<u>Low Temperature Rating</u>		11.5 EER
			50	
Water-Cooled Unitary Air Conditioners	<65,000 Btu/h Cooling Capacity	<u>Standard Rating</u>		9.3 EER
		80°F db/67°F wb	85	
ARI 210-81 ARI 210/240-84 CTI 201 (86)	≥65,000 <135,000 Btu/h Cooling Capacity	<u>Integrated Part Load Value</u>		8.3 IPLV
			75	
		<u>Standard Rating</u>		10.5 EER
		80°F db/67°F wb	85	

\* For detailed references, see ASHRAE Standard 90.1.

\*\* EER = Energy Efficiency Ratio, IPLV = 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 TACs & PTAC H.P.'s	Sub-Category & Rating Condition (Outdoor Temp.)	Efficiency Rating	Minimum Performance <sup>b</sup>
ARI 310-87	Cooling Mode	Standard Rating (95°F db)	EER	10.0 - (0.16 x Cap./1000)
		Low Temp. Rating (82°F db)	EER	12.2 - (0.20 x Cap./1000)
ARI 380-87	Heating Mode	Standard Rating (47°F db/43°F wb)	COP	2.9 - (0.026 x 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 Performance <sup>d</sup>
Water-Source Heat Pumps ARI 320-86 CTI 201-(86)	<u>Standard Rating</u> 70°F Entering Water <sup>b</sup>	3.8 COP
Groundwater-Source Heat Pumps ARI 325-85	1. High Temperature Rating 70°F Entering Water <sup>b</sup>	3.4 COP
	2. Low Temperature Rating 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 Reference Standards <sup>c</sup>	Efficiency Rating <sup>d</sup>	Minimum Performance	
Air Conditioners <sup>a</sup> Air Cooled ARI 360-86	EER	≤760,000 Btu/h: 8.5	>760,000 Btu/h: 8.2
	IPLV	7.5	
Air Conditioners <sup>a</sup> Water/Evaporatively Cooled ARI 360-86 CTI 201-86	EER	9.6	
	IPLV	9.0	
Heat Pumps <sup>a</sup> Air Cooled-Cooling Air Cooled-Heating ARI 340-86	EER	<760,000 Btu/h: 8.5	≥760,000 Btu/h: 8.2
	IPLV	7.5	
	COP (47°F)	2.9	
	COP (17°F)	2.0	
Condensing Units <sup>b</sup> Air Cooled ARI 365-87	EER	9.9	
	IPLV	11.0	
Condensing Units <sup>b</sup> Water/Evaporatively Cooled 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, Electrically Operated**

Reference Standards <sup>b</sup>	Category	Efficiency Rating <sup>c</sup>	Minimum Performance
ARI 550-86 & ARI 590-86 CTI 201-86	Water-Cooled		
	≥300 Tons	COP	5.2 <sup>a</sup>
		IPLV	5.3 <sup>a</sup>
	≥150 Tons <300 Tons	COP	4.2
		IPLV	4.5
	<150 Tons	COP	3.8
		IPLV	3.9
	Air-Cooled With Condenser		
	≥150 Tons	COP	2.5
		IPLV	2.5
	<150 Tons	COP	2.7
		IPLV	2.8
Condenserless, Air-Cooled			
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 <sup>a</sup>	Minimum Performance <sup>c</sup>
ANSI Z21.13-87 H.I. Htg. Boiler Std. 86 ASME PTC 4.1-64 U.L. 795-73	Gas-Fired ≥300,000 Btu/h	1. Max. Rated Capacity Steady-State	E <sub>c</sub> 80%
		2. Min. Rated Capacity Steady-State	E <sub>c</sub> 80%
U.L. 726-75 H.I. Htg. Boiler Std. 86	Oil-Fired ≥300,000 Btu/h	1. Max. Rated Capacity Steady-State	E <sub>c</sub> 83%
		2. Min. Rated Capacity Steady-State	E <sub>c</sub> 83%
H.I. Htg. Boiler Std. 86 ASME PTC 4.1-64	Oil-Fired (Residual) ≥300,000 Btu/h	1. Max. Rated Capacity Steady-State	E <sub>c</sub> 83%
		2. Min. Rated Capacity 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 <sup>a</sup>	Minimum Performance <sup>c</sup>
ANSI Z21.47-83	Gas-Fired ≥225,000 Btu/h	1. Max. Rated Capacity Steady-State	E <sub>t</sub> 80%
		2. Min. Rated Capacity Steady-State	E <sub>t</sub> 78%
U.L. 727-86	Oil-Fired <sup>d</sup> ≥225000 Btu/h	1. Max. Rated Capacity Steady-State	E <sub>t</sub> 81%
		2. Min. Rated Capacity 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 <sup>a</sup>	Minimum Performance <sup>c</sup>
ANSI Z83.9-86	Duct Furnaces Gas-Fired	1. Max. Rated Capacity Steady-State	$E_t$ 78%
		2. Min. Rated Capacity Steady-State	$E_t$ 75%
ANSI Z83.8-55	Unit Heaters Gas-Fired	1. Max. Rated Capacity Steady-State	$E_t$ 78%
		2. Min. Rated Capacity Steady-State	$E_t$ 74%
U.L. 731-88	Unit Heaters Oil-Fired	1. Max. Rated Capacity Steady-State	$E_t$ 81%
		2. Min. Rated Capacity Steady-State	$E_t$ 81%

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

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

<sup>c</sup> $E_t$  = 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> (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 Efficiency (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 12,000 Btu/hour	60
5. Gas wall gravity type over 12,000 Btu/hour up to 15,000 Btu/hour	61
6. Gas wall gravity type over 15,000 Btu/hour up to 19,000 Btu/hour	62
7. Gas wall gravity type over 19,000 Btu/hour up to 27,000 Btu/hour	63
8. Gas wall gravity type over 27,000 Btu/hour up to 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

*All Table 63.29-A should be "-1"  
63.31-A*

A63.29 ALTERNATIVE HVAC PIPING INSULATION TYPES. Insulation thicknesses in Table 63.29-A are based on insulation with thermal conductivities within the range listed in Table 63.29-A 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-A for the applicable fluid operating temperature range at the mean rating temperature shown (when rounded to the nearest 0.01 Btu in./(h °F ft<sup>2</sup>)), 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 63.31-A in.

K = conductivity of alternate material at the mean rating temperature indicated in Table 63.31-A for the applicable fluid temperature range, Btu in./(h ft<sup>2</sup> °F)

k = the lower value of the conductivity range listed in Table 63.31-A for the applicable fluid temperature range, Btu in./(h ft<sup>2</sup> °F)

Table A63.45-1

**Typical Lighting Power for Magnetically Ballasted Fluorescent Lamp-Ballast Systems (watts)**

	4 Lamps		3 Lamps		3 Lamps		2 Lamps	
	2 Ballasts		2 Ballasts		Tandem-Wired Ballasts		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 Combination	4 Lamps		3 Lamps		2 Lamps		1 Lamp	
	1 Ballast		1 Ballast		1 Ballast		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 F40T12	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.

Table A63.45-3

**Typical Lighting Power for Electronically Ballasted Instant-Start Fluorescent Lamp-Ballast Systems (watts)**

Lamp/Ballast Combination	4 Lamps 1 Ballast		3 Lamps 1 Ballast		2 Lamps 1 Ballast		1 Lamp 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 Combination	4 Lamps 1 Ballast		3 Lamps 1 Ballast		2 Lamps 1 Ballast		1 Lamp 1 Ballast	
	ANSI Watts	Ballast Factor	ANSI Watts	Ballast Factor	ANSI Watts	Ballast Factor	ANSI Watts	Ballast Factor
	17-watt F17T8	54(RS)	0.77			27(RS)	0.77	14(RS)
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 &amp; Electric

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

Next page is numbered 387

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

- (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, ANSI Z21.22;
  - (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, ANSI Z21.60;
  - (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 IR3:
  - (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;

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- (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.

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

TABULAR SUMMARY UL STANDARD 296 AND UL STANDARD 795

FUNCTION/BURNER INPUTS	OIL BURNERS UL 296				COMMERCIAL/INDUSTRIAL GAS UL 795				ATM Draft
	3 GPH	7 GPH	20 GPH	Over 20 GPH	Mechanical Draft Burners				
	400,000 Btu or less	1 million Btu or less	3 million Btu or less	3 million Btu or less	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	
Prepurge timing	--	--	--	--	4	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>16,17</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 ½ high fire rate; OR  
90 sec at ¼ 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>20</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 SHUTOFF VALVES (SSOV) FOR MECHANICAL OR ATMOSPHERIC BURNERS — UL 795 REQUIREMENTS, EFFECTIVE OCTOBER 1, 1974

	400,000 to 2,500,000 BTUH	Over 2,500,000 to 5,000,000 BTUH	Over 5,000,000 to 12,500,000 BTUH	Over 12,500,000 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. ½ inch or larger electrically operated valve in a vent line between the two SSOV's.