DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Office of Housing
Washington, D.C. 20410

REVISION NO. 8 "Minimum Property Standards for One- and Two-Family Dwellings, 4900.1"

May 1979

This transmits revised paragraphs for the captioned document. The revision is made to:

(1) Clarify criteria and eliminate inconsistencies in response to field, user and product association requests,

(2) Bring criteria in line with recognized codes,

(3) Delete gratuitous, procedural, programmatic and redundant material,

(4) Update reference material as necessary,

(5) Correct format and edit material in anticipation of reprinting the standards and

(6) Eliminate definitions easily obtainable from technical publications.

This revision is applicable to all HUD field office jurisdictions and is effective immediately.

Changes are indicated by an asterisk (*). The attached pages should be inserted in the captioned document and the corresponding old pages removed.

INTRODUCTORY STATEMENT

These Minimum Property Standards are intended to provide a sound technical basis for the planning and design of housing under the numerous programs of the Department of Housing and Urban Development. The Standards describe those characteristics in a property which will provide present and continuing utility, durability, desirability, economy of maintenance, and a safe healthful environment.

A property complying with these standards is considered technically adequate in all HUD field office jurisdictions. The requirements contained herein define the min. level of quality acceptable to HUD in each specific condition. The use of min. standards alone, however, will not necessarily achieve an acceptable or desirable end-product. Other factors, such as the appropriateness of the building to the site and to the neighborhood, and the acceptability of the property as a whole must be considered in determining eligibility.

Consideration of environmental quality is addressed throughout the text for specific subjects. As a general policy, development of all properties must be consistent with the national program for conservation of energy and other natural resources, and care must be exercised to avoid air, water, land and noise pollution and other hazards to the environment.

* The Minimum Property Standards consist of four volumes of mandatory standards. These are One- and Two-Family Dwellings, 4900.1; Multifamily Housing, 4910.1; Care-Type Housing 4920.1; and Intermediate Minimum Property Standards for Solar Heating and Domestic Hot Water Systems, 4930.2. Variations and exceptions for seasonal homes intended for other than year-round occupancy are listed in 4900.1. Exceptions for housing for elderly and handicapped are listed in 4900.1 and 4910.1. The Manual of Acceptable Practices 4930.1 is a technical, informational and guidance publication to assist in interpretation and use of the mandatory standards. The data, back-up explanations and details therein help in understanding the full intent of the mandatory standards. The Manual is in no sense an additional set of standards.

An effort has been made to present the material in the standards in the simplest manner that will define a min. level of acceptability and allow consistent interpretation by all users. The standards have been oriented to types of buildings rather than to programs or type of occcupancy. Where practicable, requirements have been stated in performance terms to permit flexibility. Dependence has been placed upon nationally recognized building industry standards and reference to them has been employed in the several appendices to each volume.

Where no specific level of performance is stated in the standards, the Manual of Acceptable Practices may be used to determine acceptance or equivalence. This manual is not an additional standard, but is intended, as the name implies, to provide illustrations and data representing good current practice in residential design and construction technology. It provides a broad coverage of information and is a guidance document only.

* The numbering system is the same for all four volumes of standards, and for the major headings of the Manual of Acceptable Practices. Within this numbering system, Chapter 5, Materials, and Chapter 6, Construction, are further subdivided into the sixteen divisions of the Uniform Construction Index, a recognized industry standard. This numbering system should permit each volume of standards to be used independently, or with the Manual of Acceptable Practices.

PURPOSE

These new physical standards for housing have been developed to improve and expand residential quality in our nation, and to accomplish the following purposes:

1. To combine the diverse standards for private housing for mortgage insurance financing with those for low-rent public housing into a single unified set of standards;

2. To update the various minimum property standards and related guide material following a careful review and analysis of previous provisions;

3. To provide improved design and construction standards based more on performance than has been true in the past, with appropriate flexibility to meet local conditions;

4. To encourage design innovations and improved building technologies giving promise of increased quality and reduced costs; and

5. To aid national and local efforts being made to improve the environmental factors of urban areas.

CHAPTER 1

GENERAL USE

100 APPLICATION

100-1 GENERAL

*100-1.1 These Minimum Property Standards for housing apply to buildings and to the sites upon which they are located. The buildings may consist of detached, semi-detached, duplex, or row houses. They may be site-built or factory manufactured. These standards also cover the immediate site environment for the dwellings, including streets, storm water disposal, and other services and facilities for the site.

*100-1.2 *Variations, additions, and exceptions to the basic standards for the above types of housing, which are applicable to housing designed for elderly or handicapped occupancy or to buildings otherwise required to be accessible to the physically handicapped, are identified in these standards by italic type.* CHANGES FOR SEASONAL HOMES NOT INTENDED FOR YEAR-ROUND OCCUPANCY ARE PRINTED IN CAPITAL LETTERS.

100-1.3 Standards for buildings other than those described above are contained in the Minimum Property Standards for Multifamily Housing, 4910.1, and in the Minimum Property Standards for Care-Type Housing, 4920.1.

100-2 PROPOSED CONSTRUCTION

Proposed construction shall comply with or exceed all applicable minimum standards contained herein.

100-3 EXISTING CONSTRUCTION

Existing construction, including repairs, additions and partially completed construction shall comply with the objectives of this MPS as stated in the paragraphs titled GENERAL. (A listing of all applicable paragraphs of this nature is given below by format number). Existing construction shall also comply with Chapter 2, General Acceptability Criteria, and with the intent of all other applicable standards. Work not started at the time of the request for HUD consideration shall conform to the specific standards when practicable.

100-3 EXISTING CONSTRUCTION (contd.)

100-1.1	311-1.1	509-1.1	606-1.1
[300]	400-1	600	607-1.1
[301-1]	402-1	602-1	608-1
[302-1]	403-1	603-1	609-1
305-1.1	404-1	604-1	615-1.1
[307-1.2]	405-1.1	605-1	616-1.1
[310-1.1 a, c, e]	500		

*100-4 REHABILITATION CONSTRUCTION

One and two family dwellings involving rehabilitation shall be guided by Handbook 4940.4, Minimum Design Standards for Rehabilitation for Residential Properties.

101 VARIATIONS TO STANDARDS

101-1 NEW MATERIALS AND TECHNOLOGIES

These standards are intended to encourage the use of new or innovative technologies, methods or materials. See 613. Alternatives, nonconventional or innovative methods and materials shall demonstrate, however, equivalent quality to these standards in structural soundness, durability, economy of maintenance or operation and usability.

101-2 SPECIAL CONDITIONS

Certain conditions in the geographic area or on the site may justify modification of specific standards, or make compliance with the standards impracticable or impossible. In these cases, variations in accordance with procedures given in 101-4 may be permitted.

101-3 HIGHER STANDARDS

The Minimum Property Standards are essentially min.; consequently, the field office may, for specific cases, require compliance with higher standards than contained herein where considered necessary to obtain those characteristics of livability, utility, services and low maintenance expense to assure continued acceptance. See Variation Procedures 101-4.

101-4 VARIATION PROCEDURES

101-4.1 Variations to design and planning standards and to construction methods and materials demonstrating equivalency shall be made in the following ways:

For [ ] See Note 1 on page 3-5.

*101-4.2 For a particular design or construction proposed to be used on a non-repetitive basis for a specific case or project, the decision is the responsibility of the field office. Headquarters concurrence is not required.

*101-4.3 Where a variation is intended to be on a repetitive basis, a recommendation for a Local Acceptable Standard, substantiating data, and background information shall be submitted by the field office to the Director, Office of Architecture and Engineering Standards, HUD, Washington, D.C. for determination of acceptance.

102 LOCAL CODES AND REGULATIONS

102-1 STANDARDS AS CODES

102-1.1 These standards are not intended to serve as a building code. Such codes are primarily concerned with factors of health and safety and not the many other aspects of design and use which are included herein as essential for continued acceptance by the occupants.

102-1.2 Where the local code, regulation or requirement permits lower standards than required herein, these Minimum Property Standards shall apply. In the event the local code, regulation or requirement precludes compliance with these standards, the property may be ineligible unless the intent set forth herein is fully attained by the alternate means proposed.

102-2 COMPLIANCE WITH CODES

102-2.1 These min. standards shall not be construed as relieving the builder of his responsibility for compliance with local ordinances, codes and regulations including established requirements of a health authority having jurisdiction.

102-2.2 The Department of Housing and Urban Development does not assume responsibility for enforcing or determining compliance with local codes and regulations or make interpretations regarding their application in any specific instance.

103 INDEPENDENT INSPECTION AGENCY

Where the term "independent inspection agency" is used in these standards, the reference is to an agency which maintains a program of continuous control, testing and inspection over the quality of the product. Such an agency must conform to procedures set forth in ANSI Z34.1, and shall be acceptable to HUD.

c. *In housing for the elderly, beds shall be accessible from two sides and one end.*

401-3.4 RESERVED

*401-3.5 Combined Spaces

a. Where required habitable rooms are combined into multi-use spaces for compatible functions, the furniture requirements and circulation space for each area shall be applied to the multi-use space.

b. For efficiency apartments, the combined living-dining sleeping space shall accommodate the living space requirements in 401-3.1, dining space in 401-3.2, and sleeping space requirements in 401-3.3b(3).

401-3.6 Optional Minimum Room Sizes

Table 4-1.1 may be used in lieu of furnishability requirements in 401-3.1 through 401-3.5. When the table is used for any room, it shall be used for all rooms within the dwelling.

TABLE 4-1.1

MIN. ROOM SIZES

*A. Min. Room Sizes for Separate Rooms

Names of Space (1)	Min. Area (Sq Ft) (7)					Least Dimension
	LU with 0-BR	LU with 1-BR	LU with 2-BR	LU with 3-BR	LU with 4-BR	
LR	NA	160	160	170	180	11'-0"
DR	NA	80	80	95	110	8'-0"
BR (primary) (2)	NA	120(8)	120	120	120	9'-4"
BR (secondary)	NA	NA	80	80	80	8'-0"
Total area, BR's	NA	120	200	280	380	---

B. Min. Room Sizes for Combined Spaces

Combined Space (1) (4)	Min. Area (Sq Ft) (7)					Least Dimension(3)
	LU with 0-BR	LU with 1-BR	LU with 2-BR	LU with 3-BR	LU with 4-BR	
LR-DA	NA	180	180	200	220	---
LR-DA-SL	220	NA	NA	NA	NA	---
LR-DA-K (5)	NA	220	220	250	280	---
LR-SL	180	NA	NA	NA	NA	---
K-DA (6)	80	100	100	110	120	---

Notes

(1) Abbreviations:

LU = Living Unit
LR = Living Room
DR = Dining Room
DA = Dining Area
O-BR = LU with no separate Bedroom
K = Kitchen
NA = Not Applicable
BR = Bedroom
SL = Sleeping Area

(2) Primary bedrooms shall have at least one wall space of at least 10 ft uninterrupted by openings less than 44 in. above the floor.

(3) The min. dimensions of a combined room shall be the sum of the dimensions of the individual single rooms involved, except for the overlap of combined use of space.

(4) For two adjacent spaces to be considered a combined room, the horizontal opening between spaces shall be at least 8 ft 0 in., except that between kitchen and dining functions, the opening may be reduced to 6 ft - 0 in. Spaces not providing this degree of openness shall meet min. room sizes required for separate rooms.

(5) A combined LR-DA-K shall have a clear opening between the kitchen and dining area of at least 4 ft - 0 in.

(6) These required minima apply when the only eating space is in the kitchen.

(7) The floor area of an alcove, or recess off a room, having a least dimension less than required for the room, shall be included only if it is not more than 10 percent of the min. room size permitted and is useful for the placement of furniture.

*(8) *In a one bedroom living unit in housing for elderly, the bedroom may have an area of 80 sq ft min. unless designed for occupancy by a wheelchair user.*

401-3.7 SEASONAL HOMES SHALL HAVE AT LEAST TWO HABITABLE ROOMS WHICH, FOR THE INTENDED SEASON OF OCCUPANCY, COMPLY WITH THE GENERAL OBJECTIVES FOR LIVING, DINING, AND SLEEPING SPACES. THE FOLLOWING MIINIUM ROOM SIZES MAY BE USED IN LIEU OF FURNISHABILITY REQUIREMENTS.

LIVING ROOM:	120 SQ TT
LIVING - SLEEPING:	150 SQ FT
LIVING - COOKING:	150 SQ FT
PRIMARY SLEEPING:	90 SQ FT
SECONDARY SLEEPING:	70 SQ FT

401-4 KITCHEN, BATHS, LAUNDRY

401-4.1 Kitchen

a. Each dwelling shall have a kitchen area which provides for efficient food preparation, serving and storage, as well as utensil storage and cleaning up after meals.

b. Kitchen fixtures and countertops shall be provided in accordance with Table 4-1.2. Required countertops shall be approximately 24 in. deep and 36 in. high. Clearance between base cabinet fronts in food preparation area shall be 40 in. min.

c. Required countertops may be combined when they are located between two fixtures -- stove, refrigerator, sink. Such a countertop shall have a min. frontage equal to that of the larger of the countertops being combined. This combined counter may also be the mixing counter when its min. length is equal to that required for the mixing counter. Countertop frontages may continue around corners. A 72 in. compact kitchen with wall cabinets may be used in efficiency living units *except in housing for the elderly.*

d. *In housing for the elderly, a 72 in. compact kitchen with wall cabinets and with refrigerator not below the countertop may be used in any size living unit.*

TABLE 4-1.2

COUNTERTOPS AND FIXTURES

	Number of Bedrooms				
	0	1	2	3	4
Work Center	Minimum Frontages in Lineal In.				
Sink (1)	18	24	24	32	32
Countertop, each side	15	18	21	24	30
Range or Cooktop Space (2)(3)(6)	21	21	24	30	30
Countertop, one side (4)	15	18	21	24	30
Refrigerator Space (5)	30	30	36	36	36
Countertop, one side (4)	15	15	15	15	18
Mixing Countertop	21	30	36	36	42

*Notes

(1) When a dishwasher is provided, a 24 in. sink is acceptable.

(2) Where a built-in wall oven is installed, provide an 18 in. wide counter adjacent to it.

(3) A range burner shall not be located under a window nor within 12 in. of a window. Where a cabinet is provided above a range, 30 in. clearance shall be provided to the bottom of an unprotected cabinet, or 24 in. to the bottom of a protected cabinet.

(4) Provide at least 9 in. from the edge of a range to an adjacent corner cabinet and 15. in. from the side of a refrigerator to an adjacent corner cabinet.

(5) Refrigerator space may be 33 in. when a refrigerator is provided and the door opens within its own width.

(6) When a range is not provided, a 30 in. wide space shall be provided.

e. Kitchen storage shelf area shall be provided in accordance with Table 4-1.3. At least one third of the required area shall be located in base or wall cabinets. At least 60 percent of the required area shall be enclosed by cabinet doors.

TABLE 4-1.3

KITCHEN STORAGE AREA

Storage Location	Number of Bedrooms 0	1	2	3	4
Min. Sq Ft Shelf Area (1,2,3,4)	24	30	38	44	50
Min. Sq Ft Drawer Area (5)	4	6	8	10	12

Notes

(1) A dishwasher may be counted as 4 sq ft of base cabinet storage.

(2) Wall cabinets over refrigerators shall not be counted as required shelf area.

(3) Shelf area above 74 in. shall not be counted as required area.

(4) Inside corner cabinets shall be counted as 50 percent of the shelf area, except where revolving shelves are used, the actual shelf area may be counted.

(5) Drawer area in excess of the required area may be counted as shelf area if drawers are at least 6 in. in depth.

f. *In housing for the elderly, at least one half of the 10 percent of the living units with bathrooms designed for wheelchair users shall have kitchen equipment, work space and storage space that is accessible to and usable by wheelchair occupants.*

g. FOR SEASONAL HOMES, THE FOLLOWING KITCHEN REQUIREMENTS MAY BE USED IN LIEU OF THE PRECEDING CRITERIA:

(1) 5 LIN FT OF BASE CABINET

(2) 5 LIN FT OF WALL CABINET

(3) 6 SQ FT OF COUNTERTOP

(4) SEPARATE KITCHENS SHALL HAVE A MINIMUM AREA OF 50 SQ FT

401-4.2 Baths

a. Each dwelling unit shall have one bathroom containing a bathtub with a min. outside width of 30 in., a lavatory and water closet. In other bathrooms showers may be substituted for bathtubs. Bathrooms shall provide for comfortable access to, and use of, each fixture. Bathrooms shall be convenient to the bedrooms.

b. A SEASONAL HOME SHALL CONTAIN AT LEAST ONE LAVATORY, WATER-CLOSET, AND BATHTUB OR SHOWER. THE ACCESSORIES LISTED IN 401-4.2c ARE NOT REQUIRED.

*c. Bathrooms shall be provided with the following accessories:

(1) Grab-bar and soap dish at tub or shower

(2) Shower curtain rod or enclosure at shower

(3) Toilet paper holder at watercloset

(4) Mirror and medicine cabinet or equivalent enclosed storage

(5) One towel bar convenient to tub and lavatory

d. Each half bath shall be provided with items 3, 4, and 5, in 401-4.2c.

e. Stall showers shall have a min. area of 1024 sq in. and a least dimension of 30 in.

f. Water impervious wainscot shall be provided at walls around showers or tub-showers to a min. height of 6 ft from finished floor.

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CHAPTER 5 - MATERIALS

D I V I S I O N 5

505 METALS

505-1 STEEL

505-1.1 Structural Steel

Structural steel used in building construction shall conform to the ASTM standard appropriate to its grade and use.

505-1.2 Concrete Reinforcement

Reinforcing steel shall be in accordance with the recommendations of the American Concrete Institute.

505-2 ALUMINUM

Aluminum shall be in accordance with the Specifications for Aluminum Structures of the Aluminum Association.

505-2.1 Wrought Alloys

Wrought aluminum alloys shall fall within the following composition limits:

Silicon	7.0% max.
Magnesium, Manganese, Chromium	6.0% total max.
Iron	1.0% max.
Copper	0.4% max.
Zinc	1.0% max.
Others	0.5% total max.
Aluminum	Balance

These limits apply to both bare products and the core of clad products. The cladding of clad products shall be within the same limits except that the maximum zinc limit may be 2.5 percent in order to assure that the cladding is anodic to the core.

Special wrought alloys with a silicon content up to 7.0 percent may be acceptable for structural uses where special appearance is desired.

505-2.2 Cast Aluminum Alloys

Cast aluminum alloys shall be those in which the alloying elements are silicon, magnesium, manganese or a combination of these. Other elements shall not exceed the following limits:

Iron	1.2% max.
Copper	0.4% max.
Nickel	0.4% max.
Titanium	0.2% max.
Others	0.5% total max.

505-3 ANCHORS AND TRUSS PLATES

505-3.1 Metal Framing Anchors and Truss Plates

Metal framing anchors and truss plates less than 1/8 in. in thickness shall be zinc coated or coated to give corrosion protection.

505-3.2 Light Gauge Sheet Metal Work

Light gauge sheet metal for non-structural work shall be in accordance with 507.

505-4 METAL CURTAIN WALLS

Metal curtain walls shall comply with NAAMM Specifications (See Appendix C). Each metal curtain wall panel shall bear the manufacturer's label and certification of compliance with applicable standards.

*505-5 CORROSION-RESISTANT METALS

The following metals are considered to be corrosion resistant:

Sheet metal, nails or hardware of aluminum alloys, brass, bronze, copper, galvanized steel, lead, stainless steel, terne plate, or zinc-copper alloys.

DIVISION 6

506 CARPENTRY

506-1 GENERAL

506-1.1 Material shall comply with specific grading requirements of the association recognized as covering the material or species used, and under whose grading rules it is produced.

506-1.2 Structurally end-jointed lumber, may be used interchangeably with solid sawn lumber of the same grade and species.

506-1.3 Edge-glued and finger jointed end-glued kiln dried lumber may be used for non-structural purposes, interior and exterior. Adhesives for non-structural end- and edge-glued lumber products shall conform to ASTM D 3110, Standard Specification for Adhesives Used in Non-Structural Glued Lumber Products. When considered necessary by the HUD field office, data may be required.

506-1.4 All sidings are covered in Division 509.

506-2 GRADEMARKING AND LABELING

*506-2.1 Lumber

Dimension and board lumber, and timbers shall be identified by the grademark of the recognized grading association or of an independent lumber grading inspection agency authorized to grade the species. The association or independent inspection agency and the grading rules under which they grade shall be certified by the Board of Review, American Lumber Standards Committee. See Appendix F.

506-2.2 Structurally End-Jointed Lumber and Glue Laminated Timber

Material shall be certified and grade marked in accordance with appropriate provisions of PS 56.

506-2.3 Plywood

Each sheet of plywood used structurally or as underlayment shall bear the mark of a recognized association or independent agency. See Appendix F.

*506-2.4 Pressure Treated Lumber for Termite Protection

Lumber or plywood required to be treated for protection against termite infestation shall be labeled with a permanent mark, indicating conformance with the applicable standard, and the information required by the standard shall appear on the label. The label shall be an approved quality-mark of an independent inspection agency that is acceptable to the HUD field office. See 606-2.3 and Appendix F.

506-2.5 Fire Retardant Lumber

Each piece of fire retardant pressure treated lumber and plywood shall be labeled with a permanent mark which indicates a classification of pressure treated wood that does not have a flame spread rating higher than 25, with no evidence of significant progressive combustion when tested for 30 minute duration. The label shall be the Underwriters' Laboratories, Inc. FR-S label, or that of an independent inspection agency.

506-2.6 Fiberboard Sheathing

a. Each sheet of intermediate density sheathing shall be permanently marked "Intermediate." In addition to such marking, producers shall be prepared to provide certification to the HUD field office that their 1/2 in. Intermediate Fiberboard Sheathing complies in all respects with AIMA IB Specification No. 3.

b. Each sheet of nail base sheathing shall be permanently marked "Nail-Base." In addition to such marking, producers shall be prepared to provide certification to the HUD field office that their 1/2 in. Fiberboard Nail-Base Sheathing complies in all respects with AIMA IB Specification No. 2.

506-2.7 Hardboard

Each panel or package of hardboard shall be labeled with the manufacturer's name, compliance with the applicable standard and with specific type of hardboard.

*506-2.8 Particleboard

Particleboard shall be grademarked as to its compliance with applicable standards. NPA or TECO grademarks shall be accepted as evidence that the material complies with these standards.

506-5.2 Hardboard

a. Hardboard shall be of the following types for the locations indicated:

(1) Exterior wall finish and other surfaces exposed to weather, Siding grade.

(2) Interior wall finish, baths or kitchens, Class I - Decorative grade.

(3) Other interior wall finish, Class I or II - Decorative grade.

(4) Floor underlayment, Underlayment grade.

b. Special hardboard products shall be evaluated in accordance with 513.

506-5.3 Particleboard

Particleboard floor underlayment shall comply with CS 236 Type 1-B1 and, in addition shall exhibit a max. thickness swelling of 0.063 in. when immersed in water for 24 hrs in accordance with ASTM C 1037.

*506-5.4 (RESERVED)

*506-5.5 Fiberboard Sheathing

Fiberboard sheathing shall be impregnated or coated to render it water resistant but vapor permeable. Sheathing used without corner braces shall comply with the criteria for resistance to racking for sheathing material as shown in Appendix D.

506-5.6 Sheathing Paper

Sheathing paper, when used, shall have a vapor permeance of not less than 5 perms.

506-5.7 Plywood

Plywood shall be of the type shown for specific location in Table 5-6.2.

506-5.7 Continued

*TABLE 5-6.2

PLYWOOD

Location	Exposed to Weather	Not Exposed to Weather
Ext wall finish	Ext	---
Int wall finish	---	Interior (2)
Int ceiling finish	---	Interior
Wall sheathing	(1)	Interior Const. or Ext
Roof sheathing	(1)	Interior Const. or Ext(6)
Subflooring	(1)	Interior Const. or Ext
Underlayment	---	Interior Const. (2)
Combin. subfloor-underlayment	(1)	Interior Const.
Truss gussets	Ext (3)	Ext (4)
Built-up structural members	Ext (3)	Ext (4)
Soffits	Ext (5)	---
Porch or carport ceiling	Ext (5)	---

Notes: (1) Plywood having edge or surface exposed to the weather including underside of roof overhangs, soffits and ceiling of porches and carports shall be exterior type. This does not apply to surfaces in ventilated attics or ventilated basementless spaces.

(2) Plywood underlayment and wall finish in bathrooms shall have exterior glues.

(3) These shall be protected by roof covering or metal capping.

(4) Interior type may be used if bonded with exterior glues.

(5) May be sanded panels with surfaces painted according to 609-7.2a.

*(6) If subject to prolonged exposure during construction, use interior type with exterior glue.

507-7 GUTTERS AND DOWNSPOUTS

507-7.1 Gutters

a. Sheet metal shall comply with 507-5.

b. Wood gutters shall be of a natural resistant species or equivalent.

507-7.2 Downspouts

a. Sheet metal for ext. downspouts shall comply with 507-5.

*b. Int. downspouts shall be cast iron, steel or copper pipe, ABS or PVC plastic pipe. See Appendix F.

507-8 SPECIAL FLASHING MATERIALS

Special flashing materials such as bituminous fabrics, plastics, combination flashings, etc., are considered non-standard materials, See 513.

TABLE 5-7.1

SHEET METAL USES

USE	MATERIALS								
	Aluminum (8)		Copper (9)	Galv. Iron or Steel (10)		Sheet Lead (11)	Stainless Steel	Terne Plate (12)	Zinc-Copper Alloy (13)
	Minimum			Minimum Gage					
	Thickness	Tensile Strength	Minimum Thickness	G90 (1.25 oz.)	G115 (1.50 oz.)	Minimum Weight	Minimum Thickness	Min. Gage	Minimum Thickness
	in. (1)	psi	in.	ga.	ga.	psf	in.	ga.	in(2)
Areaways	---	---		16	18	---	---	---	---
Flashing									
exposed	.019	16,000	.020	26	28	2.5	.015	30	.020
concealed	.015	14,000	.012	28	30	1.5	.010	30	.012
head	.024	16,000	.020	28	28	---	.015	30	.020
Gutters	.027	16,000	.020(6)	26	26	---	.015	---	.025
Downspouts	.020	14,000	.020(6)	26	28	---	.015	---	.025
Roofing	*.024(3)	19,000	.020	26	28	3.0	.015	---	.020(2)
Siding	(4)	---	---	26(7)	26(7)	---	---	---	---
Roof Valley	.019	16,000	.020	26	28	2.5	.015	30	.020
Gravel Stops (fascias)	.024	19,000	.020	26	28	---	.015	---	.020
Ventilators	.027	16,000	---	26	28	---	---	---	---
Ductwork	(5)	16,000	---	(5)	(5)	---	---	---	---
Shower Pans	---	---	.015	---	---	4.0	---	---	---

(See Notes for TABLE 5-7.1 on next page)

Notes For Table 5-7.1

(1) Thickness shown is nominal thickness. Actual min. thickness may be 0.002 in. less to allow for rolling tolerance.

(2) Zinc-copper alloy gutters, downspouts, roofing, or other fabricated products where additional stiffness is required shall be of semi-cold rolled temper and shall contain not less than 0.80 percent copper.

*(3) Roof shingle thickness 0.019 in. min.

*(4) Siding materials shall comply with AAMA - 1402.3.

*(5) Comply with NFPA-90-B.

(6) Use cold-rolled temper copper.

(7) When baked acrylic or vinyl finish on face is proposed for galv steel siding, pretreat with hot phosphate or chromate prior to applying baked acrylic or vinyl finish on the face and wash coat primer on the reverse side.

(8) The following uses of aluminum alloys shall be protected by suitable means:

(a) Aluminum alloys used in contact with other metallic materials, except zinc.

(b) Aluminum alloys in contact with concrete, masonry, or with other absorbent materials likely to be continuously or repeatedly wet.

Aluminum conduit, piping or ductwork shall not be imbedded in concrete slabs, columns, beams, or walls.

Aluminum alloys shall not be used in contact with wood containing wood preservatives other than pentachlorophenol, Wolman salts, creosote, or zinc naphthanate. Contacting surface of aluminum shall be protected by suitable means.

Nails, screws, hangers, clips, and other accessory products used with aluminum siding, roofing, gutters, downspouts, etc., shall be aluminum except that hot-dipped galv gutter spikes may be used.

(9) Copper used in contact with other metallic materials except lead shall be protected by suitable means.

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Notes for Table 5-7.1 - Continued

(10) Galv iron or steel, used in contact with other metallic materials except zinc shall be protected by suitable means.

Nails and fittings used with galv sheet metal shall be galv.

(11) Stainless steel used in contact with other metallic materials shall be protected by suitable means.

Nails and fittings shall be stainless steel.

(12) Terne plate used in contact with other metallic materials shall be protected by suitable means.

(13) Zinc-copper alloys used in contact with copper or high-copper alloys shall be protected by suitable means.

Nails and fittings used with zinc-copper alloys shall be hot-dipped galv or aluminum alloy.

508-5.3 Aluminum Windows

Aluminum windows shall bear the label of an independent inspection agency. The label shall identify the manufacturer by name or symbol, and shall certify compliance with the applicable standard.

508-6 WOOD WINDOWS

508-6.1 Operating Wood Windows

Operating windows shall be manufactured units including frame, sill, sash, weatherstripping and operating hardware. Job site assembled windows composed of frames and sash made by different manufacturers are not acceptable.

Each operating wood window unit shall bear the label of an independent inspection agency. The label shall identify the manufacturer by name or symbol and shall certify compliance with the applicable standard. See Appendix F for accepted independent inspection agencies.

508-6.2 Fixed Sash Windows

Fixed sash windows (picture windows, bay windows) may be manufactured units or job-built or job assembled units of stock or special sash and frames.

508-6.3 Decay Treatment Requirements

For decay treatment requirements, see 506-2.9 and 606-3.

508-7 HARDWARE

*508-7.1 Hardware shall comply with 402-3.4. Locks shall meet or exceed the performance criteria of ANSI A156.2 for the series and grades as follows:

a. Living unit entrance doors and building entrance doors serving one or two families, series 4000, grade 2.

b. Doors within living units, series 4000, grade 3.

The performance criteria are considered to be Sections 8, 9 and 10 of ANSI A156.2. Evidence of conformance shall be provided to the HUD field office when requested.

Use three butts on all exterior doors.

*508-7.2 Labeling

Locks shall be labeled as complying to the performance criteria of the applicable series and grade of ANSI A156.2. This information shall appear on the lock or in the installation instructions or on the packing box.

508-7.3 Screening

a. Insect screening for windows shall be 18 x 14 mesh or equivalent.

b. Hardware cloth for ventilators shall be 8 x 8 mesh.

c. Structural spaces may be ventilated by prefabricated panels having slots not exceeding 1/8 in. x 1 in.

508-8 GLAZING PANELS

508-8.1 Safety Glazing

a. Safety glazing materials shall be used in the locations specified by and shall be in compliance with the Consumer Product Safety Commission's (CPSC) Safety Standard for Architectural Glazing Materials. Table 5-8.1 shows the location and product category required by CPSC.

TABLE 5-8.1

TABLE OF SAFETY GLAZING REQUIREMENTS

Glazing Location	Size of Individual Panes	Product Category (2)
Doors, Storm doors, Combination doors, Glazed panels (1)	Not greater than 9 sq ft	I
	Greater than 9 sq ft	II
Shower and bathtub doors and enclosures	All sizes	II
Sliding glass doors (patio type)	All sizes	II

509-3.3 Conditions of Use

Wood shingles shall be No. 1 or No. 2.

509-4 INTERIOR WALL AND CEILING FINISHES

509-4.1 Materials

See Table 5-6.2 for plywood.

509-4.2 Labeling

Hardwood plywood shall be labeled to show the grade, species and stain or simulated decorative finish of the face ply and compliance with the applicable standards.

509-4.3 Conditions of Use

*a. Wall finishing materials shall provide a washable finish to the extent of removing ordinary household stains. The finish of walls in kitchens, bathrooms and laundries shall be resistant to damage from grease, water, detergents and normal household chemicals.

b. Wainscot in showers or tub enlosures with shower shall be materials recommended by manufacturer for this use.

c. Gypsum wallboard used as backing for wainscot in showers or tub enclosures shall be water resistant. Insulating (foil-backed) wallboard shall not be used in this area.

d. When hardboard is used, use Class I-Decorative grade hardboard for interior wall finish of bath, kitchens or laundries and Class I or II-Decorative grades hardboard for other interior wall finishes.

509-4.4 Elderly Housing

Abrasive wall finish such as a sand finish shall not be used in housing for the elderly.

509-4.5 SEASONAL HOMES

INTERIOR WALL AND CEILING FINISH IS NOT REQUIRED. EXTERIOR WALL STUDS, CEILING JOISTS, AND/OR RAFTERS MAY BE EXPOSED TO THE INTERIOR. INTERIOR PARTITIONS MUST HAVE FINISH MATERIALS ON AT LEAST ONE SIDE TO ASSURE PRIVACY. WHEN INTERIOR WALL AND CEILING FINISH IS PROPOSED, COMPLY WITH THE APPLICABLE STANDARDS.

509-5 FINISH FLOORING, RIGID

509-5.1 Materials

a. Wood flooring shall comply with the grading requirements of the association recognized as covering the material and under whose grading rules it is produced.

b. Underlayment and adhesives when used shall be as recommended by the manufacturer of the finish flooring.

509-5.2 Labeling

a. Each bundle or package of wood flooring shall be labeled with grade and species.

b. Ceramic tile shall be identified as required by the applicable referenced standard.

509-5.3 Conditions of Use

a. Wood flooring shall be kiln-dried or otherwise seasoned to moisture content approximately that which it will attain in service.

b. Floors in kitchens, laundries, and bathrooms shall be resistant to damage from grease, water, detergents, and household chemicals.

c. FOR SEASONAL HOMES, FINISH FLOORING IS NOT REQUIRED EXCEPT IN BATHROOMS AND TOILET COMPARTMENTS, OR WHEN SUBFLOORING IS SQUARE EDGE BOARD. IF PROVIDED, FINISH FLOORING SHALL COMPLY WITH APPLICABLE STANDARDS.

d. Floors in housing for the elderly shall be slip-resistant.

509-6 FINISH FLOORING, RESILIENT

509-6.1 Materials

a. Adhesives and underlayments shall be designed for the specific installations and as recommended by the manufacturer of the finish flooring.

b. Particleboard floor underlayment shall comply with Appendix C and, in addition, shall exhibit a maximum thickness swelling of 0.063 in. when immersed in water for 24 hr in accordance with ASTM D 1037.

509-6.1 - Continued

c. The thickness of resilient flooring may be less than required by the referenced standards in Appendix C, but not less than shown in Table 5-9.1.

*TABLE 5-9.1
MINIMUM RESILIENT FLOORING THICKNESSES

Material		Nominal Wearlayer Thickness (In.)	(2) Traffic Condition Where Material and Thickness are Acceptable			
			SMOOTH TILE		EMBOSSED TILE	
			Through Pattern	Surface Pattern	Through Pattern	Surface Pattern
Resilient Tile	Asphalt Tile	1/8	H	L	M	L
		3/32	M	L	L	L
	Rubber Tile	1/8	H	L	M	L
		5/64	M	L	L	L
	Vinyl Tile	.08	H	L	M	L
		.05	M	L	L	L
	Vinyl Asbestos Tile	1/8	H	M	M	L
		3/32	H	L	L	L
		1/16	M	L	L	L
Resilient Sheet (1)	Rotovinyl (3)	0.020	H			
		0.014	M			
		0.010	L			
	Vinyl Plastic (Backed) Sheet	0.050	H			
		0.030	M			
		0.020	L			
	Linoleum	0.090	H			
		0.050	M			

*Notes

(1) Wearlayer may be smooth, embossed or otherwise textured.

(2) H (heavy traffic) - public stairs, entrance corridors, lobbies, elevators
M (medium traffic) - stairs within living units and public areas except those designated under H above
L (light traffic) - areas within living units except stairs

(3) Floor covering with translucent or transparent vinyl surface with backing.

509-6.2 Labeling

Particleboard floor underlayment shall be grademarked as to its compliance with 509-6.1. NPA or TECO grademarks shall be accepted as evidence that the underlayment complies with these standards.

509-6.3 Conditions of Use

a. Hardboard used as floor underlayment, shall be underlayment grade.

b. Floors in kitchens, laundries, and bathrooms shall be resistant to damage from grease, water, detergents, and household chemicals.

c. FOR SEASONAL HOMES, FINISH FLOORING IS NOT REQUIRED EXCEPT IN BATHROOMS AND TOILET COMPARTMENTS, OR WHEN SUBFLOORING IS SQUARE EDGE BOARD. IF PROVIDED, FINISH FLOORING SHALL COMPLY WITH APPLICABLE STANDARDS.

d. Floors in housing for the elderly shall be slip-resistant.

509-7 PAINTING

509-7.1 History of Use

All paints, stains or other coatings shall have a history of satisfactory use under conditions equal to or similar to the conditions present in the area concerned.

509-7.2 Record of Use

When considered necessary, experience records of sufficient duration to permit evaluation of the material's suitability may be required.

*509-7.3 Lead Content

No paint shall contain more than .06 percent lead by weight (or the amount permitted by the current HUD regulation) calculated as lead metal in the total non-volatile content of liquid paints or in the dried film of paint already applied.

509-7.4 Suitability

The paint, stain or coating system selected shall be designed for and recommended by the manufacturer for the specific use proposed. The printed application instructions shall clearly identify the suitability of the material for the type of exposure (exterior or interior), the type of surface to be covered (wood, metal, masonry, concrete, plaster, etc.) and the conditions to which the paint will be subjected (exposure to moisture, frequent washing, relatively heavy traffic, etc.). If a paint proposed for exterior surfaces is not inherently mold resistant, a suitable fungicide shall be included in the formulation.

*509-7.5 Washability

Interior finish coat shall provide a washable finish to the extent of removing ordinary household stains. The finish of walls in kitchens, bathrooms and laundries shall be resistant to damage from grease, water, detergents and normal household chemicals.

509-8 WALL COVERINGS

509-8.1 General

Wall coverings shall be of such kind and quality for a given material to assure (a) intended life, (b) renewability and (c) resistance to damage from grease, water, detergents and normal household chemicals in kitchens, bathrooms and laundries.

509-8.2 Wallpaper

a. Wallpaper colors shall be sunfast and waterfast.

b. Wallpaper in kitchen and bathrooms shall be of the water resistant type.

509-9 OTHER FINISHES

509-9.1 Other finishes installed shall be of such kind and quality to assure adequate rigidity, fire safety, resistance to moisture in areas subject to moisture and reasonable durability and economy of maintenance.

509-9.2 Carpeting and cushioning standards are listed in Appendices C and F.

D I V I S I O N 12

*512 FURNISHINGS

512-1 CARPETS AND MATS

For carpets and mats, see Appendices C & F.

D I V I S I O N 1

601 GENERAL STRUCTURAL REQUIREMENTS

*601-1 SUBSURFACE SOIL EXPLORATION

601-1.1 The scope and type of soil investigation shall be sufficient to permit structural design that will suit the soil conditions present at the building site.

601-1.2 All soils shall be identified by the nomenclature of ASTM D 2487 Classification of Soils for Engineering Purposes, ASTM D 2488, Recommended Practice for Description of Soils or HUD Handbook 4075.8, Engineering Soil Classification for Residential Developments.

601-2 STRUCTURAL DESIGN

601-2.1 General

All structural design for buildings and structures shall be based on generally accepted engineering practices. All loadings shall be in accordance with ANSI A58.1 except as shown otherwise in this Standard.

601-2.2 Earthquake Design

Seismic design shall be in accordance with ANSI A58.1 except as noted in 601-9, Earthquake Loads.

601-3 DESIGN DEAD LOADS

In calculating the dead loads, the actual weight of the material making up the construction shall be used, except as otherwise specified herein. Partitions and other known loads caused by special installation, such as stationary equipment shall be included in arriving at the applicable dead loads. Where a choice of materials is permitted, design dead loads shall be based on the heavier material except that design dead load for resistance to uplift, overturning or displacement shall be based on the lighter material.

601-4 DESIGN LIVE LOADS

601-4.1 General

Design live loads shall consist of the weight of all moving and variable loads that may act on the building or other structures including loads on floors, operational loads on roofs and ceiling, but not including wind, snow, earthquake or dead load. The design live loads specified herein are min. If local building code requirements are higher than those contained herein, the local code requirements shall be used.

601-4.2 Floor and Ceiling Loads

Design live floor and ceiling loads shall be not less than the uniformly distributed loads shown in Table 6-1.1.

601-4.3 Concentrated Loads

Consideration shall be given to effect of concentrated wheel loads on structures. Floors in garages or portions of buildings used for storage of passenger cars for not more than nine passengers shall be designed for the designated uniform live loads of Table 6-1.1 or 2000 lb acting on an area of 20 sq in.

TABLE 6-1.1

FLOOR OR CEILING LIVE LOADS

Location	Live Load (psf)
Dwelling rooms (other than sleeping quarters)--	40
Dwelling rooms (sleeping quarters and attic floors)----------	30
Ceiling joist-attics (served by permanent or disappearing stair)----------	30
Ceiling joist-attics (limited storage roof slope over 3 in 12)----------	20
Ceiling joists-attics (without storage roof slope 3 in 12 or less)----------	10
Stairs----------	60
Public stairs and corridors (two family dwellings----------	60
Garages and carports (passenger cars)---------	75(1)
Balconies and porches----------	60
Sidewalks and driveways----------	250

Note: (1) See 601-4.3, Concentrated Loads

*601-10 COMBINED LOADS

All live loads shall be considered to act in the combinations listed in ANSI A58.1 or in the applicable codes cited in this standard whichever produce the most unfavorable effects in the building, foundation or structural member concerned, reduced when appropriate in accordance with HUD standards. See 601-4.5.

*601-11 DESIGN DEFLECTIONS

Max. permissible design deflections for:

Concrete - ACI 318, Building Code Requirements for Reinforced Concrete.

Structural steel and open web joists - AISC Manual of Steel Construction.

Wood - AITC Timber Construction Manual.

Wood floors, ceiling joists and rafters - NFPA Span Tables for Joists and Rafters.

Walls and Partitions. Deflection of exterior curtain walls and interior partitions shall not exceed 1/240 of the clear height between floors when subjected to the applicable wind load, acting either inwardly or outwardly, in addition to any gravity loads. If plaster or other brittle materials are used, deflection shall not exceed 1/360 of the clear height.

601-12 RESERVED

601-13 RESERVED

601-14 RESERVED

601-15 RESERVED

601-16 FOUNDATIONS

601-16.1 General

Foundations shall be proportioned to assure that the following objectives will be attained:

a. Loading of the soil supporting the selected type of foundation will not cause it to fail.

601-16.1 Continued

b. Foundations will be properly designed so that their structural failure is prevented.

c. The total settlement of the building will not be excessive so as to impair the usefulness of the structure.

d. The differential settlement between parts of the building will be controlled so that structural damage or inconvenience in service will not occur.

e. Neighboring structures will not be adversely affected by proposed construction.

601-16.2 Excavation and Backfill

a. Excavation for footings or foundation walls shall extend at least 6 in. into natural undisturbed soil which will provide adequate bearing or to stable rock formation.

Bearing for footings or foundations is permitted on controlled fills in certain localities where determined acceptable by the HUD field office. Land development for buildings on such controlled fills shall be engineered by a qualified engineer.

When the bearing capacity or stability of the soil is questionable, soil analysis, bearing tests or special foundation design shall be required.

Exterior wall footings or foundation walls including those of accessory buildings shall extend a min. of 6 in. below the finished grade and where applicable, below the prevailing frost line.

b. Basementless Spaces (Crawl Space)

*(1) Ground level shall be at least 18 in. below bottom of wood floor joists and 12 in. below bottom of wood girders except when pressure treated wood is used for these members. Where it is necessary to provide access for maintenance and repair of mechanical equipment located in the underfloor space, the ground level in the affected area shall be not less than 2 ft below wood floor joists.

601-16.2 b. Continued

*(2) The interior ground level shall be above the outside finish grade unless:

(a) Adequate gravity drainage to a positive outfall is provided or

(b) The permeability of the soil and the location of the water table is such that water will not collect in the basementless space.

(3) When drainage is necessary, the surface shall be properly sloped.

(4) Where soil and moisture conditions warrant, or when specifically required herein, surface shall be covered with a vapor barrier material. See 607.

c. Backfill

Material used for backfill shall be clean and free of wood scraps or other deleterious substances and shall be placed carefully against walls and shall be well compacted.

601-16.3 Footings

a. Wall Footings

(1) Bottom of footings shall be level. When size of footing is not determined by design, footing shall be as required by the HUD field office. Footings shall be of concrete or other suitable material. Side forms shall be used for concrete where conditions prevent shaped trenches.

(2) Min. thickness shall be 6 in., and unless reinforced, not less than 1 1/2 times the footing projection.

(3) Footings poured integrally with wall, flared or otherwise, may be used when properly designed and when soil and climate conditions permit trench foundations. The slope of flare shall be not less than 60 degrees from horizontal.

601-16.3 Continued

b. Stepped Wall Footings. Vertical step shall not exceed 3/4 of the horizontal distance between steps. Horizontal distances between steps shall be not less than 2 ft. Horizontal and vertical steps shall be placed monolithically. Vertical connection shall be the same width as the footing and not less than 6 in. in thickness.

c. Pier, Column and Masonry Chimney Footings. Min. thickness 8 in., except 12 in. for chimney footings and unless reinforced, not less than 1 1/2 times the footing projection.

d. Footing Reinforcing. Reinforce footings when the projection on each side of wall, pier or column exceeds 2/3 of the thickness, or when required because of soil conditions.

e. Depth for Frost. The bottom of all footings including pile caps shall be placed at least below the locally accepted extreme frost penetration level or to the level established by the HUD field office, whichever is lower.

*f. Depth for High Volume Change Soils. Foundations of structures located in areas known or determined to contain soils of high volume change potential shall be designed in accordance with the recommendations of a qualified engineer.

601-16.4 Foundation Walls

*a. General. These standards apply to concrete or masonry walls below grade. Pressure-treated wood foundations shall comply with standards referenced in Appendix E.

b. Top Course Capping.

(1) Walls of hollow masonry shall be capped with 4 in. solid masonry or concrete or shall have cells of top course filled with concrete or grout. Capping may be omitted where a sill plate which bears on both inner and outer face shells is provided.

(2) Where a continuous concrete cap is required for termite protection, it shall be reinforced in accordance with Division 603.

(3) Cap walls of hollow masonry units under girders; min. thickness, 6 in.

602-3.7 Fill and Soil Compaction Control

Land development or site improvement where the reforming of the topography by fill is so extensive that building foundations are supported by fill or where the depth of fill below floor slabs (including basement floor or garage floor) exceeds the depths permitted in 603, shall be controlled fill designed, compacted and tested in accordance with generally accepted good practice and placed under the supervision of a qualified engineer.

602-4 RESERVED

602-5 SITE UTILITIES - UNDERGROUND UTILITIES

*602-5.1 Underground piping and related items shall be protected from corrosion. Underground mechanical and electrical systems shall be protectively coated to minimize corrosion where soil conditions warrant. Where applicable, sacrificial anodes may be used.

602-5.2 Sacrificial anodes may be used where soil resistivity does not exceed 15,000 ohm - centimeters. Otherwise, an impressed current system of corrosion prevention shall be used.

602-5.3 Site work construction for utility systems shall also be completed in accordance with requirements in 615 and 616.

*602-5.4 Underground utilities servicing more than two dwelling units shall not be located beneath buildings.

602-6 ROADS AND WALKS

602-6.1 General

Surfaces and base courses for roads, streets, parking areas and walks shall be of durable materials and construction shall be in conformance with generally accepted local design practices and these standards.

602-6.2 Drainage

Adequate surface and underground drainage systems shall be required to serve all paving and the improvements as necessary to insure continuing stable soil support for these improvements.

*602-6.3 Curbs and Gutters

All pavement shall be protected at the edges by curbs, gutters, curbs and gutters, or other suitable means to prevent ravelling of the pavement edge and to provide an adequate drainage-way for surface runoff.

606-4.2 Wood Columns

a. Columns shall bear on concrete or solid masonry bases. In basements, porches, garages and carports, top of base shall be not less than 3 in. above the finish floor. In basementless spaces, top of base shall be not less than 8 in. above inside grade.

b. Exterior columns shall be anchored to pier or base, and roof construction shall be anchored to columns. Columns in basement shall be anchored to girder and doweled or anchored to base. Where earthquake design is required, columns shall be anchored to the base and top of column shall be anchored to girder by bracing in both directions or by other suitable means acceptable to the HUD field office.

606-4.3 Sills and Plates

a. These standards apply to sill plates and to rafter and joist plates for masonry wall construction. Frame wall and partition plates or continuous headers are covered under Wall and Partition Framing.

b. Sills, when used, and plates shall be set true and level and provide full bearing on foundation or wall.

c. Width of plates shall be such as to provide for full end bearing of studs and not less than 1 1/2 in. bearing for ends of joists and rafters. Rafter plates bearing on uncapped masonry walls shall bear on both faces of the unit masonry.

d. Sills and plates shall be anchored to foundations or walls in such a manner as to resist all wind loads and earth pressure. Except in cases where earthquake design is required, or where concrete slab construction is used, anchors may be omitted when a structural analysis of wind and earth pressure indicates anchorage is not required.

606-4.4 Wood Floors, Girders and Beams

a. End bearing for joists and girders shall be such that the allowable bearing stress of the species used is not exceeded and shall be not less than:

(1) Girders, 4 in. Wood shims not acceptable.

606-4.4 Continued

(2) Joists, framed into masonry, 3 in.

(3) Joists framed into sides of beams, or onto sill plate or foundation, 1 1/2 in.

b. Joists framed into side of wood girder or beam shall be supported by steel angel, joist hanger, ledger, or by special fasteners designed for this purpose.

c. Joists framed into side of steel beam shall bear on lower flange of beam or on a ledger, bolted to beam. Block between joist if flange bearing is used. Unless lateral tie is provided by subfloor, tie every third joist to opposite joist with a 1 1/2 in. x 18 in. ga steel strap. Where joist frame into only one side of steel beam, prevention of rotation of steel beam shall be assured.

d. Joists and girders framing into masonry walls shall bear on solid masonry not less than 4 in. thick. Provide 1/2 in. air space at ends and sides of wood girders and joists framing into concrete or masonry walls unless treated wood is used. Joists 5 ft or more above grade shall be anchored to masonry walls by metal anchors, at intervals of not more than 6 ft oc.

e. Joists framed on exterior sill plate or foundation wall shall be anchored in such a manner as to resist all wind loads and earth pressure. Also provide end block or header joist (band joist) to prevent lateral movement and to provide for subfloor nailing when required.

*f. Joists framed over girders or bearing partitions shall be lapped not less than 3 in. and nailed together, or joists may be butted over center of bearing and tied together with wood or metal strap. Ties may be omitted if subfloor provides ties across joist. If steel beam is used attach plate to beam for joist anchorage or cross block to prevent lateral movement.

g. Joists shall be doubled under all parallel partitions except when single joist is of sufficient size to adequately support partition load in addition to contributory floor load. Space joists to receive piping or ductwork without cutting joists except as permitted by 606-4.

606-4.7 Continued

d. Where line wire is used for exterior stucco backing, studs in unsheathed walls shall be blocked at mid-height. Line wire backing without sheathing may be used for one-story construction and for 2-story construction in areas subject to wind loads in excess of 20 psf. In areas subject to earthquake design 2-story construction of this type is permitted only when the structural frame is designed and constructed to withstand the required lateral forces assumed to act nonconcurrently in the direction of each main axes of the structure.

e. Openings shall be framed to provide a rigid enclosure for installation of doors and windows. Sill shall not cut into jamb stud more than 1/2 in. Header shall be supported by jamb studs and be designed to support load imposed.

f. Wood posts supporting beams or lintels, as in post and beam framing, shall be designed as columns, and intermediate studs or blocking shall be provided between posts as required for support of interior and exterior covering material.

*g. Bearing and exterior wall studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with other partitions. End joints in double top plates shall be offset at least 48 in.

(1) A single top plate may be installed in bearing and exterior walls providing the plate is adequately tied at joints, corners, and intersecting walls by at least the equivalent of 3 in. by 6 in. by 0.036 in. thick galvanized steel that is nailed to each wall or segment of wall by the equivalent of at least 3-8d nails, and providing the rafters or joists are located no more than 2 in. from the supporting studs. Top plates may be omitted over lintels which are adequately tied to adjacent wall sections as previously described or by 1 in. by 4 in. by 12 in. wood spliced nailed to each wall section by no fewer than 3-8d nails.

(2) Top plates for nonbearing partitions may be single.

h. A continuous header sized according to the span of the largest opening may be used in lieu of a double top plate. Header members shall be connected at corners and at intersecting bearing partitions with sheet metal corner ties, lag screws or other suitable means.

i. Corners of rooms shall be blocked or framed to receive interior finish.

606-4.8 Stair Framing

a. Treads shall be hardwood, vertical grain softwood, or flat grained softwood covered with other suitable finish flooring material. Stairs to basement or attic storage area may be flat grained softwood.

b. Stringers shall have a min. effective depth of at least 3 1/2 in., and shall have solid bearing at top and bottom. The max. distance between stringers is 30 in. for nominal 5/4 in. treads, and 36 in. for nominal 2 in. treads.

c. Factory built stairs having wedged and glued treads and risers may be supported by two stringers when width of stair does not exceed 42 in.

606-5 SUBFLOOR AND SHEATHING

606-5.1 General

a. Provide safe support of loads without excessive deflection and provide backing and support for the attachment of finish materials.

b. Provide at least 1/2 in. clearance between subflooring and masonry or concrete walls.

c. When roof deck is also finished ceiling surface, a vapor barrier with a permeance of not more than 1/2 perm shall be installed between deck and roof insulation in areas where the design temperature is 10 F. or lower.

d. Application of materials by staples, shall comply with Use of Materials Bulletin No. UM-25.

606-5.2 Wood Boards and Planks

a. Board and planks shall have ends cut parallel to and over center of supports, with not more than two adjacent pieces breaking joints on the same support. Except for plank subflooring, end matched T and G material may break joints between supports, provided end joints in adjacent pieces do not occur in the same space, and each piece bears on at least two supports.

DIVISION 7

607 THERMAL AND MOISTURE PROTECTION

*607-1 GENERAL

Construction shall provide: adequate resistance to the penetration of weather and moisture, reasonable durability and economy of maintenance.

607-2 WATERPROOFING, DAMPPROOFING AND VARPOR BARRIERS

607-2.1 Waterproofing

Basement and habitable areas below grade shall be designed and constructed so as to be protected at all points against penetration of water.

*a. Membrane Waterproofing for Slabs-On-Ground. Where bottom of slabs-on-ground in habitable areas are at or below outside finish grade, install a waterproof membrane under the slab. Membrane material shall provide at least the equivalent protection of 2 ply hotmopped felts, 6 mil polyethylene, or 55 lb roll roofing. All laps shall be sealed. Mopping asphalt shall conform with ASTM D 449 or FS SS-A-666.

b. Foundation Waterproofing. Where habitable areas are provided below grade, foundation walls shall be waterproofed by a waterproof membrane extending from edge of footing up to finish grade line. All laps shall be sealed. Membrane shall be firmly affixed to wall. Membrane material shall provide at least the equivalent protection of 2 ply hotmopped felts, 6 mil polyvinyl chloride, or 55 lb roll roofing.

c. Alternate Waterproof Membranes. Alternate membranes shall be tested in accordance with ASTM E154. They shall be of one piece construction or have a practical field jointing system which assures a waterproof joint.

d. Hydrostatic Pressure. Where hydrostatic pressure occurs, slabs-on-ground and exterior surfaces of walls below ground level shall be waterproofed. Waterproofing shall be designed and applied in accordance with accepted engineering practice.

*607-2.2 Dampproofing

Where waterproofing is not required, install dampproofing to protect spaces below grade against the penetration of moisture.

a. Dampproofing of Slabs. Treatment material having a vapor transmission rate not exceeding 1/2 perm shall be installed as required by 603-7.4.

b. Dampproofing Walls. Where no habitable areas are provided below grade, foundation walls shall be dampproofed as follows:

(1) Masonry foundation walls. Treatment materials shall provide at least the equivalent protection of 1 coat of portland cement, 3/8 in. thick plus 1 coat of bituminous dampproofing material complying with Appendix C.

(2) Concrete foundation walls. Treatment materials shall provide at least the equivalent protection of 1 coat of bituminous dampproofing material applied at the rate recommended by the material manufacturer. Bituminous material shall comply with Appendix C.

607-2.3 Foundation Drainage

Foundation or footing drainage shall be provided around foundations enclosing basements or habitable areas below grade. Drains shall be installed at or below the area to be protected and shall discharge by gravity or by mechanical means to a positive outfall such as a drainage ditch or swale, or into a storm system.

607-2.4 Vapor Barriers

*a. Walls. A vapor barrier having a vapor transmission rate not exceeding 1 perm shall be installed on the warm side (winter) of the insulated walls. The materials of the wall on the cold side of the vapor barrier, such as insulation, sheathing, exterior finish or combination of materials shall have a vapor transmission rate of more than 1 perm, or have provision for vapor venting to outside.

b. Ceilings. When a vapor barrier is provided in ceiling under a ventilated roof or attic space, transmission rate of vapor barrier shall not exceed 1 perm. Install on warm side of ceiling.

607-2.4 Continued

c. Roof Deck. When a concrete slab, steel deck, wood plank, or other roof deck material is also the finish ceiling surface or the space below is not ventilated, a vapor barrier having a vapor permeance of not more than 1/2 perm shall be installed near the warm side of the construction.

Joints at sides and ends of fiberboard roof deck shall be designed to provide effective sealing of vapor barrier.

d. Slabs-On-Ground. (See 507-2.2 and 603-7 for requirements).

*e. Crawl Spaces. Ground surface treatment material having a vapor transmission rate not exceeding 1 perm shall be installed as required by 403-3 and 601-16.2b(4).

607-2.5 Special Conditions

a. In locations where the foundation is subjected to a high water table or where surface or ground water drainage may present a problem, additional precautions will be required.

b. Where the specific site conditions indicate that well drained soil exists or where ground surface water will not present a problem, lower standards may be permitted.

c. In dry regions with an average annual precipitation of less than 15 in., where no problems exist on the site under construction, lower standards for moisture protection may be permitted.

607-3 BUILDING INSULATION

607-3.1 General

a. Insulation of buildings shall be such as to assure conservation of energy, economy of operation and comfort to the occupants.

b. INSULATION MAY BE OMITTED FROM SEASONAL HOMES, NOT INTENDED FOR YEAR ROUND OCCUPANCY, AT THE DISCRETION OF THE HUD OFFICE WHOSE DETERMINATION SHALL BE BASED UPON CLIMATIC CONDITIONS AND THE PROPOSED SEASON OF OCCUPANCY OF THE PROPERTY.

607-3.2 Overall Coefficient of Heat Transmission

a. All buildings which are heated or cooled mechanically shall be constructed to comply with the U values shown in Tables 6-7.1, 6-7.2 and 6-7.3. U values shown do not include adjustments for framing in walls, ceilings or floors, nor for the sash frame in windows or glass doors.

b. Where the stated U value of any one component of roof deck, ceiling, wall or floor cannot be practically obtained, such U values may be increased to the min. figure attainable and the U value for other components decreased until the overall heat gain or heat loss does not exceed the total resulting from conformance to the stated U values.

*607-3.3 Roof Decks, Ceilings, Walls and Openings

a. For roof decks, ceilings, walls and door and window openings, U values shall not exceed those shown in Table 6-7.1.

*b. As an alternative, dwellings which conform to paragraphs 4.1 through 4.3.2.2.1 of ASHRAE Standard 90-75, Energy Conservation in New Building Design, shall be considered to be in conformance with Table 6-7.1. Attached and semi-detached or row-type dwellings shall be considered A-1 type dwellings when using this alternative.

*TABLE 6-7.1

Maximum U values of Ceilings, Walls and Openings

Building Component	Winter Degree Days (65 F Base)			
	2500 or less	2501 to 4500	4501 to 8000	8001 or more
Roof Deck (1)	0.14(2)	0.08	0.08	0.08
Ceiling	0.05	0.05	0.05	0.04
Masonry Walls	0.10	0.10	0.10	0.10
Frame Walls	0.08	0.08	0.08	0.08
Doors and Windows(3)	1.13	1.13	0.69	0.69

Notes:

(1) Roof/Ceiling assemblies, in which the finished ceiling surface is the underside of the roof deck.

(2) When mechanical cooling is proposed, use 0.08.

(3) Max. glass area shall not exceed 15 % of the gross area of all exterior walls enclosing heated spaces, except when demonstrated that the winter daily solar heat gain exceeds the 24 hr heat loss.

D I V I S I O N 9

609 FINISH MATERIALS

609-1 GENERAL

Application of finish materials shall be such as to: prevent entrance or penetration of moisture or weather; provide adequate protection from damage by decay, corrosion, insects and other undesirable elements; and provide reasonable durability, economy of maintenance and an attractive appearance.

609-2 EXTERIOR WALL FINISHES

609-2.1 General

a. Exterior wall finishes shall be installed in a manner to restrict the entrance of moisture and weather. Attachment and anchorage of finish to backing or structure shall be adequate to resist design wind forces. See 601-6.

b. Use of brittle or otherwise easily injured exterior finish materials shall be restricted to 7 ft 0 in. or more above grade where large numbers of children are anticipated or where the probability of damage to the exterior finish is considerable.

c. When sheathing is used for attachment of siding, see 606-5.4 and Table 6-6.5.

609-2.2 Wood Siding, Hardboard, Plywood

a. Wood siding shall be applied with corrosion resistant nails which will penetrate 1 in. into studs, blocking or wood sheathing.

b. Headlap shall be adequate to prevent entrance of moisture into walls.

c. Butt joints of horizontal sidings shall occur over studs, except where wood sheathing is used. Joints in adjacent pieces shall be staggered.

*d. Max. spacing of studs or blocking shall be 24 in. for 3/8 in. square edge ungrooved hardboard panels with or without sheathing. For all other hardboard, max. spacing of studs or blocking shall be 16 in.

609-2.2 Continued

*e. For spacing of supports for plywood sheathing and siding, see Table 6-6.3 and Appendix F.

609-2.3 Wood Shakes and Shingles

a. Wood shakes and shingles shall be applied with corrosion resistant nails over suitable wood sheathing or to furring strips over fiberboard or gypsum sheathing.

b. Shakes and shingles shall be coursed and lapped in a manner to prevent the entrance of moisture.

609-2.4 Asbestos Cement Siding

a. Application shall be over solid wood sheathing or over fiberboard or gypsum sheathing where nailing strips or other special fastening methods are used.

b. Headlap shall be adequate to prevent entrance of moisture into wall.

c. Use corrosion resistant nails of sufficient length to penetrate supporting materials.

d. Caulk all vertical joints where siding abutts other materials.

e. Installation of flat sheet siding shall be in accordance with the Manual of Application Methods for Flat Asbestos-Cement Sheets published by the Mineral Fiber Products Bureau.

609-2.5 Stucco (Exterior)

Preparation and application shall comply with ANSI A42.2 and A42.3.

609-2.6 Aluminum Siding

a. Application shall conform to AAMA 1403.2, Installation Specifications for Residential Aluminum Siding.

b. See 605-5.5 for sheathing paper requirements.

TABLE 6-9.6

MINIMUM ROOF SLOPE AND UNDERLAY

Minimum Roof Slope (in.)	Underlay (2 in. headlap) (4 in. sidelap)
3 in 12	Double
4 in 12	Double in areas where the outside design temperature is 0 F or less, single in other areas.
5 in 12 or more	Single

d. Underlay shall be 15 lb asphalt-saturated asbestos roofing felt or 30 lb asphalt-saturated organic felt.

609-3.7 Built-up Roofing

a. Quantity of materials and min. roof slopes per square of built-up roofing on wood sheathing or decks shall comply with Table 6-9.7.

b. Materials

(1) Bituminous materials shall comply with 509-3.2

(2) Aggregate shall be clean, durable gravel, crushed stone or air-cooled blast furnace slag complying with ASTM D 1863.

(3) Aggregate sized larger than 3/4 in. may be used but shall not be included in required weight.

c. Application---Wood Decks

*(1) If underside of roof deck is finished ceiling surface, install one layer of unsaturated building paper over entire roof deck. Min. lap, 2 in.

(2) Apply two dry plies of 15 lb felt or one dry ply of 30 lb felt, and three plies of 15 lb felt mopped down and mopped together. Over entire surface, apply a uniform flood coat of bitumen and embed surfacing aggregate.

(3) A 19" selvage, mineral surfaced, roll roofing cap sheet may be used when installed over 2 mopped plies of No. 15 felt.

(4) Install metal gravel stop over dry or mopped sheets at eaves and rake.

(5) Where roofing serves as flashing at intersections of walls or chimneys, install cant strips and turn up roofing felts at least 4 in. Mop felts to intersections.

TABLE 6-9.7

BUILT-UP ROOFING

Roof Type	Minimum and Maximum Roof Slope	Bitumen Per Square			Surfacing Per Square
		Average Mopping Coats	Minimum Flood Coat	Minimum Total Bitumen	
Asphalt (Type I) and Aggregate	1/4 in 12 to 1 in 12	15-20 lbs Asphalt	60 lbs Asphalt	105 lbs Asphalt	400 lbs gravel or crushed rock or 300 lbs slag on level roof. 300 lbs gravel or crushed rock or 225 lbs slag at 3 in 12 roof slope. Proportional weight for intermediate roof slope.
Asphalt (Type II) and Aggregate	1 in 12 to 3 in 12	15-20 lbs Asphalt	50 lbs Asphalt	95 lbs Asphalt	
Coal Tar Pitch (Type I) and Aggregate	1/4 in 12 to 1/2 in 12 (1)	20-25 lbs Pitch	75 lbs Pitch	135 lbs Pitch	
Asphalt (Type II) and Cap Sheet	2 in 12 to 6 in 12	15-20 lbs Aspaht	None	45 lbs Asphalt	19" selvage, double coverage, mineral surface cap sheet

*Note: (1) Slopes less than 1/4 in 12 are acceptable when roof is designed and constructed to avoid ponding and excessive deflection.

Notes for Table 6-9.9 Continued

(2) Fasteners only - no adhesive between plies.

(3) With fasteners and an adhesive between plies.

e. Application---Laminated System

(1) On ceilings, base layer shall be applied at right angle to framing members.

(2) Space nails or screws in base layers as described in 609-4.3c(1), (2) and (4).

(3) Face layer (no adhesive between plies), space nails or screws as described in 609-4.3c(1), (2) and (4). Nails used for face layer shall be long enough to penetrate at least 3/4 in. into wood framing members.

(4) Face layer (with adhesive between plies), apply adhesive to entire back surface of face layer spread with a notched spreader blade. Laminating adhesive shall comply with ASTM C 475 unless otherwise recommended by wallboard manufacturer. Space nails on face layer 16 in. oc (screws 24 in. oc). Temporary field nails of face layer may be used as described in ANSI A97.1.

f. Joint Treatment

*(1) Protect all exterior corners subject to impact damage with corrosion-resistant metal corner beads, or other suitable type of corner protection.

(2) All joints in wallboard surfaces intended to receive paint or wallpaper finishes shall be taped and cemented in accordance with manufacturer's directions.

(3) Treated joints in predecorated wallboard may be left exposed except when subjected to extreme moisture conditions.

609-4.4 Hardboard

a. Min. thickness, 1/4 in. direct to framing, 1/8 in. over rigid backing.

b. Max. spacing of framing, 16 in. oc unless over rigid backing.

c. Provide solid backing for all edges. Fit panels to allow for expansion.

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*d. Nailing

(1) Nail with matching color paneling nails with screw-thread or annular-thread shank. Length of nail shall be that which will provide at least 3/4 in. penetration into support.

(2) Space nails 4 in. oc along edges and 8 in. oc into intermediate framing. Min. edge distance, 3/8 in.

e. Adhesives or special fastenings may be used when installed in accordance with manufacturer's directions.

609-4.5 Lath and Plaster

a. Furring, lathing, and plastering work shall at least conform to the following standards:

(1) Specifications for Interior Lathing and Furring, ANSI A42.4.

(2) Specifications for Gypsum Plastering, ANSI A42.1.

(3) Specifications for Portland Cement Plastering, ANSI A42.2 and A42.3.

b. Run V groove on brown and finish coats around all metal trim, and at similar conditions.

c. Finish work shall be level and plumb, true to lines, levels, and dimension. Finished plain surfaces shall be as nearly perfect as practicable for the types of materials and job conditions; however, deviation from a true plane surface shall not exceed 1/8 in. when measured from a 6 ft straightedge placed against the surface to any point on the surface and under the straightedge.

609-4.6 Plywood

a. Provide solid backing for all edges.

b. Max. spacing of supports:

(1) 1/4 in. plywood, 16 in. oc. Plywood less than 1/4 in. thick apply over rigid backing.

(2) 3/8 in. plywood, 24 in. oc.

c. Nailing

(1) Nail with matching color paneling nails with screw-thread or annular-thread shank or finish nail, set and puttied. Length of nail shall be that which will provide at least 1/2 in. penetration into support.

(2) Space nails at least 8 in. oc on ceilings, 12 in. oc on walls. Min. edge distance, 3/8 in.

d. Adhesives or special fastenings may be used when installed in accordance with manufacturer's directions.

*609-4.7 Solid Wood Paneling

a. Apply over vapor barrier when application is direct to exterior wall framing or blocking.

b. Max. width, 12 in.

c. Min. thickness, 1/2 in.

d. Max. spacing of supports, 24 in. oc.

e. Nailing:

(1) Nail to each bearing with 11 or 12 ga casing or finishing nails. Length of nail shall be that which will provide at least 3/4 in. penetration into support.

(2) Provide 2 nails at each bearing for boards less than 6 in. wide, and 3 nails in boards 6 in. and wider.

(3) Adhesives or special fastenings may be used when installed in accordance with manufacturer's directions.

609-4.8 Plastic and Metal Wall Tile

Plastic and metal wall tile shall be backed by plaster complying with 609-4.5, or by gypsum board complying with 609-4.3, except at bathtubs and showers the plaster shall be portland cement and gypsum board shall be specially designed water-resistant, conforming with ASTM C 630. Insulating (foil-backed) gypsum board shall not be used. The tile shall be installed in accordance with manufacturers directions.

609-4.9 High Pressure Laminated Plastic Panel Systems

*a. Apply over plywood or other subbase material in accordance with panel manufacturer's recommendations.

b. Min. total thickness of the high pressure laminated plastic panel, 3/16 in.

609-4.10 Fiberboard

a. Min. thickness and max. spacing of supports shall be as follows:

Thickness (in.)	Spacing of supports (in. oc)
1/2	16
3/4	24

b. Nailing

(1) Nail with 11 or 12 ga casing or finishing nails. Length of nail shall be that which will provide at least 3/4 in. penetration into support.

(2) Space nails 6 in. oc on ceilings, 8 in. oc on walls. Min. edge distance, 3/8 in.

c. Fastenings for special types of interior fiberboard finish may be used.

609-5 FINISH FLOORING, RIGID

609-5.1 General

Installation of rigid finish floors shall be in conformance with recognized trade standards and shall provide a floor free of objectionable defects.

D I V I S I O N 15

615 MECHANICAL

*615-1 CONSTRUCTION

615-1.1 General

Provide mechanical systems which will assure safety of operation, convenience and comfort, protection from destructive elements, reasonable durability and economy, and adequate capacity and quality.

615-1.2 Standards

Except as modified herein, the design, construction, installation, adjusting and labeling of all equipment, accessories and appurtenances for heating and air conditioning shall comply with the applicable recognized standards given in Appendices C and E.

615-1.3 Electrical Equipment

All electrical equipment shall be installed in accordance with the current National Electrical Code, NFPA 70.

615-1.4 Distribution

Heating, ventilating and air conditioning systems shall be designed, installed, balanced, adjusted and controlled to provide for the distribution of conditioned air to all habitable rooms and other spaces in accordance with the calculated heat loss or gain of the spaces to be conditioned, and in proportion to fluctuations of outdoor temperature.

615-1.5 Accessibility

All individual items of equipment and components thereof shall be 100% accessible for repair, removal or replacement without functional impairment or dismantling of any adjoining major surfaces or assemblies.

615-1.6 Noise

The dwelling shall be free of objectionable sound as provided in HUD Circular 1390.2, Noise Abatement and Control. Equipment conforming to other sound level criteria referenced in these standards shall also be acceptable.

*615-1.7 Stairways

Heating equipment or open flame appliances shall not be installed under unprotected combustible stairways.

615-1.8 Air Quality

Heating equipment chimney emissions shall meet applicable local, state and Federal ambient air quality and emissions standards.

615-1.9 See 515 for other mechanical equipment and component requirements.

615-2 MECHANICAL VENTILATION

615-2.1 General

a. Section 615-2 applies to all mechanical ventilation systems whether required or optional.

b. Ventilation (either natural or mechanical) shall be provided in accordance with Table 4-3.1. Optional mechanical ventilation or air conditioning may be installed to supplement natural ventilation in living areas or attic.

c. Individual living area ventilating fans shall be controlled by a self contained switch or by a wall switch, either independent or combined with light switch. Powered attic space ventilators shall be controlled by an automatic thermostat.

d. Fan grilles shall be removable or hinged to permit access to fan and motor for cleaning, servicing, replacement, or repair.

*e. Ductwork shall be designed for the shortest practical run and elbows shall be kept to a min.

f. Air discharge openings through roofs or exterior walls shall be protected against the entrance of rain and snow, birds, large insects and foreign objects. Automatic louvers or backdraft dampers shall be provided on other than attic ventilators to prevent a reverse flow of air when the fan is not in operation.

615-2.2 Bathrooms

*a. Where natural ventilation is not provided, mechanical exhaust ventilation shall be installed in accordance with Table 4-3.1. Air shall be discharged by an exhaust fan directly to the outdoors, or may be discharged into an attic space which is cross-vented with a total net free area of 1/150 of the ceiling area.

b. Make-up air shall be provided to the bathroom by means of an air intake grille located in the lower part of the bathroom door or wall, or by undercutting the bathroom door. If an intake grille is installed, it shall be vision-proof. The make-up air opening shall be sized for the air volume requirements of the exhaust fan at a velocity not to exceed 500 fpm.

615-2.3 Kitchens

*a. Where natural ventilation is not provided, mechanical exhaust ventilation shall be provided in accordance with Table 4-3.1. Air mechanically exhausted from the kitchen shall be through a range hood or through a ceiling or wall exhaust grille.

b. Mechanical exhaust air intake openings (grilles) shall be located either:

(1) In the ceiling or wall not more than 4 ft from the center-line of the range, or

(2) In the wall directly above the back of the range.

A metal collector hood of the size and height required by 615-2.4b may be optionally installed.

615-2.4 Range Hoods

a. Mechanical kitchen range hoods shall be labeled and listed by a recognized testing and inspection agency, and installed in accordance with such listing.

b. Range hood shall be at least as long as the range, shall be at least 17 in. wide, and the bottom of the hood rim shall be not more than 30 in. above the range top.

c. Range hood fan shall have a min. capacity of 40 cfm per linear ft of hood length, except that when installed over a range located in an island or peninsula, fan shall have a min. capacity of 50 cfm per linear ft of hood length.

615-2.5 Furnace and Heater Rooms

Mechanical ventilation of furnace and heater rooms shall comply with the combustion, ventilation, and combustion draft hood requirements of NFPA Standards 31 and 54.

615-3 HEATING

615-3.1 Heat Loss Calculations

*a. Calculations of heat loss shall be made in accordance with the data and procedures contained in the current ASHRAE Handbook, IBR Guides sponsored by the Hydronics Institute, ARI, SMACNA, NEMA or ACCA, and the limitations set forth in 607-3. NAHB Research Foundation's Insulation Manual may be used as a reference.

*b. Inside design temperature shall be not less than 70 F. Outside design temperature shall be that established by the ASHRAE Handbook at the 97 1/2% design value for the location involved or as determined by the HUD field office based upon its record of experience.

*c. *For housing for the elderly, inside design temperature shall not be less than 75 F in all habitable rooms and corridors when the outside temperature is at design level. Lower inside design temperatures may be used for storage rooms, work rooms, and other similar spaces.*

615-3.2 Hot Water and Steam Systems

*a. Design and installation of the entire system shall be in accordance with the ASHRAE Handbook or IBR Installation Guides.

b. Heating systems shall be installed with 3/4 in. drains at all low points and with a vent at all high points to permit complete drainage of the entire system by gravity.

*c. When make-up water is of such a quality that excessive corrosion or scaling is known to exist, a suitable water treatment system as recommended by WQA shall be provided.

*d. One pipe system shall be installed in compliance with the recommendation of the manufacturer of the special one pipe system fittings used.

*e. Radiators, convectors, baseboard radiation and other terminal heating devices shall be provided with an accessible control valve or damper.

*f. Accessible means shall be provided for balancing the distribution of heat to all heated spaces. When a control valve or baseboard or convector damper is combined with a balancing device, the balancing device shall provide a balanced distribution of heat at the adjusted max. opening of the shutoff valve or damper. Series-loop systems, consisting of a single circuit serving baseboard type units on one floor level only, may be installed without balancing devices in the water circuit, but shall have dampers for the air convection control.

g. When boiler insulation is applied during installation, its conductance shall not exceed 0.50 Btu/(h x sq ft x F).

h. Supply and return piping in unheated attic spaces, ventilated crawl spaces, and other exposed locations shall be insulated with insulation having a conductance value C not exceeding 0.45.

i. Insulation on heating piping in insulated crawl spaces may be omitted where closable vents are provided.

615-3.3 Warm Air Heating Systems - General

*a. Design of all warm air heating systems shall be in accordance with the recommendations of the ASHRAE Handbook or applicable manuals of SMACNA, ACCA and ARI. Installation shall comply with NFPA Standards 90B, 31 and 54.

b. Duct insulation is covered in 515-3.

615-3.4 Warm Air Heating - Air Control

*a. Provide all but one supply air outlet with a shutoff damper.

b. Provide an accessible balancing damper, either behind the supply air register or in the duct. The damper shall be either a friction fit or locking type and shall be adjustable. The position of the damper shall be indicated by an adjustment arm outside the duct or shall be visible for adjustment when the air outlet is removed.

615-3.5 Warm Air Heating - Return Air

a. A return air inlet shall not be provided in a bathroom, kitchen, garage, utility space, a space used for fuel or flammable storage, or a confined space in which a draft diverter or draft regulator is located, or to which combustion air is supplied. Otherwise, all other habitable spaces shall be provided with an access to a return inlet.

b. Return air from any living unit shall not be delivered to or pass through any other living unit.

615-3.6 Warm Air Heating - Perimeter Systems

a. Perimeter heating ducts shall be completely encased in not less than 2 in. of concrete except when the duct is of concrete pipe, ceramic tile, asbestos-cement or other materials acceptable to the HUD field office. All ducts imbedded in slabs shall have a min. of 2 1/2 in. of concrete above the duct.

b. When the bottom of ductwork adjacent to the perimeter of the slab is at or above exterior finish grade, ducts and fittings (except within two duct diameters of the supplying plenum) may be of any suitable, non-combustible material not subject to deterioration or mildew in the presence of moisture.

*c. When the bottom of ductwork adjacent to the slab perimeter is below exterior finish grade, the duct system wholly or partially below such grade shall be of ceramic tile pipe conforming to ASTM C 700, asbestos-cement pipe conforming to ASTM C 428 or concrete pipe conforming to ASTM C 14. Joints which are wholly or partly below exterior grade shall be watertight. Taped or cement grouted joints are not considered watertight.

615-3.7 Warm Air Heating - Underfloor Plenum

a. When underfloor space is used as a supply plenum, a clearance of at least 1 in. shall be maintained between furnace plenum and joists, beams, or any combustible construction. High sidewall outlets connected directly to the underfloor plenum may be used for bathrooms and kitchens.

b. The construction enclosing an underfloor plenum shall be sealed against air leakage and the ground surface shall be covered with a vapor barrier material. When plastic film is used, joints shall be lapped at least 2 in. when not sealed. The ground cover material shall have a flame spread classification not exceeding 200, unless it is covered with at least 2 in. of sand.

c. Unless the ground is covered with at least 2 in. of sand, there shall be firmly placed and secured under each floor opening into the plenum a noncombustible receptacle at least 3 in. wider than the opening and having 1 in. vertical lips all around.

d. The perimeter wall shall be insulated in accordance with 607-3.

e. Fuel-burning devices shall not be installed in a plenum. All material enclosing the underfloor space, including perimeter wall insulation, shall have a flame spread classification not exceeding 200.

f. If the underfloor space serves as a crawl space, access shall be provided through an opening not more than 18 in. by 24 in. fitted with a tight cover and located to prevent the use of the space for storage purposes.

615-3.8 Warm Air Heating - Self-Contained Units

*a. Self-contained heating units, such as room or space heaters, and recessed heaters, may be installed in single story structures, and also in split level or two story structures provided that heat distribution is achieved throughout the building.

b. The heat output of a self-contained space heater shall be limited to 50,000 Btuh when the unit is equipped with a fan, and 45,000 Btuh without a fan. When included, a fan shall provide at least 9 cfm per 1000 Btuh of heater output, or shall limit the air temperature through the heater to 100 F at rated heater capacity.

c. There shall not be more than one doorway or one archway between the heater outlet and any space or room to be heated by it.

d. The distance between the heater outlet and the center of any space to be heated by it shall not exceed 20 ft measured through the center of the intervening opening. This distance may be increased at the discretion of the HUD field office for locations having outside design temperatures of 20 F or higher.

e. Self-contained heater outlets shall be located no closer than 6 in. to any wall. Allowance also shall be made so that opened doors, draperies, or other similar combustible materials cannot be moved closer than 12 in. to the heater outlet.

f. An unobstructed floor space, at least 18 in. wide, shall be provided adjacent to the heater outlet.

*g. Dampers designed to restrict warm air flow from self-contained heaters having a single outlet shall not be installed. Dampers for heaters with two or more outlets shall be designed to limit warm air flow to no more than 50 percent capacity.

h. Thermostats for the control of self-contained heaters shall be located in the space or room in which the principal heater outlet is located.

*615-3.9 Electrical Heating

a. All electric heating installations shall comply with NEC. When a recognized industry certification of testing program is available for heating units, systems and components, (e.g., NEMA and UL) such equipment shall be labeled to show conformance. Test results to verify uncertified equipment shall be made available to the HUD field office upon request.

b. The average heat output of an electric heating unit shall not exceed the heat output rate permitted by the listed rating.

c. Thermostatic control for electric heating shall be provided in each heated room or space except when a central electric heating system is installed.

d. The wattage rating of electric heating units shall not exceed the rating of the controlling thermostat and relay combination. Also, the heat intensity of the heating elements shall not exceed 250 watts per linear foot.

e. All resistance heating cables and prefabricated electric conductive panels shall bear a label identifying the manufacturer and rating of each unit. Cables shall be of standard lengths and shall not be cut. Prefabricated electric conductive panels shall not be cut, and lighting fixtures shall not be fastened to nor cut into the active area of the panel. Panels and cables shall be thermostatically controlled.

f. Bathroom wall heaters and switches shall be located as far as practicable from plumbing fixtures, and at least 30 in. from tub or shower.

615-3.10 Oil Fired Equipment

a. Installation of fuel oil burners, oil tanks, and piping shall comply with NFPA Standard No. 31.

b. Oil fired equipment, unless otherwise listed by a qualified testing, rating and listing agency, shall be equipped with a listed barometric draft regulator.

c. Type L vents may be used with oil fired equipment when listed as being suitable for such venting use.

615-3.11 Gas Fired Equipment

a. All gas fired heating equipment including conversion burners shall be labeled, listed and installed in conformance with the appropriate ANSI, AGA or UL requirements.

b. All gas fired heaters shall be vented.

c. Vent materials including convectors shall be UL labeled and listed. They shall be installed in accordance with the listing, NFPA requirements and the manufacturer's instructions. Type L vents may be used with both gas and oil appliances when listed as being suitable for such venting use.

d. Above-roof enclosures or housing, when installed in connection with listed gas vents, shall be furnished by the manufacturer of the gas vent, or shall be constructed and installed in accordance with the gas vent manufacturer's specifications and installation instructions. Above-roof enclosures or housing shall not be installed in connection with single wall metal pipe used for venting gas appliances.

e. Gas fired appliances of the "sealed combustion chamber" type (all combustion air from outside and combustion gases vented to outside through vent without draft diverter) shall be AGA or UL listed and installed in accordance with the listing and the manufacturer's instructions.

f. Except as provided in (c.) above, no gas vent shall terminate less than 5 ft in vertical height above the highest draft hood on connected appliances.

615-3.12 LP Gas Containers and Piping

The construction and installation of storage containers and service piping for Liquefield Petroleum Gases shall comply with NFPA 58.

615-3.13 SEASONAL HOMES

HEATING FACILITIES IN SEASONAL HOMES MAY BE OMITTED, OR MAY BE PROVIDED BY A FIREPLACE, AT THE DISCRETION OF THE HUD OFFICE. THE DECISION SHALL BE BASED UPON CLIMATE AND PROPOSED SEASON OF OCCUPANCY. WHEN PROVIDED, HEATING FACILITIES SHALL COMPLY WITH THE APPLICABLE STANDARDS.

615-4 MECHANICAL COOLING

615-4.1 General

*a. These standards are intended to cover mechanical or absorption-type refrigeration equipment to provide summer air conditioning by either a central system with distribution ducts or piping, or packaged room or zonal air conditioners with free air discharge. They are not intended to cover evaporative coolers.

b. For requirements pertaining to individual air cooling units for single rooms or apartments, see 515-4.

*c. The capacity of the sytem and its equipment shall be not less than the calculated total heat gain under design indoor and outdoor conditions except as recommended by ARI and ACCA.

d. Suitable and durable means shall be provided to prevent transmission of objectionable noise or vibration generated by the sytem or equipment. See 515-4.5 and 615-1.6.

615-4.2 Heat Gain Calculations

*a. Calculations shall be made in accordance with SMACNA, ARI and ACCA Manuals or the ASHRAE Handbook.

b. Average inside design temperature shall be 75 F dry bulb.

c. Heat gain calculations shall be made using the summer design dry bulb at 2 1/2% as shown in the current ASHRAE Handbook.

615-4.3 Air Distribution Systems

a. Duct insulation is covered in 515-3.

b. For underfloor plenum systems suitable for both cooling and heating, see 615-3.7.

*c. Duct systems shall be designed and installed in accordance with a recognized and acceptable method such as contained in the ASHRAE Handbook, or applicable manuals of the SMACNA and ACCA, and shall comply with NFPA 90B.

*d. Provide all but one supply air outlet with a shutoff damper.

e. Provide an accessible balancing damper, either behind the supply air register or in the duct. The damper shall be either a friction fit or locking type and shall be adjustable. The position of the damper shall be indicated by an adjustment arm outside the duct or shall be visible for adjustment when the register is removed.

*f. Return air inlets shall be of sufficient number and so located that return air will not cause objectionable drafts. Grilles for return air shall be sized so that the velocity of air will not exceed 500 fpm. When multiple return air ducts are installed, they shall include dampers to balance the designed air flow.

g. Return air from one living unit shall not be delivered to or pass through any other living unit.

h. Cooling coils shall be located so that conditioned air leaving the coil will not pass over the heat transfer surface of any furnace. Exception: Factory assembled units which are specifically tested and listed for this type of service.

615-4.4 Coolant Distribution Systems

*a. Distribution systems employing liquid media for cooling shall be designed in accordance with the applicable criteria contained in the ASHRAE Handbook and shall be capable of producing summer comfort conditions within the concept of this standard. Refrigerant lines shall be insulated with a min. 3/8 in. thick material having a vapor transmission rate not in excess of 0.1 perms. Insulate chilled water lines with max. conductance C = 0.6.

b. All exposed refrigeration piping located less than 6 ft above any floor or outside grade shall be suitably protected to prevent damage to piping or injury to persons.

c. Where condenser cooling water is known to cause excessive corrosion, scaling or obstruction within the piping or equipment, suitable approved water-treatment means will be required by the HUD field office. Dielectric connectors shall be used between ferrous and non-ferrous piping in the cooling water circuit.

d. Suitable means shall be provided for the collection and disposal of condensate from cooling equipment. The condensate drain shall be constructed of at least 3/4 in. nominal pipe size of copper, galv steel, plastic or other corrosion-resistant material.

e. Where the cooling coil or air-conditioning unit is located above a habitable space, or where structural damage may result from condensate overflow, an additional watertight pan of corrosion-resistant metal shall be installed beneath the cooling coil or unit to catch overflow condensate due to a clogged condensate drain; or one pan with standing overflow and separate drain may be provided in lieu of the second drain pan. The additional pan, or the standing overflow, shall be provided with a drain pipe, min. 3/4 in. nominal pipe size, discharging at a point which can be readily observed.

615-9.3 House Sewer

a. The house sewer shall be installed in accordance with the nationally recognized model plumbing code having jurisdiction in the area. State and local codes which deviate from nationally recognized plumbing codes or standards in order to satisfy local conditions may be accepted by the HUD field office if such deviations are identified and substantiated with satisfactory engineering data.

*b. The house sewer shall have watertight joints. It shall be on a grade of not less than 1/8 in. per ft. Ells or bends of 90 degrees will not be acceptable.

c. The generally recognized practices for good pipe installation outlined in ASTM D 2316 shall be followed, except for the following additional requirements:

(1) Backfilling over the pipe shall be placed in tamped 6 in. layers to a total depth not less than 12 in. above the top of the pipe. Backfilling of areas at walls, patios, driveways and drainage swales shall be tamped in 6 in. layers from the top of the pipe to finish grade.

(2) Mechanical earth moving equipment such as bulldozers shall not be permitted on the backfill.

615-9.4 Septic Tank

a. The design shall provide adequate volume for settling, for sludge and scum storage, and access for cleaning. The structural design shall provide for a sound, durable tank which will sustain all loads and pressures, and will resist corrosion. The HUD field office may require a test for watertightness and strength.

b. Liquid capacity shall be based on the number of bedrooms proposed or reasonably anticipated and shall be at least as required in Table 6-15.6. The liquid depth of the tank or a compartment thereof shall be not less than 30 in. A liquid depth greater than 6 ft shall not be considered in determining tank capacity.

c. No tank or compartment thereof shall have an inside horizontal dimension less than 24 in. Scum storage volume shall be not less than 15 percent of the required liquid capacity.

d. Inlet and outlet connections shall be submerged or baffled. The inlet invert shall be at least 1 in. above the outlet invert.

*e. Baffles, and pipe fittings used as baffles, shall extend upward to within 1 in. of the underside of the cover, and downward to a point of 40% of the liquid depth below the liquid surface. If an outlet fitting has no opening above the liquid level of the tank through which the tank scum layer could enter, the 1 in. clearance to the underside of the cover is not required. When a partition wall is used to subdivide the tank, it shall have a 4 in. diameter min. opening, with the same invert elevation as the tank outlet. The partition wall opening shall have an outlet device equivalent to the tank inlet or outlet, so that outside air can enter both sides of the partition.

f. When multi-compartment tanks are used, the volume of the first compartment shall be equal to or greater than that of any compartment.

g. Access to each compartment of the tank shall be provided by a 16 in. min. manhole or removable cover. The inlet and outlet connections shall also be accessible through properly placed manholes, handholes or by easily removable covers.

h. Provide a min. of 4 in. of soil over the top of the septic tank for growing grass. Where the top of the tank is lower than 18 in. below grade, manholes shall be built up to within 18 in. of grade.

615-9.5 Percolation Tests

a. Percolation tests shall be conducted in accordance with the procedure given in Appendix D.

b. For individual lots, one percolation test per lot is required as a min. provided the soil is uniform and of one type. Where the soil is not uniform or there is more than one type of soil on the lot, one percolation test per lot is required as a min. at the center of each variation of type of soil of significant size.

c. For subdivisions or multiple lots, one percolation test per acre is required as a min. for each area consisting of a uniform soil of one type.

d. Test results and soil evaluation shall be used by the HUD field office to determine suitability for a soil absorption system and the type, design and size of the system to be installed.

616-3.2 Individual branch circuits shall be provided as required to comply with the NEC for fixed appliances and equipment.

616-4 LIGHTING OUTLETS

616-4.1 Exterior

An outside fixture, with interior wall switch control, shall be installed at each main and service doorway. Also an outside fixture with interior wall switch control or grounded weatherproof receptacle shall be provided for each balcony and patio unless otherwise acceptable to the HUD field office.

616-4.2 Kitchen, Baths, Halls

Permanent lighting fixtures, wall switch controlled, shall be installed in kitchens, dining rooms, bathrooms, and halls.

*616-4.3 Habitable Rooms

In other habitable rooms, including living rooms and bedrooms, permanent lighting fixtures which are wall switch controlled, or wall switch controlled receptacle outlet or outlets, shall be installed.

*616-4.4 Bathroom Outlets

Bathroom lighting fixtures shall be controlled by a grounded wall switch not readily accessible from tub or shower. When installed, electric bathroom heaters and control switches shall be located as far as practical from plumbing fixtures, and at least 30 in. from tub or shower.

*616-4.5 Stairways

Permanent lighting fixtures shall be installed to illuminate stairways connecting habitable rooms or halls at different elevations. Such lighting fixtures shall be multiple wall switch controlled from each elevation. Other lighting fixtures may serve as stairway fixtures when located to serve such dual purpose.

*616-4.6 Basement Stairs

A permanent lighting fixture, wall switch controlled from the head of the basement stairs, shall be installed to properly illuminate basement stairs. Multiple wall switch control shall be installed at both elevations when basement is provided with other exit doorways.

616-4.7 Other Spaces

Permanent lighting fixtures shall be installed in other areas requiring general illumination, including food preparation centers and laundry trays. The number, type, and location of outlets in spaces such as closets, utility room, garage, attic, and basement shall be acceptable to the HUD field office.

616-5 CONVENIENCE OR RECEPTACLE OUTLETS

*616-5.1 Grounding

All receptacles both inside and outside the house shall be of the grounded type. Receptacles installed outdoors and in bathrooms shall have approved ground-fault circuit protection.

616-5.2 Habitable Rooms

Duplex grounded receptacle outlets shall be installed in all habitable rooms so that no point along the floor line of usable wall space is more than 6 ft from an outlet. An additional receptacle shall be provided between all doors and between doors and fireplace when separated sufficiently for placement of furniture.

616-5.3 SEASONAL HOMES

RECEPTACLE OUTLETS FOR SEASONAL HOMES MAY BE SPACED SO THAT NO POINT ALONG THE FLOOR LINE OF USABLE WALL SPACE IS MORE THAN 8 FT FROM AN OUTLET.

616-5.4 Placement

Receptacles shall be spaced appropriately for furniture placement. In habitable rooms not provided with permanent ceiling or wall fixtures, a min. of three receptacles shall be installed.

616-5.5 Night Light

In housing for the elderly, a convenience outlet for receiving a night light shall be provided approximately 2 ft above the floor between the bed location and the bathroom.

A P P E N D I X A

*DEFINITIONS

Abbreviations, terms, phrases and words used in these Minimum Property Standards shall have the meanings given in this appendix. The following terms are defined for HUD purposes and the definitions may differ from those used in building codes and elsewhere.

ABSORPTION BED. A system of below ground open joint or perforated pipe surrounded by coarse aggregate through which septic tank effluent flows and seeps into the soil. The system is usually constructed by excavating a shallow rectangular area, installing the pipe system and backfilling the excavation.

ABSORPTION FIELD. A system of below ground open joint or perforated pipe surrounded by coarse aggregate through which septic tank effluent seeps into the soil. The system is constructed by excavating two or more connecting trenches, installing the pipe system and backfilling the trench excavation.

ATTIC. Accessible space between top of uppermost ceiling and underside of roof. Inaccessible spaces are considered structural cavities.

BASEMENT. A space of full story height below the first floor wholly or partly below exterior grade and which is not used primarily for living or related commercial accommodations. Space, partly below grade, which is used primarily for living accommodation or related commercial use is not considered as basement space. See First Story.

BASEMENTLESS SPACE. (Crawl Space) An unfinished accessible space below the first floor which is usually less than full story height.

COMMUNITY SYSTEM. A central utility system owned, operated and maintained by a private corporation or a nonprofit property owners' association.

CONDUCTANCE, THERMAL. The time rate of heat flow through a unit area of a material of a given thickness, per unit of temperature difference. Value is expressed in Btu/(hr x sq ft x F). (symbol C).

CONDUCTIVITY, THERMAL. The time rate of heat flow through a unit area of a homogenous material under the influence of a unit temperature gradient. Value is expressed in (Btu x in.)/(hr x sq ft x F). (symbol k).

COURT:

Inner Court. An open outdoor space enclosed on all sides by exterior walls of a building or by exterior walls and property lines on which walls are allowable.

Outer Court. An open outdoor space enclosed on at least two sides by exterior walls of a building or by exterior walls and property lines on which walls are allowable, with one side open to a street, driveway, alley, or yard.

COVERAGE. That percentage of the plot area covered by buildings, including accessory buildings.

DWELLING. A building designed or used as living quarters for one or two families.

Detached. A living unit which is completely surrounded by permanent open space.

Duplex. A detached building with two living units arranged side by side or one above the other.

End-Row. Same as semi-detached.

Row. A living unit, the walls on two opposite sides of which are party, lot line or common walls. Configurations such as quadruplexes and triplexes containing living units with two party, lot line or common walls not necessarily opposite to each other may be considered row or end-row houses.

Semi-Detached. A living unit of which one side wall is a party, lot line or common wall.

EXIT. That portion of a means of egress which provides a way of travel to the exterior.

FINISH RATING. The time at which the stud, joist or core reaches an average temperature rise of 250 F or an individual temperature rise of 325 F as measured on the plane of the stud, joist or core nearest the fire in accordance with ASTM E119 test.

FOUNDATION. Construction, usually below or partly below grade which provides support for exterior walls or other structural parts of the building.

GAS VENT. A chimney designed and approved for use of gas burning appliances only.

GROUNDWATER. An area of contained underground or perched water whose upper level provides a subsurface water table.

HABITABLE ROOM. A room designed and used for living, sleeping, eating or cooking, or combination thereof. Bathrooms, toilet compartments, closets, halls, storage spaces, laundry and utility rooms, basement recreation rooms and similar areas are not considered habitable rooms.

IMPACT INSULATION CLASS. IIC is a single-figure rating which provides an estimate of the impact sound insulating performance of a floor-ceiling assembly.

INDIVIDUAL SYSTEM. A utility system such as water or sewerage serving a single property and located on that property.

LISTED AND LISTING. Terms referring to materials, equipment or products which have been tested to and comply with an applicable standard and which are shown in a list published by a recognized certifying agency.

LIVING UNIT. A residential unit providing complete, independent living facilities for one family including permanent provisions for living, sleeping, eating, cooking and sanitation.

NONCOMBUSTIBLE. As applied to a building construction material means a material no part of which will ignite, burn or release flammable vapors when subjected to fire in accordance with ASTM E136 test Noncombustibility of Elementary Materials.

PERM. The unit of measurement of the water vapor permeability of a material. Value of one perm is equal to one grain of water vapor per square foot per hour per inch of mercury vapor pressure difference.

PROPERTY. An area of ground under one legal ownership including all buildings and improvements thereon.

PUBLIC SPACE. Public space is a legal open space on the premises accessible to a public way or street, such as a yard, court, or open space permanently devoted to public use and abutting the premises.

PUBLIC SYSTEM. A central utility owned, operated, and maintained by a municipality, county, or other unit of local government having power to tax or levy assessments.

R THERMAL RESISTANCE. A measure of ability to retard heat flow. R is the numerical reciprocal of U, thus $R = \frac{1}{U}$.

REQUIRED. Mandatory.

SEASONAL HOMES. Homes intended for seasonal or other than year-round occupancy.

SEPARATION. A permanent open space between the building exterior walls and the lot line or the center line of a facing street or alley. Where two or more buildings are on a lot, the horizontal open space between exterior walls.

SHALL. Indicates that which is required.

STORY. That portion of a building between a floor and the next floor above, or roof.

First Story (First Floor). The lowermost story which is primarily above exterior grade on one or more sides, containing at least 50 percent living accommodations or related nonresidential uses. Stories below grade used for storage, parking, mechanical equipment or other services are considered basement stories. Related nonresidential uses include laundry space, recreation or hobby rooms, commercial use and related corridor space.

Half Story. A story finished as living accommodations located wholly or partly within the roof frame and having a floor at least half as large as the story below. Space with less than 5 ft clear headroom shall not be considered as floor area.

Top Story. The story between the uppermost floor and the ceiling or roof above.

TOILET ROOM. (Half Bath). Enclosed space, containing one or more waterclosets and a lavatory.

U OVERALL COEFFICIENT OF HEAT TRANSMISSION. The combined thermal value of all the materials in a building section, air spaces, and surface air films. U is expressed in Btu/(hr x sq ft x F).

WALL.

Common Wall. A wall separating two living units in the same real estate entity.

Firewall. A wall with qualities of fire resistance and structural stability which subdivides a building into fire areas, and which retards the spread of fire.

Lot Line Wall. A wall adjoining and parallel to the lot line used primarily by the party upon whose lot the wall is located. Lot line walls may share common foundations.

Party Wall. A wall used jointly by two parties under easement, erected upon a line separating two parcels of land, each of which is a separate real estate entity.

A P P E N D I X B

ABBREVIATIONS

A	Acceptable
AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
ABPA	American Board Products Association
ABS	Acrylo nitrile butadiene styrene
*ACCA	Air Conditioning Contractors Association (Formerly NESCA)
ACI	American Concrete Institute
agg	Aggregate
AGA	American Gas Association
AHAM	Association of Home Appliance Manufacturers
AHLI	American Home Lighting Institute
AIA	American Institute of Architects
AIA	American Insurance Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning & Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America (Formerly Structural Clay Products Institute - SCPI)
BOCA	Building Officials and Code Administrators, International, Inc.
BRAB	Building Research Advisory Board
Btuh	British thermal units per hour
cf	Cubic feet
cfm	Cubic feet per minute
CFR	Code of Federal Regulations
CISPI	Cast Iron Soil Pipe Institute
*CPSC	Consumer Product Safety Commission
CPVC	Chlorinated polyvinyl chloride
CS	Commercial Standard
CSPE	Chlorosulfonated Polyethylene
CTI	Ceramic Tile Institute
cts	Coats
cy	Cubic yards
dBA	Sound pressure level as measured using the A-weighted network (decibels)
D.C.	District of Columbia

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Div.	Division
dwv	Drain, waste and vent
EEA	Electric Energy Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
ext.	Exterior
F	Fahrenheit (degrees)
FGJA	Flat Glass Jobbers Association
FHA	Federal Housing Administration
FHDA	Fir and Hemlock Door Association
fpm	Feet per minute
FS	Federal Specification
ft	Feet
GA	Gypsum Association
ga	Gauge
gals	Gallons
galv	Galvanized
GAMA	Gas Appliance Manufacturers Association
gph/kw	Gallons per hour per kilowatt
gpm	Gallons per minute
gpsf/h	Gallons per square foot per hour
HPMA	Hardwood Plywood Manufacturers Association
hr	Hour
HUD	Department of Housing and Urban Development
HVI	Home Ventilating Institute
HYDI	Hydronics Institute (See IBR)
IAPMO	International Association of Plumbing and Mechanical Officials
IBR	Institute of Boiler and Radiator Manufacturers (Superceded by HYDI)
ICBO	International Conference of Building Officials
id	Inside diameter
in.	Inches
IPS	International Pipe Standard
int.	Interior
kw	Kilowatts
lb	Pounds
LP	Liquified Petroleum
max.	Maximum
MCA	Mechanical Contractor's Association of America
*MIMA	Mineral Insulation Manufacturers Association (Formerly NMWIA)
min.	Minimum
mph	Miles per hour
MPS	Minimum Property Standards
NA	Not Applicable
NAAMM	The National Association of Architectural Metal Manufacturers
NAHB-RF	National Association of Home Builders--Research Foundation
NBBPVI	National Board of Boiler and Pressure Vessels Inspectors

NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
*NESCA	National Environmental Systems Contractors Association (See ACCA)
NFPA	National Forest Products Association
NFPA	National Fire Protection Association
NIMA	National Insulation Manufacturers Association
NKCA	National Kitchen Cabinet Association
*NMWIA	National Mineral Wool Insulation Association (See MIMA)
*NOFMA-OFGR	National Oak Flooring Manufacturers' Association-Official Flooring Grading Rules
NPA	National Particleboard Association
NRMCA	National Ready-Mixed Concrete Association
NSF	National Sanitation Foundation
NTMA	National Terrazzo and Mosaic Association
NWMA	National Woodwork Manufacturers Association
oc	On center
od	Outside diameter
oz	ounces
%	Percent
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	Product Standard
ppm	Parts per million
psf	Pounds per square foot
psi	Pounds per square inch
PVC	Polyvinyl chloride
SBI	Steel Boiler Institute - Division of Hydronics Institute
SCACM	Southern California Association of Cabinets Manufacturers
SCS	Soil Conservation Service
SEAOC	Structural Engineers Association of California
SGCC	Safety Glazing Certification Council
SI	International Standard
SMACNA	Sheet-Metal and Air Conditioning Contractors National Association, Inc.
SPMA	Sump Pump Manufacturers Association
sq yd	Square yard
SSBC	Southern Standard Building Code
t & g or T & G	Tongue and groove
TCA	Tile Council of America
TECO	Timber Engineering Company
U	Coefficient of thermal transmission Btu/(hour) (square foot) ($F_{inside} - F_{outside}$)
UBC	Uniform Building Code by ICBO
UL	Underwriters' Laboratories, Inc.
UM	Use of Materials Bulletin
USDA	United States Department of Agriculture
vcp	Vitrified clay pipe
wi	Wrought iron
WM	Western Wood Moulding and Millwork Producers
WQA	Water Quality Association (Formerly Water Conditioning Foundation)

504 Masonry - Continued

Cementitious Materials (1)

Portland Cement	ASTM C 150
Portland Cement, Air Entraining	ASTM C 175
Portland Blast Furnace Slab Cement	ASTM C 205
Hydrated Lime, Type S	ASTM C 207
Quick Lime	ASTM C 5
Gypsum	ASTM C 22
Masonry Cement	ASTM C 91

Note (1) Cementitious materials other than allowed by ASTM C 270 or listed herein are considered non-standard materials and shall be submitted for review before use in accordance with 500-3. Chemical analysis and tests for compressive strength (ASTM C 270) and for bond strength (ASTM E 149) will be required.

Aggregate	ASTM C 144
Mortar and Grout	
Reinforced Masonry	ASTM C 476
Non-reinforced Masonry	
Masonry Types M, S, N or O	ASTM C 270
Other Mortars	ASTM E 447
Building Brick	
Clay Brick	ASTM C 62
Facing Brick	ASTM C 216
Sand Lime Brick	ASTM C 73
Fire Brick	FS HH-R-191 or ASTM C 106
Sewer and Manhole Brick	ASTM C 32
Paving Brick	ASTM C 7
Structural Clay Tile	
Load Bearing	FS SS-T-341 or ASTM C 34
Glazed Structural Clay Tile	ASTM C 126
Non-load Bearing	FS SS-T-351 or ASTM C 56
Structural Clay (facing)	ASTM C 212
Hollow Brick	
Hollow Masonry Units Made from Clay or Shale	ASTM C 652
Concrete Masonry	
Hollow Units	ASTM C 90
Hollow Non-load Bearing	ASTM C 129
Solid Units	ASTM C 145
Concrete Brick	ASTM C 55
Solid Core Split Block	ASTM C 55
Cast Stone	ACI 704

504 Masonry - Continued

Miscellaneous Masonry

Clay Flue Lining----------ASTM C 315
Ceramic Glazed Facing, Tile or Brick----------ASTM C 126
Structural Clay Floor Tile----------FS SS-T-321
or ASTM C 57
Sewer Brick----------FS SS-B-391
or ASTM C 32
Ceramic Tile----------TCA 137.1
Concrete Masonry Catch Basins, Manholes-------ASTM C 139
Precast Concrete Culvert, Storm drain,
Sewer Pipe----------ASTM C 76
Drain Tile----------ASTM C 4, or
ASTM C 412
Cold-drawn Steel Wire----------ASTM A 82
Screen Tile----------ASTM C 530
*Gypsum Tile or Block----------ASTM C 52

505 METALS

Aluminum - AA, Aluminum Construction Manual

Aluminum - See chemical composition in standards.

Carbon Steel Forgings----------ASTM A 235
Alloy Steel Forgings----------ASTM A 237
Mild- to Medium-Strength Carbon-Steel Casting
for General Application----------ASTM A 27
High Strength Steel Castings----------ASTM A 148
Structural Steel----------ASTM A 36
High Strength, Low Alloy Steel----------ASTM A 242
High Strength Structural Steel----------ASTM A 440
High Strength, Low Alloy Steel----------ASTM A 441
Structural Steel, 42,000 psi----------ASTM A 529
High Strength, Low Alloy Steel----------ASTM A 572
High Strength, Low Alloy Steel----------ASTM A 588
Welded and Seamless Steel Pipe----------ASTM A 53
Cold-Formed Welded and Seamless Steel Tubing---ASTM A 500
Hot-Formed Welded and Seamless Steel Tubing----ASTM A 501
Hot-Formed Welded and Seamelss High-Strength
Low-Alloy Structural Tubing----------ASTM A 618
Flat-Rolled Carbon Sheets of Structural
Quality----------ASTM A 245
High Strength Cold-Rolled Steel Sheets
and Strip----------ASTM A 374
High Strength Hot-Rolled Steel Sheets
and Strip----------ASTM A 375
Steel Sheet, Zinc Coated (Galvanized) by the Hot-
Dip Process, Physical (Structural) Quality---ASTM A 446
Hot Rolled Carbon Steel Sheets and Strip-------ASTM A 570
Steel Hot-Rolled and Cold-Rolled Sheet
and Strip----------ASTM A 606
Steel Sheet and Srrip Hot-Rolled and
Cold-Rolled----------ASTM A 607
Cold-Rolled Steel Sheet Carbon Structural------ASTM A 611
Tempered Alloy Steel Plate----------ASTM A 514
Steel Structural Rivets----------ASTM A 502

Glass and Other Glazing Panels

Acrylic Plastic Sheets for Glazing Panels	FHA UM-58
Glass	FS DD-G-451
Safety Glass and Other Safety Glazing Panel Materials	CPSC 16 CFR Part 1201
Safety Glazing Material Used in Buildings	SGCC Certified Products Directory
Tempered Glass	FS DD-G-1403
*Voluntary Standards and Tests of Thermal Performance of Residential Insulating Windows and Sliding Glass Doors	AAMA 1502.6

509 FINISH MATERIALS

509-2 EXTERIOR WALL FINISHES

Aluminum	AAMA 1402.2
Asbestos-cement	FS SS-S-346, ASTM C 220, ASTM C 221, ASTM C 223
Building Paper, Grade D	FS UU-B-790
Fiberboard Shingle Backer	ASTM C 208, Class G
Basic Hardboard	PS-58 ANSI A135.4
Hardboard Siding	PS-60 ANSI A135.6
Mat-Formed Wood Particleboard	CS-236 Type 2, B2
Plywood	PS-1 or PS-51
Rigid PVC (polyvinyl chloride)	PS-55
Textured Plywood Panel Siding	UM-64
Stucco (exterior plaster)	ANSI A42.2

509-3 ROOF COVERINGS

Asbestos-cement Shingles	ASTM C 222 or FS SS-S-291
*Asphalt Shingles A, B and C Fire Rating	ASTM D 225 FS SS-S-1534, Class C ASTM D 3462

Underlayment

Asphalt Saturated Felt	ASTM D 226 FS HH-R-595
Asphalt-Saturated-Asbestos Felt	ASTM D 250 FS HH-R-590
Building Paper-Type 1 Graded	FS UU-B-790
Concrete Roofing Tile	FHA UM-17

509-3 Roof Coverings - Continued

Built-up Roofing:

Aggregate	ASTM D 1863
Asphalt	ASTM D 312 or FS SS-A-666
Asphalt-saturated Asbestos Felt	ASTM D 250, ASTM D 655 or FS HH-R-590
Asphalt-saturated Felt	ASTM D 226 or FS HH-R-595
Bituminous-saturated Cotton	ASTM D 173 or FS SS-C-450
Coal-tar-saturated Felt	ASTM D 277 or FS HH-R-595
Coal-tar-pitch	Type A, ASTM D 450 Type 1, FS-R-P-381
*Asphalt-prepared Felt, Mineral Surface	FS SS-R-630
Fibrous Glass Roofing Felt	FS SS-R-620
Wide Selvage Roll Roofing	ASTM D 371
Elastomeric CSPE Sheets	FHA UM-62
Metal Roofing (see 507-5)	

509-4 INTERIOR WALL AND CEILING FINISH

Accoustic Tile	FS SS-S-118
Ceramic Wall Tile	TCA 137.1
Portland Cement	ASTM C 150, Type 1
Hydrated Lime	ASTM C 206, C 207, Type S
Sand	ASTM C 144
Metal Lath	ANSI A42
Organic Adhesives	ANSI A136.1
Dry-set Portland Cement Mortar	ANSI A118.1
Fiberboard	ASTM C 208, Class D FS-LLL-I-535, Class D
Gypsum Veneer Base	ASTM C 588
Gypsum Veneer Plaster	ASTM C 587
Gypsum Wall Board	ASTM C 36 or FS SS-L-30
Water-resistant backing board	ASTM C 630
Nails	ASTM C 514
Laminating Adhesives	ASTM C 475
Hardwood and Decorative Plywood	PS-51
High Pressure Laminated Plastic Panel	NEMA LD-1
Prefinished Hardboard Paneling	PS-59, ANSI A135.5

509-4 Interior Wall and Ceiling Finish - Continued

Basic Hardboard----------PS-58
ANSI A135.4

Lath and Plaster
- Metal Lath----------ANSI A-42.4
- Gypsum Lath----------ASTM C 37 or FS SS-L-30
- Gypsum Plaster----------ASTM C 28 or FS SS-P-402
- Inorganic Aggregates----------ASTM C 35
- Lime----------ASTM C 6 or C 206
- Keene's Cement----------ASTM C 61 or FS SS-C-161

509-5 FINISH FLOORING-RIGID

Ceramic Tile----------TCA 137.1
- Adhesive (organic)----------ANSI A136.1
- Dry-set Portland Cement Mortar----------ANSI A118.1
- Expoxy Adhesive and Grout----------ANSI A118.3

Terrazzo (NTMA Specs and Technical Data).

Wood
- Block, Slat----------PS-27
- Block, Laminated----------HPMA-LF-71
- *Strip Oak Flooring----------NOFMA-OFGR/ Vol. 1, No. 1

509-6 RESILIENT FLOORING

Asphalt Tile (Type I)----------FS SS-T-312
Vinyl Tile (Type III)----------FS SS-T-312
Linoleum----------FS LLL-F-1238
Rotovinyls (Unfilled Vinyl Sheet)----------FS L-F-001641
Rubber Tile (Type II)----------FS SS-T-312
Seamless Coating System----------FS TT-C-1685
Vinyl-asbestos Tile (Type IV)----------FS SS-T-312
Backed Vinyl Plastic Sheet or Tile (Grade C)--FS L-F-475
Homogeneous Vinyl Sheet----------FS L-F-00450

Underlayment
- Basic Hardboard----------PS-58 ANSI A135.4
- Particleboard (Type I-B1)----------CS-236
- Plywood----------PS-1

509-7 PAINTING (RESERVED)

509-8 WALL COVERINGS

Vinyl-coated Wall Covering----------FS CCC-W-408

509-9 OTHER FINISHES

Carpeting and Cushioning----------FHA UM-44
Bonded Urethane Carpet Cushion----------FHA UM-47

510 SPECIALTIES (RESERVED)

511 EQUIPMENT

Minimum Construction Performance Standards
for Kitchen Cabinets----------ANSI A161.1

*512 FURNISHINGS (RESERVED)

513 SPECIAL CONSTRUCTION (RESERVED)

514 CONVEYING SYSTEMS (RESERVED)

515 MECHANICAL

515-1 GENERAL

515-2 MECHANICAL VENTILATION

Ventilation----------HVI-Air Flow Test AMCA-210
Fan Noise Rating----------HVI-Sound Test, AMCA-300

515-3 HEATING

Air Duct, Insulated----------UL181
Furnaces
Oil----------UL727 & 730
Gas----------AGA listed
Electric----------UL573, NFPA-70

*Boilers (Steam & Hot Water)
Oil----------ASME, MCA, SBI, IBR, UL726 & 296
Gas----------ASME, MCA, SBI, AGA, IBR
Electric----------ASME, SBI, UL174

Radiation
Baseboard----------IBR rated
Finned Tube----------IBR rated
Electric----------UL1042, NEMA

Fuel Tanks----------UL58

515-4 COOLING

A/C Central	ARI 210, UL465
Room Units	UL484, AHAM CN-1
Sound Rating	ARI 270
Heat Pump	ARI 240, UL559

515-5 PLUMBING

ABS DWV	FHA UM-54
ABS Pipe	FHA UM-43
Cast Iron Soil Pipe	ASTM A 74
	C 564
	CISPI HS-72
	CISPI HSN-72
	ANSI A112.5
Cast Iron Water Pipe	AWWA 106
	AWWA 108
Clay Pipe	ASTM C 700
	ASTM C 425
	ASTM C 594
	FS SS-P-361
Copper Drainage Tube	ANSI H23.6
	ASTM B 88
Copper Water Tube and Pipe K, L & M	ANSI H23.1
	ASTM B 88
Welded Brass Tube	ASTM B 587
CPVC Pipe	FHA UM-61
Galvanized Steel Threaded Pipe	FS WW-P-406
No-HUB C.I. Pipe	CISPI 301
*Plumbing Fixtures	FS WW-P-541
	ANSI A112
Polybutylene Water Distribution Pipe	FHA UM-68
PE DWV	FHA UM-56
PE Pipe	FHA UM-31
PVC DWV	FHA UM-53
PVC Pipe	FHA UM-41
PVC Thin Wall	ASTM D 2949
Stainless Steel - Grade TP-409	ASTM A 268

515-6 DOMESTIC WATER HEATERS

Oil	UL732
Gas	AGA listed
Electric	UL174

515-7 SPECIAL PIPING SYSTEMS

Gas Piping	NFPA 54 & 58

515-8 WATER SUPPLY SYSTEM

Water Softeners----------WQA S-100
Water Filters----------WQA S-200
*Community Water Systems
Minimum Design Standards for
Community Water Supply Systmes----------HUD Handbook 4940.2

515-9 SEWAGE DISPOSAL SYSTEM

*Community Sewage Systems
Minimum Design Standards for
Community Sewerage Systems----------HUD Handbook 4940.3
*Tanks, Septic, Bituminous-Coated Metal--------UL70

516 ELECTRICAL

516-1 MATERIALS

All Electrical Equipment (wiring, lighting, appliances, etc.)----------NEC and UL AHLI Standards

508 DOORS, WINDOWS AND GLAZING

A WINDOWS AND SLIDING GLASS DOORS - AIR INFILTRATION

A-1 Test Procedure

Air leakage shall be tested in accordance with ASTM E 283.

A-2 Performance Criteria

*a. When tested at a static air pressure of 1.567 psf, the rate of air leakage will not exceed 1/2 cfm per ft of crack length. Air leakage for jalousie windows is not to exceed 1 1/2 cfm per sq ft of total ventilating area. Air leakage for sliding glass doors is not to exceed 1 cfm per sq ft of overall frame dimension.

b. In areas subject to winds (90 mph and over) the performance requirements may be increased at the discretion of the HUD field office so that air leakage will not exceed 1/2 cfm per foot of crack length. Awning type windows not to exceed 3/4 cfm per square foot of total ventilating area. Sliding glass doors not to exceed 1/2 cfm per sq ft of overall frame dimensions.

B WINDOWS AND SLIDING GLASS DOORS - WATER RESISTANCE

B-1 Test Procedure

Water infiltration shall be tested in accordance with ASTM E 331.

B-2 Performance Criteria

a. Minimum Performance - No water shall pass the interior face of the unit when tested at a static pressure of 2.86 psf with water applied at the rate of 5.0 U.S. gal per sq ft per hour for a time period of 15 minutes.

b. In areas subject to wind driven rain (90 mph and over) the static pressure in (a) may be raised to 6.24 psf at the discretion of the HUD field office.

C WINDOWS AND SLIDING GLASS DOORS - PHYSICAL LOAD

C-1 Test Procedure

Physical load tests shall be conducted in accordance with ASTM E 330.

C-2 Performance Criteria

a. Minimum Performance

(1) Under a uniform load of 10 psf applied to surface of unit, except jalousie windows and sliding glass doors, max. deflection of any member shall not exceed 1/175 of its span.

(2) Under a uniform load of 20 psf applied for 10 seconds to the ext., then a uniform load of 10 psf applied to the int. for 10 seconds, there shall be no glass breakage, damage to hardware or residual deflection.

b. In areas subject to winds 90 mph and over, the uniform loads, shown in a. (2) may be increased to 40 psf ext. and 20 psf int. loadings, at the discretion of the HUD field office.

Appendix D - Continued

d. Percolation rate measurements should be made on the day following the saturation process, except in sandy soils.

*e. If water remains in the test hole after overnight saturation, adjust the depth to 6 in. over the gravel. From a fixed reference point, measure the drop in water level at approximately 30 minute intervals over a 4 hr period. The drop which occurs during the final 30 minute period is used to calculate the percolation rate. The above 4 hr period may be omitted if the soil has been saturated at least 12 hrs. In which case, the drop which occurs during the 30 minute period following soil saturation is used to calculate the percolation rate.

Note: If a soil or site is determined to be poorly drained with an accompanying high water table, it is unsuitable regardless of percolation test data.

f. If no water remains in the hole after overnight saturation, add clear water to a depth of about 6 in. over the gravel. From a fixed reference point, measure the height of the water surface at approximately 30 minute intervals over a 4 hr period, refilling the hole to a depth of 6 in. when the percolation rate indicates the hole will run dry before the next reading is made. The drop which occurs during the final 30 minute period is used to calculate the percolation rate.

Note: If a hole must be refilled to obtain a final 30 minute reading, determine from the previous reading the water level drop during that interval. Add water until the level above the bottom equals this figure plus one-half in. Continue the test, measuring the drop during the final 30 minute period.

g. In sandy soils, or other soils in which the first six in. of water seeps away in less than 30 minutes, after the overnight saturation period, the time interval between measurements can be taken as 10 minutes and the test run over a period of one hr. The drop which occurs in the final 10 minute period is used to calculate the percolation rate.

603 Concrete - Continued

Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connection in Reinforced Concrete Construction----------AWS D12.1

Testing Gypsum and Gypsum Products----------UBC 24-26

Veneer Application, Recommended Standards of ICBO----------UBC 30-1

604 MASONRY

Brick Masonry - SCPI, Building Code Requirements for Engineered Brick Masonry - 1969.

Load Bearing Concrete Masonry - NCMA, Specifications for the Design and Construction of Load Bearing Concrete Masonry - 1970.

Building Code Requirements for Masonry - ANSI A41.1 - 1953.

Building Code Requirements for Reinforced Masonry - ANSI A41.2 - 1960.

Concrete Masonry Structures - Design and Construction - ACI Committee 531 - Report Title No. 67-23a, ACI Journal - May, June 1970.

Recommended Practices for Cold Weather Masonry Construction - International Masonry Industry All-Weather Council - August 1, 1970.

605 METALS

Specification for the Design, Fabrication and Erection of Structural Steel For Buildings, AISC

Specification for the Design of Cold-Formed Steel Structural Members, AISI

Specification for the Design of Light Gage Cold-Formed Stainless Steel Structural Members, AISI

Standard Specifications for Open Web Steel Joists, J and H Series, Steel Joist Institute, AISC

Standard Specifications for Long Span Steel Joists, LJ and LH Series, Steel Joist Institute, AISC

Standard Specifications for Deep, Long Span Steel Joists, DLJ and DLH Series, Steel Joist Institute, AISC

Manual of Cold-Formed Welded Structural Steel Tubing, Welded Steel Tube Institute

Design Manual for Structural Steel Tubing, AISI

Aluminum Formed Sheet Building Sheathing Design Guide, AA

Specifications for Aluminum Structures, AA

Aluminum Standards and Data, AA

Welding Aluminum, AA

Metal Curtain Walls, NAAMM Specifications Manual

D1.1, Structural Welding Code, AWS

D12.1, Reinforcing Steel Welding Code, AWS

606 CARPENTRY

*Span Tables for Joists and Rafters and National Design Specifications for Wood Construction, NFPA

Maximum Span for Joists and Rafters - Southern Forest Products Association Technical Bulletin #2 and Canadian Dimension Lumber by Canadian Wood Council.

615-3 Heating - Continued

Installation:

NFPA No. 31 - Standard for the Installation of Oil Burning Equipment.
NFPA No. 54 - Standard for the Installation of Gas Appliances and Gas Piping.
*NFPA No. 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
*NFPA No. 70 - National Electrical Code.
NFPA No. 211 - Standard for Chimneys, Fireplaces, and Venting Systems.

Also applicable standards by:
American Insurance Association
ASME
UL, AGA, NECA
NAHB Manual

Furnaces
Oil----------UL727 & 730
Gas----------AGA listed
Electric----------UL573, NFPA 70

Boilers (Steam & Hot Water)
Oil----------MCA, SBI, IBR, UL726 & 296
Gas----------MCA, SBI, AGA, IBR
Electric----------SBI, UL174

Radiation
Baseboard----------IBR rated
Fanned Tube----------IBR rated
Electric----------UL, NEMA

Fuel Tanks----------UL58

Boiler Ratings

Net ratings of boilers shall conform to their listing in:

(1) "IBR Ratings for Boilers," (Cast Iron), published by the Hydronics Institute.

(2) "Net Load Recommendations for Heating Boiler," published by the Mechanical Contractors Association of America.

(3) "Directory of Approved Appliances and Listed Accessories," published by the American Gas Association.

(4) "Boiler Ratings," published by the Steel Boiler Institute.

615-3 Heating - Continued

Boiler Construction
ASME - Code for Low Pressure Heating Boilers.

Warm Air Furnaces
One and Two Family Dwelling Code (Under Nationally Recognized Model Codes) Chapters 11, 12, 13, 15 & 16

*Hot Water & Steam Systems
ASHRAE Handbook
IBR Installation Guides

Duct and Duct Insulation
One and Two Family Dwelling Code (Under Nationally Recognized Model Codes) Chapter 16, Ducts

Self Contained Heating Units
One and Two Family Dwelling Code (Under Nationally Recognized Model Codes) Chapter 14, Vented Decorative Appliances, Floor Furnaces, Vented Wall Furnaces and Vented Room Heaters

Gas Vents
One and Two Family Dwelling Code (Under Nationally Recognized Model Codes) Chapter 15, Venting of Appliances

Heat Output of Radiator, Baseboard and Convector Systems
IBR Test
Product Standard (PS)
Commercial Standard (CS)

615-4 MECHANICAL COOLING

*Summer Air Conditioning - Central Design
ASHRAE Handbook
ARI Standard 230, UL465
ACCA Manual J
NFPA Standard 90B
IBR C 30
SMACNA Installation Standard and Guides
NEMA

Summer Air Conditioning - Room Units
UL 484
AHAM CN-1

Refrigeration Systems
ANSI B9.1
ANSI Z21.40.1 Gas Fired Units
ANSI Z21.40.1a Gas Fired Units

Gas Piping and Systems
NFPA No. 54
NFPA No. 58

Oil Systems
NFPA No. 31

Safety
ANSI B15.1

Electrical
NEC
UL - No. 465

Heat Pump
ARI 240
UL 559

615-5 PLUMBING

Joints and Connections
ASTM C 564; CISPI-HSN; CISPI 301

Pipe Protection
AWWA - C - 204

Water Softening
WQA S-100

Plumbing Fixtures
FS WW-P-541

Plumbing, Drainage and Venting Systems
Chapter 22 - One and Two Family Dwelling Code
(BOCA, NBC, SSBC and UBC)

615-6 DOMESTIC WATER HEATING SYSTEMS AND STORAGE

Electric Hot Water Heater Standards
EEI
FS, UL174

Gas Hot Water Heaters
AGA - listed

Oil Hot Water Heaters
UL732

Water Heater Controls
ANSI Z21.22

Pressure Relief Valves - Water Heaters
NBBPVI
AGA

Hot Water Tank Construction
ANSI Z21.10

*Service Water Heating
ASHRAE Handbook

615-7 SPECIAL PIPING SYSTEMS

NFPA Standards 54 and 58

615-8 WATER SUPPLY

Drinking Water Standards

U.S. Public Health Service Drinking Water Standards

U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations, effective June 24, 1977, Federal Register, December 24, 1975 and July 9, 1976

Individual Water Systems

Manual of Individual Water Supply Systems by the U.S. Environmental Protection Agency

*615-9 SEWAGE DISPOSAL SYSTEM

HUD Handbook 4075.8
HUD Handbook 4940.3
Installing Vitrified Clay Pipe Sewers----------ASTM C 12
Underground Installation of Flexible Thermoplastic Sewer Pipe----------ASTM D 2321

Percolation Test Procedure

See Appendix D

616 ELECTRICAL

616-1 MATERIALS AND INSTALLATION

NEC
UL

616-6 EMERGENCY SYSTEMS

NFPA 101

A P P E N D I X F

USE OF MATERIALS BULLETINS

Appendix F is a partial list of Use of Materials Bulletins describing products and methods which are not included in the standard but which have been found to be technically suitable for use in HUD programs.

502 SITE (RESERVED)

503 CONCRETE (RESERVED)

504 MASONRY (RESERVED)

505 METALS

Application and Fastening Schedule Power, Mechanically and Manually Driven Fasteners----------No. UM-25

*506 CARPENTRY

Mat-Formed Wood Particleboard for Floor Underlayment----------No. UM-28

Grade Marking of Lumber----------No. UM-38

Grade Marking of Plywood----------No. UM-40

Labels of Independent Programs for Certifying Pressure Treated Lumber and Plywood----------No. UM-48

Supplement 1----------No. UM-48

Supplement 2----------No. UM-48

Supplement 3----------No. UM-48

Supplement 4----------No. UM-48

Supplement 5----------No. UM-48

Combination Subfloor/Underlayment Particleboard for Factory Built Modular Housing Units----------No. UM-57

Plywood Combination Subfloor/Underlayment Floor Panel----------No. UM-66

Particleboard Interior Stair Treads----------No. UM-70

Field Glued Plywood & Wood Farme
Structural Floor Systems----------No. UM-60

*507 THERMAL AND MOISTURE PROTECTION

Vermiculite Water-Repellent Masonry
Fill Insulation----------No. UM-30

Structural Fiberboard Insulating Roof Deck---------No. UM-29

Silicone Treated Perlite Loose Fill Insulation-----No. UM-37

Polystyrene Foam Insulation Sheathing Board--------No. UM-71

Thermal Insulation, Urea-Based, Foamed in Place----No. UM-74

508 DOORS, WINDOWS, GLAZING PANELS

Labels of Independent Programs for Certifying
Aluminum Windows and Sliding Glass Doors---------No. UM-39

Quality Certification and Labeling for
Hardwood Veneer Doors----------No. UM-52

Acrylic Plastic Sheets for Glazing----------No. UM-58

Labels Identifying Independent
Certification of Wood Windows----------No. UM-59

Polycarbonate Plastic Sheets for Glazing----------No. UM-67

*509 FINISH MATERIALS

Concrete Roofing Tile----------No. UM-17

Minimum Standards for Carpeting
and Cushioning----------No. UM-44

Bonded Urethane Carpet Cushion----------No. UM-47

Textured Plywood Panel Siding----------No. UM-64

Factory-Applied Laminated Roofing Systems Based
on Chlorosulfonated Polyethylene (CSPE)----------No. UM-62

Controlled Density Cellular Concrete Floor Fill----No. UM-65

Self-Adhering Vinyl Asbestos Floor Tile----------No. UM-69

510 (RESERVED)

511 (RESERVED)

512 (RESERVED)

513 (RESERVED)

514 (RESERVED)

*515 MECHANICAL

Plastic Bathtubs, Plastic Shower Stalls and Receptors and Plastic Lavatories----------No. UM-73

Chlorinated Poly (Vinyl Chloride) CPVC and Polybutylene (PB) Hot and Cold Water Distribution Piping----------No. UM-76

Cast Iron Sanitary Drainage System with Hubless Pipe and Fittings----------No. UM-77

Polyethylene (PE), Acrylonitrile-Butadiene-Styrene (ABS), Poly (Vinyl Chloride) (PVC) and Polybutylene (PB) Plastic Piping for Domestic Cold Water Service----------No. UM-78

Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings----------No. UM-79

U. S. GOVERNMENT PRINTING OFFICE : 1979 O - 301-162

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Office of Housing
Washington, D.C. 20410

REVISION NO. 8a "Minimum Property Standards for One- and Two-Family Dwellings," 4900.1

February 1980

This transmits revised pages for the captioned document. The revision is made to correct pagination errors caused by delays in the clearance, printing and distribution of Revisions 6a and 8. The revision contains no other changes.

This revision is applicable to all HUD field office jurisdictions and is effective immediately.

Changes are indicated by an asterisk (*). The attached pages should be inserted in the captioned document and the corresponding old pages removed.

607-2.4 Continued

c. Roof Deck. When a concrete slab, steel deck, wood plank, or other roof deck material is also the finish ceiling surface or the space below is not ventilated, a vapor barrier having a vapor permeance of not more than 1/2 perm shall be installed near the warm side of the construction.

Joints at sides and ends of fiberboard roof deck shall be designed to provide effective sealing of vapor barrier.

d. Slabs-On-Ground. (See 507-2.2 and 603-7 for requirements).

e. Crawl Spaces. Ground surface treatment material having a vapor transmission rate not exceeding 1 perm shall be installed as required by 403-3 and 601-16.2b(4).

607-2.5 Special Conditions

a. In locations where the foundation is subjected to a high water table or where surface or ground water drainage may present a problem, additional precautions will be required.

b. Where the specific site conditions indicate that well drained soil exists or where ground surface water will not present a problem, lower standards may be permitted.

c. In dry regions with an average annual precipitation of less than 15 in., where no problems exist on the site under construction, lower standards for moisture protection may be permitted.

607-3 BUILDING INSULATION

607-3.1 General

a. Insulation of buildings shall be such as to assure conservation of energy, economy of operation and comfort to the occupants.

b. INSULATION MAY BE OMITTED FROM SEASONAL HOMES, NOT INTENDED FOR YEAR ROUND OCCUPANCY, AT THE DISCRETION OF THE HUD OFFICE WHOSE DETERMINATION SHALL BE BASED UPON CLIMATIC CONDITIONS AND THE PROPOSED SEASON OF OCCUPANCY OF THE PROPERTY.

607-3.2 Overall Coefficient of Heat Transmission

a. All buildings which are heated or cooled mechanically shall be constructed to comply with the U values shown in Table 6-7.1. U values shown do not include adjustments for framing in walls, ceilings or floors, nor for the sash frame in windows or glass doors.

b. Where the stated U value of any one component of roof deck, ceiling, wall or floor cannot be practically obtained, such U value may be increased to the min. figure attainable and the U value for other components decreased until the overall heat gain or heat loss does not exceed the total resulting from conformance to the stated U values.

607-3.3 Component Coefficient Values

For ceilings, walls, floors and openings, U values shall not exceed those shown in Table 6-7-1.

TABLE 6-7.1

Maximum U Values for Ceiling, Wall and Floor Sections for Electric Resistance Heat (E.R.) and Heat Pump or Fossil Fuel Heat (F.F.) (1)

Winter Degree Days (65 F Base)	Ceilings (2)		Walls		Floors (3)		Windows (4)		Sliding Glass Doors (4)		Storm Doors (5)	
	E.R.	F.F.	E.R.	F.F.	E.R.	F.F.	E.R.	F.F.	E.R.	F.F.	E.R.	F.F.
0 - 1000	.05	.05	.08	.08	--	--	1.13	1.13	1.13	1.13	No	No
1001 - 2500	.04	.05	.07	.08	--	--	.69	1.13	.69	1.13	No (6)	No
2501 - 3500	.03	.04	.05	.08	.07	--	.69	1.13	.69	1.13	No (6)	No
3501 - 4500	.03	.03	.05	.07	.05	.07	.69	.69	.69	.69	No (6)	No (6)
4501 - 6000	.03	.03	.05	.07	.05	.07	.47	.69	.69	.69	Yes	No (6)
6001 - 7000	.026	.03	.05	.07	.05	.07	.47	.69	.69	.69	Yes	No (6)
7001 +	.026	.026	.05	.05	.05	.05	.47	.47	.69	.69	Yes	Yes

615-2.2 Bathrooms

a. Where natural ventilation is not provided, mechanical exhaust ventilation shall be installed in accordance with Table 4-3.1. Air shall be discharged by an exhaust fan directly to the outdoors, or may be discharged into an attic space which is cross-vented with a total net free area of 1/150 of the ceiling area.

b. Make-up air shall be provided to the bathroom by means of an air intake grille located in the lower part of the bathroom door or wall, or by undercutting the bathroom door. If an intake grille is installed, it shall be vision-proof. The make-up air opening shall be sized for the air volume requirements of the exhaust fan at a velocity not to exceed 500 fpm.

615-2.3 Kitchens

a. Where natural ventilation is not provided, mechanical exhaust ventilation shall be provided in accordance with Table 4-3.1. Air mechanically exhausted from the kitchen shall be through a range hood or through a ceiling or wall exhaust grille.

b. Mechanical exhaust air intake openings (grilles) shall be located either:

(1) In the ceiling or wall not more than 4 ft from the center-line of the range, or

(2) In the wall directly above the back of the range.

A metal collector hood of the size and height required by 615-2.4b may be optionally installed.

615-2.4 Range Hoods

a. Mechanical kitchen range hoods shall be labeled and listed by a recognized testing and inspection agency, and installed in accordance with such listing.

b. Range hood shall be at least as long as the range, shall be at least 17 in. wide, and the bottom of the hood rim shall be not more than 30 in. above the range top.

c. Range hood fan shall have a min. capacity of 40 cfm per linear ft of hood length, except that when installed over a range located in an island or peninsula, fan shall have a min. capacity of 50 cfm per linear ft of hood length.

615-2.5 Combustion Air

Furnaces, boilers and domestic water heaters energized by fossil fuels shall be sealed combustion types or shall be separated from the conditioned atmosphere of the home. Combustion and ventilating air shall be provided in the required amounts from outside the conditioned atmosphere of the home in accordance with the requirements of NFPA Standards 31 and 54.

615-3 HEATING

615-3.1 Heat Loss Calculations

a. Calculations of heat loss shall be made in accordance with the data and procedures contained in the current ASHRAE Handbook, IBR Guides sponsored by the Hydronics Institute, ARI, SMACNA, NEMA or ACCA, and the limitations set forth in 607-3. NAHB Research Foundation's Insulation Manual may be used as a reference.

b. Inside design temperature shall be not less than 70 F. Outside design temperature shall be that established by the ASHRAE Handbook at the 97 1/2% design value for the location involved or as determined by the HUD field office based upon its record of experience.

c. For housing for the elderly, inside design temperature shall not be less than 75 F in all habitable rooms and corridors when the outside temperature is at design level. Lower inside design temperatures may be used for storage rooms, work rooms, and other similar spaces.

615-3.2 Hot Water and Steam Systems

a. Design and installation of the entire system shall be in accordance with the ASHRAE Handbook or IBR Installation Guides.

b. Heating systems shall be installed with 3/4 in. drains at all low points and with a vent at all high points to permit complete drainage of the entire system by gravity.

c. When make-up water is of such a quality that excessive corrosion or scaling is known to exist, a suitable water treatment system as recommended by WQA shall be provided.

d. One pipe system shall be installed in compliance with the recommendation of the manufacturer of the special one pipe system fittings used.

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U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
WASHINGTON, D.C. 20410

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