ARTICLE XXI

FIRE RESISTANCE RATINGS

of

Beam, Girder and Truss Protections,

Ceiling Constructions,

Column Protections,

Floor and Ceiling Constructions,

Roof Constructions,

Walls and Partitions

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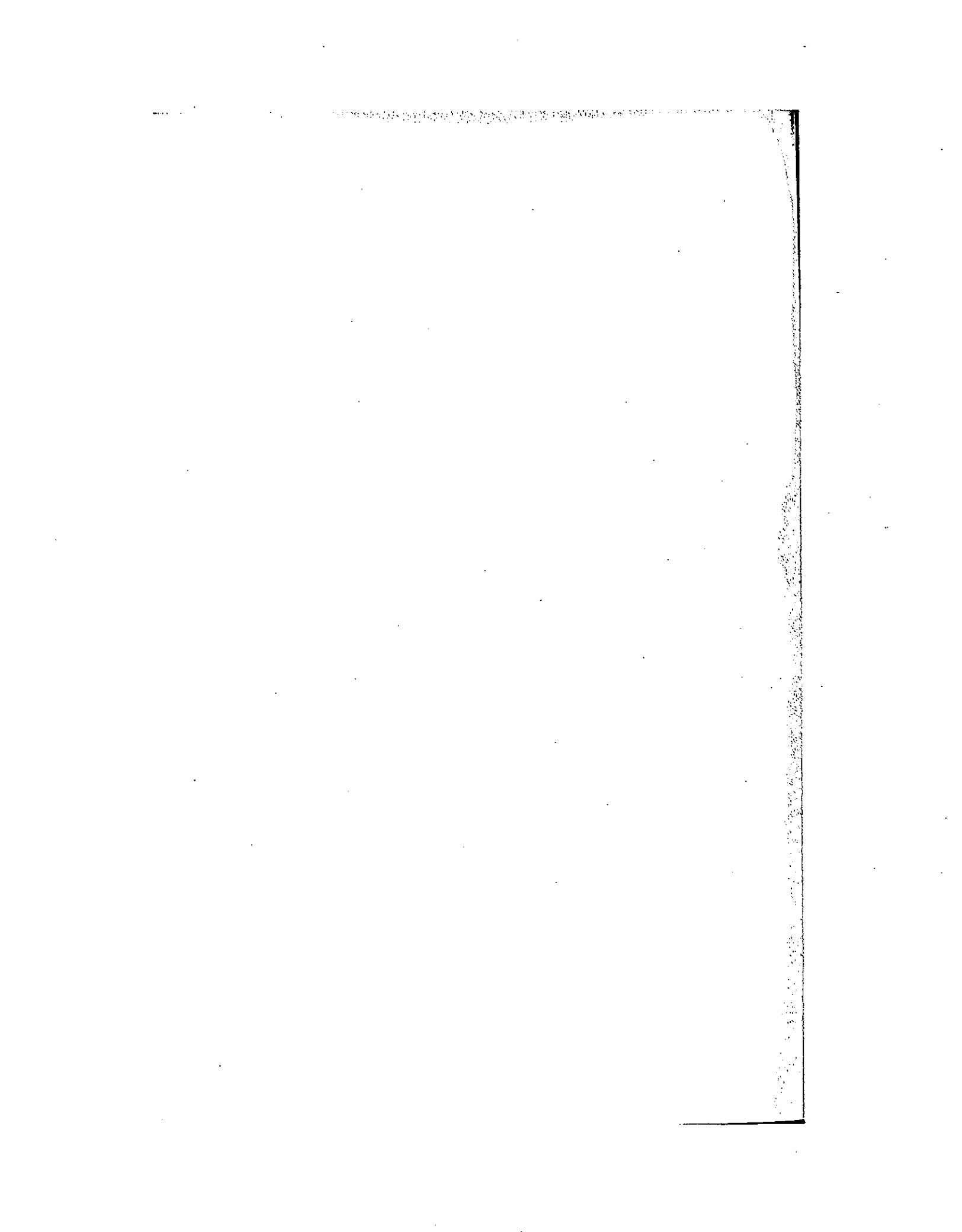


Fire Resistance Ratings

The following tables present for the information of building inspectors and other public officials, architects, engineers and others interested in fire safety in buildings, types of construction which provide fire resistance ratings of 1, 1½, 2, 2½, 3 and 4 hours, as may be required by codes or regulations. The data cover,

Beam, girder and truss protections
Ceiling constructions
Column protections
Floor and ceiling constructions
Roof constructions
Walls and partitions.

The tables are set up in terms of minimum requirements (type, details of construction and thickness of materials) for the specified fire resistance, and in such form as to fit the requirements for hours fire resistance given in building codes. Some constructions, such as brick walls and certain column protections, have obtained test ratings higher than required by building codes, and hence higher than indicated in the tables. For further data the original references, shown by numbers in parenthesis, should be consulted.

Ratings shown as "Based on Standard Fire Tests" are ratings derived from tests made substantially in accord with the "Standard Methods of Fire Tests of Building Construction and Materials," ASTM E119.

Grouped separately from ratings based on standard tests are estimated ratings of certain forms of construction which have been commonly recognized in building codes but for which standard test data have not been available. Such ratings have been included to fill some of the important gaps in the tables of ratings based on standard tests, so that building inspectors and other users of these tables would have some information to go by pending the time when more adequate test data become available.

The tables include the ratings shown in the January, 1955 Fire Protection Equipment List of Underwriters' Laboratories, Inc., and the Supplements thereto through August. Listings of Underwriters' Laboratories made since that date may include additional ratings. For data on any such ratings see the latest issue of the Fire Protection Equipment List, which is published by Underwriters' Laboratories, Inc. annually with bi-monthly supplements.

Attention is called to the fact that with ratings based on currently published listings by Underwriters' Laboratories, Inc., there is reasonable assurance that the listed materials will conform in weight, dimension, and quality to those which developed the original test rating, but that with other ratings the materials currently available may not necessarily be the same weight, dimensions and quality as those which were originally tested and rated.

Where an assembly is specified to be of noncombustible materials, care must be exercised in selecting from the tables only assemblies which are made of noncombustible materials.

Analyzing Test Data. In judging and interpreting test results it is necessary to analyze carefully the test data if ratings therefrom are to be on a comparable basis.

With many of the older fire tests the fire exposure differed to a considerable extent from the present standard fire exposure, and with many of the early floor fire tests top surface temperatures were not observed.

Many of the tests on columns were made prior to 1925 with column loads somewhat lower than permitted today. In certain cases this necessitates consideration of the effect of greater allowable loads on the fire resistance rating.

Many tests have been made on samples smaller than the minimum size specified in the standard fire test. Such tests cannot be considered the equivalent of tests made on samples of standard size. In some cases they may be satisfactory in determining heat transmission characteristics, from which fairly reliable esti-

mates of the fire resistance rating may be made, provided other characteristics affecting performance of the assembly in the standard fire test have been established, but such estimates must be made with considerable caution.

The above factors have been taken into account in arriving at the ratings shown in the following tables.

Applying Test Results to Modified Forms of Construction. Because small differences in quality of materials, forms of construction and dimensions of parts, in some cases, make large differences in the fire resistance, care must be exercised in applying test ratings to constructions which differ from those actually tested. Some of the factors which need to be considered are the following.

CONCRETE. The fire resistance of concrete depends to a considerable extent on the kind and quality of coarse aggregate used. Siliceous gravel aggregates which contain a large percentage of chert or flint show marked disruptive effects under fire exposure, whereas limestone, trap rock and a number of other aggregates exhibit only minor cracking and spalling under similar conditions.

The relation between kind of aggregate and fire resistance rating is well illustrated in the ratings given for concrete protections for steel columns.

PLASTER. In constructions where plaster coatings provide an important part of the fire resistance, it is important to note the kind of plaster, its thickness, the type and proportions of the ingredients, and the type and method of fastening the lath. Gypsum plaster is superior to portland cement or lime plaster in resisting heat transmission. Unless asbestos or other fiber is added to portland cement plaster, its fire resistance is further limited by cracking and spalling.

The richness of the plaster mix has a considerable effect on the fire resistance, particularly with gypsum plaster, and if the listed ratings are to be obtained the mix must be as specified.

The increase in fire resistance obtained by addition of a plaster coating is shown in the tables for certain constructions. In general, a facing of ¾-inch portland cement or gypsum plaster will usually increase the fire resistance of a 1-hour assembly by ½-hour. On 2-, 3- and 4-hour assemblies the increase for the same kind and thickness of plaster will be progressively greater, amounting usually to about 1 hour on a 4-hour assembly. If applied to two sides of a masonry partition the effectiveness is double that of plaster on one side. Plaster coatings, to be effective in adding to the fire resistance periods when combustible structural members are framed in, must be on the exposed faces of the walls opposite to the faces in which the combustible members are inserted.

The use of perlite or vermiculite aggregate in plaster, increases its resistance to fire.

HOLLOW UNITS. It should be noted that with hollow constructions and with constructions composed of hollow units the thickness of the hollow space is a relatively minor factor in the fire resistance. Comparative tests have indicated that it is the total thickness of solid material in the unit rather than the total thickness of the unit which is the principal factor. Therefore, with constructions involving hollow block or tile, use of a thicker unit of the same material will increase the rating only if and as the thickness of solid material in the unit is increased.

CRITICAL FEATURES IN FIRE RESISTANCE RATINGS. With masonry walls and partitions the critical feature in determining the fire resistance rating under the standard fire test is usually the temperature rise on the unexposed surface or in other words its resistance to heat transmission. However, with some constructions, the critical feature may be the load carrying ability under fire exposure or the resistance to hose stream penetration.

With columns, beams and girders the critical feature is usually the ability to carry the load under fire exposure, which in turn is usually dependent on the heat insulating value of the protective covering and its ability to stay in place during the fire exposure.

With noncombustible floor constructions the critical feature has usually been the temperature rise on the top (unexposed) surface in view of adequate protection provided on the under side, but ceiling protection is important and if deficient the critical feature becomes the load carrying ability under fire exposure which is dependent on the ceiling protection. Where the ceiling protection consists chiefly of plaster on some form of lath the method of attachment of the lath and the

security with which it and the plaster are held in place during the fire exposure are often critical features. Falling of any considerable portion of the plaster and lath during the fire exposure period makes the possible collapse of such floors under load (whether of combustible or noncombustible construction) a critical feature in the test results. This has been the case in a number of floor tests.

It should be noted that ratings of plaster facings on walls and partitions are not applicable to similar finishes on ceilings, for under fire exposure plaster may fall from a ceiling considerably before it will fall from a vertical surface, even though it be applied to the same plaster base in both cases.

Fire Walls. Fire resistance ratings as determined by the standard fire test do not provide an adequate basis for specifying minimum thickness of fire walls of buildings. In brief general terms, the standard fire test is made on a sample wall about 10 feet square and to be rated as a 4-hour wall, for example, the sample must stand up under the standard exposure fire and bear its rated load, if of load bearing construction, for a period of 4 hours without attaining a temperature on its unexposed face higher than 250 F. above the starting temperature. The hose stream test which is also specified is made on a like sample exposed to only a 1-hour fire so that this test is not a critical factor in such walls.

It is obvious that a fire test as described will not measure the ability of a wall many times the size of the test panel to stand up against fire exposure extending over more or less its entire area. Walls expand when heated and in severe building fires it is common to see them curl and fall as the result of such expansion on the heated side. Ability to withstand the impact from collapsing floors and falling objects is also important.

When a wall is called upon to stop a spreading fire that is reaching or has attained conflagration proportions it must have stability against collapse or overturning far in excess of that presented by certain types of construction which develop a 4-hour resistance in the standard fire test, if it is to serve its purpose.

Therefore until tests have been developed that will measure the kind of performance required in fire walls of buildings, it is necessary to a considerable extent, as in the National Building Code, to specify thickness and required lateral support of walls on the basis of experience and their performance in actual fires.

GENERAL NOTES

Materials and Forms of Construction

All ratings are based on use of materials and forms of construction in full conformity with requirements of the National Building Code, and in compliance with any applicable material specifications of the American Society for Testing Materials.

The thicknesses of walls, partitions and floor slabs specified in the tables are based on fire resistance only and are not to be construed as permitting such thicknesses where other considerations require greater thicknesses. See for example the Code provisions regarding height and thickness of masonry walls in section 909 of the National Building Code.

Plaster

Plaster mixes are designated as follows: "1:2, 1:3 gypsum and sand plaster" which indicates two coats of plaster, the first or scratch coat made of 1 part gypsum to 2 parts sand, and the second or brown coat of 1 part gypsum to 3 parts sand.

Plaster proportions are by weight unless otherwise indicated.

Plaster of cement and sand may be richer in cement content than specified for a given rating unless otherwise indicated.

Plaster of gypsum and sand may be richer in gypsum content than specified for a given rating unless otherwise indicated.

Plasters with vermiculite or perlite aggregate must be of the proportions as specified for a given rating.

Thickness of plaster is measured from the face of the plaster base, except that with metal lath it is measured from the back of the lath unless otherwise stated. The usual 1/16 in. white or finish coat of plaster may be included in the required plaster thickness.

Ceilings of plaster on metal lath, unless otherwise specified in individual ratings, may be in contact, furred, or suspended.

Explanatory Notes and References

Letters appearing in the tables as superscripts refer to explanatory notes given at the end of the tables.

Numbers in parenthesis given in the tables under details of construction or details of protection refer to references to sources of data listed at the end of the tables, after the notes.

U.L. refers to Underwriters' Laboratories, Inc.

BEAM, GIRDER AND TRUSS PROTECTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Reinforced Concrete Beams, Girders and Trusses	1½ in.[1] concrete, coarse aggregate air cooled slag. (62-J)	4 hrs.
	1½ in.[1] concrete, coarse aggregate expanded slag. (62-A)	4 hrs.
	1½ in.[1] concrete, coarse aggregate crushed limestone. (62-B)	3 hrs.
	1½ in.[1] concrete, coarse aggregate calcareous gravel. (62-C)	3 hrs.
	1½ in.[1] concrete, coarse aggregate siliceous gravel[a]. (62-D)	3 hrs.
Steel Beams, Girders and Trusses Individually Protected	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath cage of self furring metal lath which puts back of lath ¼ in. from steel. Plaster mix: scratch and brown coat 2 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 5-3 HR (Beam 4 HR) or Design No. 8-4 HR.	4 hrs.
	2 in. (measured from face of lath) U.L. listed vermiculite acoustical plastic on metal lath cage. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 10-4 HR (Beam 4 HR).	4 hrs.
	3⅜ in. U.L. listed sprayed fiber applied directly to adhesive coated steel beam. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 11-4 HR (Beam 4 HR).	4 hrs.
	1⅝ in. U.L. listed sprayed fiber on metal lath bent around ¾ in. U-shaped ¾ in. furring channels and spaced 1¾ in. from ¾ in. U.L. listed sprayed fiber on beam. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 6-4 HR (Beam 4 HR).	4 hrs.
	2½ in. U.L. listed sprayed fiber applied directly to adhesive coated steel beam. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 9-4 HR (Beam 3 HR).	3 hrs.
	1 in. (measured from face of lath) gypsum perlite plaster on metal lath supported by ¾ in. channels boxed around beam, which puts back of lath at least 1½ in. from the bottom and 1⅝ in. from edges of structural members. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 6-3 HR (Beam 2 HR).	2 hrs.

Letter superscripts refer to notes, page 44.

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Individually Protected	⅞ in. (measured from face of lath) gypsum vermiculite plaster on metal lath supported by metal hangars anchored in concrete pads over beams. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-1½ HR (Beam 1½ HR).	1½ hr.
	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 3-1 HR (Beam 1 HR).	1 hr.
	1½ in. sprayed fiber on metal lath cage spaced at least 3 in. from the bottom and 2 in. from edges of structural members. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 3-3 HR (Beam 1 HR).	1 hr.
Steel Beams, Girders and Trusses Protected by a Suspended Ceiling.[j]	Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster, on metal lath supported so as to provide not less than 2½ in. air space between lath and structural members. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. of U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 2-4 HR, or Design No. 7-4 HR.	4 hrs.
	Ceiling of 1 in. (measured from face of lath) gypsum-perlite plaster on metal lath, with back plaster on ceiling lath to be not less than 1 in., and on beam 1½ to 3 in., especially at corners. Lath supported so as to provide not less than 3 in. air space between lath and structural members. Steel members to project not more than 8 in. below ceiling surface. Plaster mix: scratch and brown coat 2 to 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 3-4 HR.	4 hrs.
	Ceiling of ⅝ in. (measured from face of lath) gypsum-vermiculite plaster covered with ½ in. vermiculite acoustical plastic, on metal lath supported so as to provide not less than 2½ in. air space between lath and structural members. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 4-4 HR.	4 hrs.

Letter superscripts refer to notes, page 44.

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses Protected by a Suspended Ceiling.[j]	Ceiling of 1⅛ in. (measured from face of lath) U.L. listed sprayed fiber on metal lath, and ¾ in. sprayed fiber applied directly to structural members, with at least 1½ in. air space between lath and ¾ in. protection. Steel members to project not more than 7 in. below ceiling surface. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 4-3 HR (Beam 4 HR).	4 hrs.
	Ceiling of ⅞ in. (measured from face of lath) gypsum-perlite plaster, on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct openings not to exceed 70 sq. in. in each 100 sq. ft. of ceiling area; not more than one electrical outlet in each 90 sq. ft. of ceiling area. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Damper protection, duct locations and other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 5-4 HR.	4 hrs.
	Ceiling of ⅞ in. (measured from face of lath) gypsum-vermiculite plaster, on metal lath suspended beneath structural members and ducts. Lath supported not less than 3½ in. below structural members. Duct openings not to exceed 85 sq. in. in each 100 sq. ft. ceiling area; not more than one electrical outlet in each 90 sq ft. ceiling area. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. vermiculite to 100 lbs. fibered gypsum. Damper protection, duct locations and other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-3 HR.	3 hrs.
	Ceiling of 1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath. Plaster mix: 4:1 by weight or approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. (32)	3 hrs.
	Ceiling of 1 in. (measured from face of lath) sprayed fiber on metal lath, with not less than 2 in. air space between lath and structural members. Steel members to project not more than 8 in. below ceiling surface. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 2-3 HR (Beam 2 HR).	2 hrs.
	Any ceiling protection described under Floor and Ceiling Constructions, Steel, if the beams, girders or trusses do not extend below the level of the ceiling more than 6 in. (see note j).	Same as Floor Rating

Letter superscripts refer to notes, page 44.

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Estimated Ratings

Type	Details of Construction	Rating
Reinforced Concrete Beams, Girders and Trusses	1 in.[l] concrete.	1 hr.

Type	Details of Protection	Minimum Thickness[l] Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Steel Beams, Girders and Trusses individually protected	Clay tile or concrete block; plastered with ½ in. portland cement or gypsum plaster.	—	—	2	2
	Clay tile or concrete block; plastered with ½ in. portland cement or gypsum plaster; all spaces between member and tile or block filled solid.	—	2	2	2
	Clay tile or concrete block; unplastered.	—	—	—	2
	Clay tile or concrete block; unplastered; all spaces between member and tile or block filled solid.	—	—	2	2
	Concrete, Group 1 coarse aggregates[k]; metal ties bent around beam flanges and other projecting parts.	2	2	1½	1
	Concrete, Group 2 coarse aggregates[k]; with 3 in. or finer metal mesh placed 1 in. from the finished surface.	2½	2½	2	1½
	Brick, hollow or solid (clay, concrete or sand-lime).	3¾	3¾	2¼	2¼
	Gypsum blocks, hollow; plastered with ½ in. gypsum plaster.	3	3	2	2
	Gypsum blocks, hollow; unplastered; joints grouted.	—	3	2	2
	Gypsum blocks, solid; plastered with ½ in. gypsum plaster.	2	2	2	2
	Gypsum blocks, solid; unplastered; joints grouted.	—	—	2	2
	Gypsum poured; plastered with ½ in. gypsum plaster.	1½	1½	1	½
	Gypsum, poured; unplastered.	2	2	1½	1

Letter superscripts refer to notes, page 44.

BEAM, GIRDER AND TRUSS PROTECTIONS—Continued

Estimated Ratings

Type	Details of Protection	Rating
Steel Beams, Girders and Trusses individually protected	Two ¾ in. layers of 1:3 gypsum and sand plaster on metal lath, with ¾ in. air space between.	2½ hrs.
	Two ⅞ in. layers 1:2½ portland cement and sand plaster on metal lath, with ¾ in. air space between.	2 hrs.
	¾ in. 1:3 gypsum and sand plaster on metal lath.	1 hr.
	1 in. 1:2½ portland cement and sand plaster on metal lath.	1 hr.

CEILING CONSTRUCTIONS

	Any ceiling construction described under Floor and Ceiling Constructions, provided there are no combustible materials above the ceiling.	Rating Same as Floor Rating
	Note. Where there is combustible material above the ceiling the fire resistance rating of the ceiling construction will be considerably less than the rating of the floor construction employing the same ceiling protection.	

COLUMN PROTECTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Cast Iron Columns 7 in. diam. or larger[m]	2 in.[l] hollow clay tile with outside wire ties[q]; ¾ in. mortar between tile and column; no fill. (9, 26)	3 hrs.
	1½ in. portland cement plaster on ¾ in. rib metal lath, with plaster pushed through sufficiently to leave not over ½ in. air space; Plaster mix (by volume): 1:1/10:2½ portland cement, lime and sand; no fill. (9, 26)	3 hrs.
	2 in. concrete, coarse aggregate cinders[o], 1:2:5 mix; no fill. (9, 26)	2½ hrs.
Reinforced Concrete[y] Columns	1½ in.[l] concrete coarse aggregate limestone, calcareous[n] gravel, trap rock or blast furnace slag; 12 in. or larger round or square columns.[m] (27)	4 hrs.
	2½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel[s]; 16 in. or larger round or square columns.[m] (27)	4 hrs.
	1½ in. concrete, ½ in. coarse aggregate granite, sandstone or siliceous gravel[s]; covered with 1 in. 1:2½ (by volume) portland cement and sand or gypsum and sand plaster, with admixture of not over ½ part lime; surface of column hacked or column cast in metal lath form, 16 in. or larger round or square columns.[m] (27)	4 hrs

Letter superscripts refer to notes, page 44.

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Reinforced Concrete[y] Columns	1½ in. concrete, coarse aggregate granite, sandstone or siliceous gravel[s]; light 2 in. mesh expanded metal centrally located in the protective covering. 14 in. or larger round or square columns.[m] (27)	4 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone or siliceous gravel[s]; light 2 in. mesh expanded metal centrally located in the protective covering. 12 in. or larger round or square columns.[m] (27)	3 hrs.
	1½ in. concrete, coarse aggregate granite, sandstone, or siliceous gravel[s]; 16 in. or larger round or square columns.[m] (27)	3 hrs.

Type	Details of Protection	Minimum Thickness[t] Inches, for Rating of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Steel Columns 6 x 6 in. or larger[m]	Brick (clay) with brick fill. (26)	3¾	3¾	3¾	2¼
	Concrete, coarse aggregate calcareous[n] or limestone; fill of same material. (9, 26)				
	6 x 6 in. or larger	2	1½	1	1
	8 x 8 in. or larger	1½	1	1	1
	12 x 12 in. or larger	1	1	1	1
	Concrete, coarse aggregate trap rock; fill of same material; steel wire ties[p]. (9, 26)				
	6 x 6 in. or larger	2½	2	1½	1
	8 x 8 in. or larger	2	1½	1	1
	12 x 12 in. or larger	1½	1	1	1
	Concrete, coarse aggregate granite, sandstone or cinders[o]; fill of same material; steel wire ties[aa]. (95)				
	6 x 6 in. or larger	3	2	1½	1
	8 x 8 in. or larger	2½	2	1	1
	12 x 12 in. or larger	2	1	1	1
	Concrete, coarse aggregate siliceous[x] gravel; fill of same material; steel wire ties[aa]. (95)				
	6 x 6 in. or larger	3	2	1½	1
	8 x 8 in. or larger	2½	2	1	1
	12 x 12 in. or larger	2	1	1	1

Letter superscripts refer to notes, page 44.

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	3 in. concrete block, hollow, cinder; fill of cinder concrete slabs and mortar with 1¼ in. mortar between column and blocks[r]. (29)	4 hrs.
	4 in. gypsum block, solid; corrugated metal ties or ⅜ in. metal mesh in horizontal joints; gypsum block or poured gypsum fill; ¾ in. gypsum mortar between column and block. (26)	4 hrs.
	2 in. gypsum concrete, poured; fill of same material; 4 x 4 in. wire mesh reinforcement wrapped around column[t]. (28)	4 hrs.
	2 in. gypsum block, solid; plastered with ½ in. gypsum and sand plaster; ⅞ in. 12 gauge metal cramps set in holes drilled in blocks to link adjacent blocks of the same course together; no fill. (28)	4 hrs.
	2 in. gypsum block, solid; wire lath strips laid in horizontal joints; fill of gypsum block and mortar with ½ in. mortar between column and blocks and with ½ in. gypsum and sand plaster on outside. (28)	4 hrs.
	3 in. gypsum block, hollow; covered with ½ in. gypsum and sand plaster; ⅞ in. 12 gauge metal cramps linking adjacent blocks of same course; ¼ in. mortar between column flange and block; no fill. (28)	4 hrs.
	4 in. hollow clay tile, two 2 in. layers; ½ in. mortar between tile and column; ⅜ in. metal mesh in horizontal joints; hollow clay tile fill. (26)	4 hrs.
	2 in. hollow clay tile plastered with ¾ in. 1:3 (by volume) gypsum and sand plaster; ¾ in. mortar between tile and column; ⅜ in. metal mesh in horizontal joints; limestone concrete fill. (26)	4 hrs.
	4 in. hollow clay tile plastered with ⅝ in. 1:2½ (by volume) lime and sand plaster; 1⅛ in. mortar between tile and column, ⅜ in. metal mesh in horizontal joints; limestone concrete fill. (26)	4 hrs.
	1½ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing[e], under Column Protection—Design No. 1-4 HR.	4 hrs.
	1½ in. gypsum-vermiculite plaster reinforced with wire mesh, on 2 layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. gypsum. (92)	4 hrs.
	1½ in. gypsum-perlite plaster reinforced with wire mesh, on 2 layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	4 hrs.

Letter superscripts refer to notes, page 44.

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced from flanges by ¾ in. steel furring channels at approx. 2 ft. vertical spacings. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Column Protection—Design No. 7-4 HR.	4 hrs.
	1¾ in. (measured from face of lath) gypsum-perlite plaster on self-furring metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c] under Column Protection—Design No. 6-4 HR.	4 hrs.
	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: scratch and brown coats 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 3-4 HR.	4 hrs.
	2⅛ in. perlite-plaster reinforced with plain wire fabric, on paper backed No. 16 guage welded wire fabric. Plaster mix: 3½ cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. of portland cement. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 8-4 HR.	4 hrs.
	1¾ in. U.L. listed L-shaped precast concrete units secured to flange of column and metal edge of adjacent unit by steel studs welded in place. Vertical and Horizontal joints filled with a 3:1 mix (by volume) of perlite and cement mortar. Fill of 8:1 mix (by volume) of perlite and cement. Other details as specified in U.L. listing[c], under Column Protection—Design No. 5-4 HR.	4 hrs.
	2⅛ in. gypsum-perlite plaster reinforced with poultry netting, on ½ in. gypsum lath boxed around column. Plaster mix: scratch coat 3½ cu. ft. and brown coat 4 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. unfibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 4-4 HR.	4 hrs.
	1½ in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 2-4 HR.	4 hrs.

Letter superscripts refer to notes, page 44.

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath spaced 1 in. from column. Plaster mix: 4:1 by weight or approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. Loose vermiculite fill. (32)	4 hrs.
	1 in. gypsum-perlite plaster reinforced with wire mesh, on 2 layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	3 hrs
	1½ in. gypsum-perlite plaster reinforced with wire mesh, on ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	3 hrs.
	1⅜ in. gypsum-perlite plaster, on 2 layers of ½ in. gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (92)	3 hrs.
	1¾ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (92)	3 hrs.
	1⅜ in. (measured from face of lath) gypsum-perlite plaster on self-furring metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Column Protection—Design No. 6-3 HR.	3 hrs.
	2 in. gypsum and sand plaster on ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 200 lbs. and brown coat 300 lbs. sand to 100 lbs. fibered gypsum. (90)	3 hrs.
	2 in. hollow clay tile with outside wire ties[q] or with ⅜ in. metal mesh in horizontal joints; limestone or trap rock concrete fill, extending 1 in. outside column on all sides. (26)	3 hrs.
	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column, with plaster pushed through to column flanges. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 3-3 HR.	3 hrs.
	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 4-3 HR.	3 hrs.

Letter superscripts refer to notes, page 44.

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath spaced 1¼ in. from column with plaster pushed through to column flanges. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lb. fibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 1-3 HR.	3 hrs.
	1¼ in. gypsum-vermiculite plaster on two layers ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: 2¼ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Column Protection—Design No. 5-3 HR.	3 hrs.
	1¾ in. (measured from face of lath) U.L. listed cement and plaster mixture on ⅜ in. ribbed metal lath wrapped around column. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 2-3 HR.	3 hrs.
	1½ in. gypsum-perlite plaster, on ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (94)	2½ hrs.
	Two ¾ in. layers of 1:3 gypsum and sand plaster or two 1 in. layers of 1:2½ portland cement and sand plaster, on metal lath, with ¾ in. air space between the two layers; no fill. (9)	2½ hrs.
	Four layers ½ in. gypsum wallboard. Inner three layers cemented and clinch nailed together, cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	2½ hrs.
	1 in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. Plaster mix: 100 lbs. gypsum to 2½ cu. ft. perlite. (92)	2 hrs.
	2 in. gypsum block, solid; unplastered; ⅞ in. 12 gauge metal cramps set in holes drilled in blocks to link adjacent blocks of same course together; no fill. (28)	2 hrs.
	2 in. gypsum block, solid; corrugated metal ties or ⅜ in. metal mesh in horizontal joints; gypsum block or poured gypsum fill; ¾ in. gypsum mortar between column and block. (26)	2 hrs.
	3 in. gypsum block, hollow; unplastered; ⅞ in. 12 gauge metal cramps linking adjacent blocks of same course; no fill. (28)	2 hrs.

Letter superscripts refer to notes, page 44.

COLUMN PROTECTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Columns	1 in. (measured from face of lath) gypsum-perlite plaster on self-furring metal lath to fur lath ¼ in. from steel. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Column Protection—Design No. 2-2 HR.	2 hrs.
	1 in. (measured from face of lath) gypsum-perlite plaster on metal lath spaced 1¼ in. from column. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. No fill. Other details as specified in U.L. listing[c], under Column Protection—Design No. 1-2 HR.	2 hrs.
	2½ in. plaster, two ⅞ in. layers 1:1/10:2½ (by volume) portland cement, lime and sand on metal lath; ¾ in. air space between layers; no fill. (26)	2 hrs.
	⅝ in. 1:2½ gypsum and sand plaster on ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. (92)	1½ hrs.
	Three layers ½ in. gypsum wallboard. Inner two layers cemented and clinch nailed together, cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	1½ hrs.
	Two layers ½ in. gypsum wallboard. Inner layer cemented to column flanges and tied to column with double strands 18 gauge tie wire at 15 in. spacing. Outer layer cemented to inner layer; corners cemented and taped. (69)	1 hr.
	¾ in. 1:3 gypsum and sand plaster or 1 in. 1:2½ portland cement and sand plaster, on metal lath. (9)	1 hr.
	½ in. 1:2½ gypsum and sand plaster, on ⅜ in. perforated gypsum lath boxed around column and fastened with wire ties. (92)	1 hr.
	2 in. hollow clay tile with outside wire ties[q], with or without concrete fill; ¾ in. mortar between tile and column. (26)	1 hr.
	1 in. plaster, 1:1/10:2½ (by volume) portland cement, lime and sand on metal lath; no fill. (26)	1 hr.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Concrete and Tile[u]	6 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows, and concrete cast around and over tile to a depth of 2 in. Ceiling plastered with ⅝ in. 1:3 gypsum and sand plaster. (33)	2 hrs.
	4 in. hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows and concrete cast around and over tile to a depth of 1½ in. Ceiling plastered with ⅝ in. 1:3 gypsum and sand plaster. (33)	1½ hrs.
	4 in, hollow clay tile fillers laid end to end in rows 2½ in. or more apart; reinforcing steel placed between these rows and concrete cast around them and over tile to a depth of 1½ in. Ceiling unplastered. (33)	1 hr.
Gypsum Slab[u]	4 in. reinforced gypsum concrete slab supported on properly protected floor beams; reinforced ¾ in. above bottom of slab; ceiling plastered with ¾ in. gypsum and sand plaster. (18, 19)	3 hrs.
Reinforced Concrete[u]	4½ in. slab with expanded slag aggregate. ¾ in. protection to steel reinforcement. (62-A)	4 hrs.
	6 in. slab with air-cooled slag aggregate. 1 in. protection to steel reinforcement. (62-J)	4 hrs.
	5 in. slab with limestone aggregate, with electrical raceways and junction boxes[dd]. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-K)	4 hrs.
	3 in. slab with limestone aggregate. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-K)	4 hrs.
	4 in. slab with limestone aggregate, with electrical raceways and junction boxes[ee]. Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported not less than 11½ in. from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-I)	3 hrs.
	2 in. slab with limestone aggregate. Ceiling of ¾ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported not less than 13½ in. from the bottom of the concrete slab. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. (62-I)	3 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Reinforced Concrete[u]	6 in. slab with traprock aggregate. 1 in. protection to steel reinforcement. (62-L)	3 hrs.
	6 in. slab with crushed limestone aggregate. 1 in. protection to steel reinforcement. (62-B)	3 hrs.
	6 in. slab with calcareous gravel aggregate. 1 in. protection to steel reinforcement. (62-C)	3 hrs.
	6 in. slab with siliceous sand and gravel aggregate.[s] 1 in. protection to steel reinforcement. (62-D)	3 hrs.
	4¾ in. slab with trap rock aggregate. ¾ in. protection to steel reinforcement. (62-E)	2 hrs.
	4¾ in. slab with calcareous gravel aggregate. 1 in. protection to steel reinforcement. (62-F)	2 hrs.
	4¾ in. slab with crushed limestone aggregate. 1 in. protection to steel reinforcement. (62-G)	2 hrs.
	4¾ in. slab with siliceous sand and gravel aggregate.[s] ¾ in. protection to steel reinforcement (62-H)	2 hrs.
	4 in. slab with siliceous gravel aggregate. ¾ in. protection to steel reinforcement. (33)	1 hr.
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams[u]	2½ in. concrete slab[v] on metal lath, or 2 in. reinforced gypsum slabs covered with ½ in. mortar, on joists. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	4 hrs.
	2 in. concrete slab[v] on metal lath, or 2 in. precast reinforced portland cement concrete or gypsum slabs, on joists, the precast slabs to be finished with top coating of ¼ in. mortar. Ceiling of 2 in. reinforced gypsum tile anchored to joists with metal ties and covered with ½ in. 1:3 gypsum and sand plaster. (9)	4 hrs.
	2 in concrete slab[v] on metal lath. Ceiling of 1 in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers with interlocking wire clips giving continuous support to lath. Plaster reinforced with 20 ga. wire mash. Wire mesh attached to furring channels at joints in lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	4 hrs.
	2 in. concrete floor slab[v] on metal lath, or 2¾ in. reinforced portland cement concrete plank with joints thoroughly grouted, on joists. Ceiling of 1 in. gypsum-vermiculite plaster (measured from face of lath) on metal lath. Plaster mix: 4:1 by weight or approx. 100 lbs. fibered gypsum to 2½ cu. ft. vermiculite. (32)	3 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or **Steel Beams**[u]	2½ in. concrete floor slab[v] on metal lath, or 2 in. reinforced gypsum tile covered with ½ in. mortar, on joists. Ceiling of 1 in. unsanded wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	3 hrs.
	2½ in. reinforced gypsum concrete on ⅜ in. gypsum plaster board on joists, or 2½ in. cinder concrete on metal floor lath on steel joists. Ceiling of 2 in. precast, reinforced gypsum ceiling tile suspended ½ in. below 1 in. furring channels in turn suspended ½ in. below joists; gypsum ceiling tile corrugated on under surface for effective plaster bond; all joints grouted with gypsum; ceiling finished with ½ in. 1:1 gypsum and sand plaster. (17)	3 hrs.
	2½ in. reinforced gypsum concrete on ½ in. gypsum plaster board on joists. Ceiling of 2¼ in. reinforced gypsum concrete attached to bottoms of joists, plastered with ¾ in. gypsum and sand plaster; reinforcement 1 in. above bottom of ceiling slab. (18)	3 hrs.
	2 in. precast, reinforced gypsum slabs on joists; joints grouted with gypsum. Ceiling of 2 in. precast, reinforced gypsum attached to bottoms of joists; joints grouted with gypsum; plastered with ¾ in. gypsum and sand plaster. (20)	3 hrs.
	2⅝ in. reinforced gypsum concrete on ⅜ in. gypsum plaster board supported by joists of which the lower ⅔ is encased in precast gypsum and the upper ⅓ extends into the floor slab; 1 in. minimum fireproofing on joists. Ceiling of ¾ in. 1:1 gypsum and sand plaster on metal lath. (22)	3 hrs.
	2 in. concrete slab[v] on metal lath. Ceiling of ½ in. gypsum-perlite plaster, on ⅜ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with special wire clips giving continuous support to lath. Plaster reinforced with wire mesh. Wire mesh attached to furring channels at joints in lath. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2 in. concrete slab[v] on metal lath. Ceiling of ⅝ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster reinforced with 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (65)	3 hrs.
	2½ in. perlite concrete slab[v] on paper-backed wire fabric. Ceiling of ¾ in. gypsum perlite plaster (measured from face of lath) on metal lath secured to joists with wire clips. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 6-3 HR.	3 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams[u]	2½ in. concrete slab[v] on metal lath. Ceiling: 1 in. sprayed asbestos fiber on metal lath. (33)	2½ hrs.
	2 in. concrete floor slab[v] on metal lath, or 2 in. reinforced gypsum tile covered with ¼ in. mortar, on joists. Ceiling of 1 in. unsanded wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	2½ hrs.
	2 in. concrete slab[v] on metal lath. Ceiling of ½ in. gypsum-perlite plaster applied to ⅜ in. perforated gypsum lath secured to ¾ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	2 hrs.
	2½ in. concrete slab[v] on metal lath. Ceiling: ¾ in. sprayed asbestos fiber on metal lath. (33)	2 hrs.
	2¼ in. concrete floor slab[v] on metal lath, or 2 in. reinforced gypsum tile covered with ¼ in. mortar finish, on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	2 hrs.
	2½ in. floor slab consisting of 2 in. reinforced gypsum concrete on ½ in. gypsum form boards. Ceiling of ⅝ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. 14 gauge galvanized wire secured diagonally to clips or channels at each intersection. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. gypsum. (88))	2 hrs.
	2 in. concrete floor slab[v] on metal lath, or 2 in. reinforced gypsum tile, on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster, or ¾ in. 1:2, 1:3 portland cement and sand plaster with 3 lb. asbestos fiber and 15 lb. hydrated lime per bag cement, on metal lath. (9)	1½ hrs.
	2 in. concrete slab[v] on metal lath. Ceiling of 1 in. gypsum-perlite plaster, applied to ⅜ in. perforated gypsum lath attach to ¾ in. furring channels spaced 16 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (65)	1½ hrs.
	2 in. floor slab, consisting of 1½ in. reinforced gypsum concrete on ½ in. gypsum form boards. Ceiling of 1¼ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath, attached to ¾ in. furring channels spaced 12 in. on centers, with interlocking wire clips giving continuous support to lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (65)	1½ hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) **or Steel Beams**[u]	2 in. concrete slab[v] on metal lath. Ceiling: 5/8 in. sprayed asbestos fiber on metal lath. (33)	1½ hrs.
	2 in. (measured from face of lath) reinforced concrete slab on metal lath. Ceiling of 5/8 in. U.L. listed wall board[cc] or 5/8 in. U.L. listed coreboard[cc], secured to ¾ in. furring channels, with sheet-metal screws, or 7/8 in. nailing channels with 1¼ in. nails. Joints in wallboard or coreboard not taped or cemented. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 5-1 HR.	1 hr.
	2 in. concrete floor slab[v] on metal lath. Ceiling of ½ in. gypsum-perlite plaster, on 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 12 in. on centers, with special wire clips giving continuous support to lath. Plastre mix: 2½ cu .ft. perlite to 100 lbs. gypsum. (65)	1 hr.
	2 in. concrete slab[v] on metal lath. Ceiling of 5/8 in. gypsum-perlite plaster, applied to 3/8 in. perforated gypsum lath attached to ¾ in. furring channels spaced 16 in. on centers, with steel wire clips giving continuous support to lath. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (65)	1 hr.
	2 in. reinforced concrete slab on metal lath. Ceiling of 5/8 in. U.L. listed wallboard[cc], secured to ¾ in. furring channels spaced 16 in. on centers, with sheet-metal screws, or to 7/8 in. nailing channels with 1¼ in. nails. Joints in wallboard not taped or cemented. Other details as specified in U.L. listing[c] under Floor and Ceiling Constructions—Design No. 2-1 HR.	1 hr.
	7/8 in. wood flooring nailed to wood sleepers on covering of asbestos paper weighing 14 lb. per 100 sq. ft. cemented on sheet steel deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	1 hr.
Steel Plate Deck on Steel Joists (or Beams)[u]	2 in. reinforced vermiculite concrete on steel plate deck. Ceiling of 1 in. gypsum-vermiculite plaster, (measured from face of lath) on metal lath supported at least 7 in. below underside of steel floor plates, and spaced at least 2½ in. from steel members. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof and Ceiling Constructions—Design No. 2-4 HR.	4 hrs.
	2½ in. concrete on steel plate deck. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum on metal lath. (9)	4 hrs.
	2 in. concrete on steel plate deck. Ceiling of 2 in. reinforced gypsum tile with ½ in. 1:3 gypsum and sand plaster. Tile clipped to channels which are clipped to joists. (9)	4 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Plate Deck on Steel Joists (or Beams)[u]	2½ in. concrete on steel plate deck. Ceiling of 1 in. unsanded, wood-fibered gypsum plaster, or ¾ in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath. (9)	3 hrs.
	2½ in. cinder concrete plus ½ in. cement mortar finish, on steel plate deck. Ceiling of 1⅛ in. 1:1 gypsum and sand plaster on metal lath. (9)	3 hrs.
	2½ in. concrete on steel plate deck. Ceiling of 1 in. 1:2 gypsum and sand plaster on metal lath. (9)	2½ hrs.
	2 in. concrete on steel plate deck. Ceiling of 1⅛ in. 1:1 gypsum and sand plaster, on metal lath; or ceiling of 1½ in. 1:2 gypsum and sand plaster on ribbed metal lath. (9)	2½ hrs.
	2 in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster, or 1 in. 1:2, 1:2½ portland cement and sand plaster with 10 lb. hydrated lime added per bag cement, on metal lath. (9)	2 hrs.
	2 in. concrete on steel plate deck. Ceiling of 2 in. interlocking unreinforced gypsum tile supported on upper face of lower beam flange, with ½ in. 1:3 gypsum and sand plaster. (9)	2 hrs.
	1½ in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (9)	1½ hrs.
	1 in. concrete on steel plate deck. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (33)	1 hr.
Steel Units[u], Cellular	2 in. cinder concrete (minimum thickness over cells) on top of U.L. listed cellular steel floor units. Ceiling ⅞ in. (measured from face of lath) gypsum-vermiculite plaster on metal lath supported by ¾ in. furring channels attached to 1½ in. runner channels secured to bottom of floor units. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-4 HR.	4 hrs.
	2 in. perlite concrete (minimum thickness over cells) on top of U.L. listed cellular steel floor units. Ceiling of 1 in. (measured from face of lath) gypsum-perlite plaster on metal lath, with back plaster on lath to be not less than 1 in. Lath supported not less than 3 in. from underside of steel floor units. Plaster mix: scratch and brown coat 2 to 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 3-4 HR.	4 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units[u], Cellular	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1⅛ in. (measured from face of lath) plaster consisting of ⅝ in. gypsum-vermiculite plaster and ½ in. vermiculite acoustical plastic on metal lath. Lath supported not less than 7¼ in. from underside of steel floor units. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 4-4 HR.	4 hrs.
	2 in. reinforced concrete on top of U.L. listed cellular steel floor units. Ceiling of ⅞ in. (measured from face of lath) gypsum-perlite plaster on metal lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Lath supported not less than 15½ in. from underside of steel floor, and spaced at least 3½ in. below steel beams. Duct opening in ceiling not larger than 70 sq. in. in each 100 sq. ft. ceiling area, protected by fire damper of No. 12 USS gauge steel covered with two 1/32 in. thick layers of asbestos paper. Also No. 12 USS gauge steel fire damper at junction between branch duct and main duct. Not more than one electrical outlet in each 90 sq. ft. ceiling area. Duct location, and other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 5-4 HR.	4 hrs.
	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1⅛ in. U.L. listed sprayed fiber on metal lath. Lath supported not less than 4½ in. from underside of steel floor. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 6-4 HR.	4 hrs.
	1½ in. concrete plus ½ in. cement mortar finish, on top of cellular steel units. Ceiling of 1 in. gypsum-vermiculite plaster proportioned within the range of 3½ to 5½ cu. ft. vermiculite per 100 lb. gypsum, on metal lath secured not less than 2 in. below bottom of cellular steel units. (9)	4 hrs.
	1½ in. concrete plus ½ in. cement mortar finish, on top of cellular steel units. Ceiling of 1 in. unsanded wood-fibered gypsum plaster on metal lath secured not less than 9 in. below bottom of cellular steel units. (9)	4 hrs.
	1½ in. concrete plus ½ in. cement mortar finish, on top of cellular steel units. Ceiling of 1 in. unsanded wood-fibered gypsum plaster on metal lath secured not less than 2 in. below bottom of cellular steel units. (9)	3 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units[u], Cellular	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of ⅞ in. gypsum-vermiculite plaster, on face of lath supported not less than 15⅜ in. from underside of floor units. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. vermiculite to 100 lbs. fibered gypsum. Duct opening in ceiling not larger than 85 sq. in. in each 100 sq. ft. ceiling area, and protected by No. 14 USS gauge fire damper. Not more than one electrical outlet in each 90 sq. ft. of ceiling area. Duct location and other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-3 HR.	**3 hrs.**
	2 in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1 in. U.L. listed sprayed fiber on face of adhesive coated metal lath. Lath supported not less than 4½ in. from underside of steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 2-3 HR.	**3 hrs.**
	2½ in. (minimum thickness over cells) concrete on top of U.L. listed cellular steel floor units. Ceiling of 1½ in. (minimum thickness) U.L. listed sprayed fiber applied directly to underside of adhesive coated cellular steel units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 3-3 HR.	**3 hrs.**
	2½ in. (minimum thickness over cells) reinforced concrete on top of U.L. listed cellular steel floor units. Ceiling of 1⅛ in. U.L. listed sprayed fiber on face of adhesive coated metal lath. Lath supported not less than 4½ in. from underside of steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 4-3 HR.	**3 hrs.**
Steel Units[u], Corrugated	4½ in. (measured from bottom of corrugations) concrete on top of U.L. listed corrugated steel floor units. Ceiling of 1 in. (measured from face of lath) gypsum-vermiculite plaster on metal lath. Lath supported not less than 14½ in. from underside of steel floor. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 7-4 HR.	**4 hrs.**
	4½ in. (measured from bottom of corrugations) expanded slag concrete on top of U.L. listed corrugated steel floor units. Ceiling of ⅜ in. gypsum-perlite plaster (measured from face of lath attached directly to steel floor units) on metal lath, and sufficient plaster pushed through the lath to fill the corrugations of the steel floor units. Plaster mix: scratch and brown coat 2 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 8-4 HR.	**4 hrs.**

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units[u], Corrugated	4½ in. (measured from bottom of corrugations) concrete on top of U.L. listed corrugated steel floor units. Ceiling of ⅞ in. (measured from the bottom of the corrugations) U.L. listed sprayed fiber applied directly to underside of adhesive coated corrugated steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 9-4 HR.	4 hrs.
	4½ in. (measured from bottom of corrugations) concrete on top of U.L. listed corrugated steel floor units. Ceiling of ½ in. (measured from the bottom of the corrugations) U.L. listed vermiculite acoustical plastic applied directly to underside of corrugated steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 10-4 HR.	4 hrs.
	4½ in. (measured from bottom of corrugations) expanded slag concrete on top of U.L. listed corrugated steel floor units. Ceiling of ⅜ in. gypsum-perlite plaster (measured from face of lath attached directly to steel floor units) on metal lath, and sufficient plaster pushed through the lath to fill the corrugations of the steel floor units; 1 in. plaster thickness to the face of the lath in an area 3 ft. square centered below electrical raceway junction box; not more than one junction box in each 90 sq. ft. floor area. Plaster mix: scratch and brown coat 2 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 5-3 HR.	3 hrs.
	4½ in. (measured from bottom of corrugations) crushed limestone concrete on top of U.L. listed corrugated steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 3-1 HR, or No. 4-1 HR.	1 hr.
Heavy Timber	6 in. laminated plank floor with 1 in. finish flooring on top. (31)	1 hr.
Wood Joists	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring, with building paper between. Ceiling of ½ in. gypsum-perlite plaster on ⅜ in. plain gypsum lath nailed to joists with 1½ in. nails having ⅜ in. diameter heads. Plaster reinforced with 1 in. mesh wire fabric nailed to joists through lath, with 2⅛ in. nails having ¼ in. diameter heads. Plaster mix: scratch and brown coats, 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (51)	1½ hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Joists	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of ¾ in. gypsum-vermiculite plaster on metal lath nailed to joists with 1½ in. barbed roofing nails, having 7/16 in. heads and spaced 4¾ in. on centers. Plaster applied with sufficient pressure to form large keys on back of lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. fibered gypsum. (58)	1½ hrs.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of ¾ in. gypsum-perlite plaster on metal lath nailed to joists with 1½ in. barbed roofing nails having 7/16 in. heads and spaced 4¾ in. on centers. Plaster applied with sufficient pressure to form large keys on back of lath. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. perlite to 100 lbs. fibered gypsum. (57)	1½ hrs.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of ½ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath, nailed to joists with 1 3/16 in. nails having 9/32 in. diameter heads. Plaster mix: scratch and brown coats 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (52)	1 hr.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of two layers ½ in. gypsum wallboard with 1 in. mesh wire fabric between. First layer of wallboard nailed with 1⅝ in. nails having 7/32 in. heads; wire fabric and second layer of wallboard nailed with 2⅛ in. nails having ¼ in. heads. Outside joints taped and pointed; nailheads covered with joint cement. (53)	1 hr.
	Wood floor consisting of 1 in. (nominal) tongue and groove sub and finish flooring with building paper between. Ceiling of ⅝ in. U.L. listed wallboard[cc] nailed with 1⅞ in. nails, 6 in. on centers. Joints covered with fiber tape and joint finisher. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-1 HR.	1 hr.
	Wood floor consisting of ¾ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 14 lb. per 100 sq. ft. between. Ceiling of ½ in. 1:2 gypsum and sand plaster on ⅜ in. perforated gypsum lath attached by 1⅛ in. nails with ⅜ in. heads and spaced 4 in. on centers; 3 in. strips of expanded metal lath nailed over all joints in gypsum lath using 1¼ in. nails with ½ in. heads spaced 5 in. on centers along joists and with 2 nails to each joist for joints perpendicular to joists. (9)	1 hr.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Joists	Double ⅞ in. tongue and groove wood flooring with insulating layer between. Ceiling of ½ in. 2:1 wood-fibered gypsum and sand plaster on ⅜ in. plain gypsum plaster base attached by 1¼ in. nails with 7/16 in. heads, 12 to each 16 x 48 in. lath; 3 in. strips expanded metal lath nailed over all joints in gypsum lath. (25)	1 hr.
	Wood floor consisting of ¾ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 14 lbs. per 100 sq. ft. between. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath nailed with 1½ in. No. 11 gauge barbed roofers' nails having 7/16 in. heads and spaced 6 in. on centers. (9)	1 hr.
	Wood floor consisting of ¾ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 14 lbs. per 100 sq. ft. between. Ceiling of ¾ in. 1:2, 1:3 portland cement and sand plaster with 3 lb. asbestos fiber and 15 lbs. hydrated lime added per 94-lb. bag of cement, on metal lath nailed with 1½ in. No. 11 gauge barbed roofers' nails having 7/16 in. heads and spaced 6 in. on centers. (9)	1 hr.

Estimated Ratings

Brick Arch	Minimum depth 4 in. for spans of 5 ft. or less; rise at least 1 in. per ft. of span; at least 2 in. concrete fill on top of arch; ceiling plastered with ¾ in. portland cement or gypsum plaster (23)	3 hrs.
	Minimum depth 8 in.; rise at least 1 in. per ft. of span. (23)	3 hrs.
Hollow Clay Tile Arch	Minimum depth 6 in. with at least 2 cells in the depth; shells and webs not less than ⅝ in. in thickness; vertical and horizontal dimension of cells not greater than 4 in.; at least 2 in. concrete fill on top of arch; ceiling plastered with ¾ in. portland cement or gypsum plaster. (24)	3 hrs.
Reinforced Concrete Joists (Not over 30 in. on centers)	2½ in. reinforced[w] concrete floor slab on joists. Ceiling of 1 in. unsanded, wood-fibered gypsum plaster, or ¾ in. gypsum-perlite or gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. perlite or vermiculite to 100 lbs. gypsum.	3 hrs.
	2¼ in. reinforced[w] concrete floor slab on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath.	2 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Estimated Ratings

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or Steel Beams[u]	2½ in. concrete or gypsum slab on metal lath. Ceiling of ⅞ in. 1:2 gypsum and sand plaster on metal or wire lath.	2½ hrs.

ROOF CONSTRUCTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units[u], Ribbed	3 in. U.L. listed reinforced vermiculite concrete on ribbed steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-1½ HR.	1½ hrs
	Any construction described under "Floor and Ceiling Constructions."	Same as Floor Rating

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Joists	Double ⅞ in. tongue and groove wood flooring with insulating layer between. Ceiling of ½ in. 2:1 wood-fibered gypsum and sand plaster on ⅜ in. plain gypsum plaster base attached by 1¼ in. nails with 7/16 in. heads, 12 to each 16 x 48 in. lath; 3 in. strips expanded metal lath nailed over all joints in gypsum lath. (25)	1 hr.
	Wood floor consisting of ¾ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 14 lbs. per 100 sq. ft. between. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath nailed with 1½ in. No. 11 gauge barbed roofers' nails having 7/16 in. heads and spaced 6 in. on centers. (9)	1 hr.
	Wood floor consisting of ¾ in. sub-floor and tongue and groove finish flooring with asbestos paper weighing 14 lbs. per 100 sq. ft. between. Ceiling of ¾ in. 1:2, 1:3 portland cement and sand plaster with 3 lb. asbestos fiber and 15 lbs. hydrated lime added per 94-lb. bag of cement, on metal lath nailed with 1½ in. No. 11 gauge barbed roofers' nails having 7/16 in. heads and spaced 6 in. on centers. (9)	1 hr.

Estimated Ratings

Brick Arch	Minimum depth 4 in. for spans of 5 ft. or less; rise at least 1 in. per ft. of span; at least 2 in. concrete fill on top of arch; ceiling plastered with ¾ in. portland cement or gypsum plaster (23)	3 hrs.
	Minimum depth 8 in.; rise at least 1 in. per ft. of span. (23)	3 hrs.
Hollow Clay Tile Arch	Minimum depth 6 in. with at least 2 cells in the depth; shells and webs not less than ⅝ in. in thickness; vertical and horizontal dimension of cells not greater than 4 in.; at least 2 in. concrete fill on top of arch; ceiling plastered with ¾ in. portland cement or gypsum plaster. (24)	3 hrs.
Reinforced Concrete Joists (Not over 30 in. on centers)	2½ in. reinforced[w] concrete floor slab on joists. Ceiling of 1 in. unsanded, wood-fibered gypsum plaster, or ¾ in. gypsum-perlite or gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. perlite or vermiculite to 100 lbs. gypsum.	3 hrs.
	2¼ in. reinforced[w] concrete floor slab on joists. Ceiling of ¾ in. 1:2, 1:3 gypsum and sand plaster on metal lath.	2 hrs.

Letter superscripts refer to notes, page 44.

FLOOR AND CEILING CONSTRUCTIONS—Continued

Estimated Ratings

Type	Details of Construction	Rating
Steel Joists (Fabricated from Rolled Sections or from Strip or Sheet Steel) or **Steel Beams**[u]	2½ in. concrete or gypsum slab on metal lath. Ceiling of ⅞ in. 1:2 gypsum and sand plaster on metal or wire lath.	2½ hrs.

ROOF CONSTRUCTIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Units[u], **Ribbed**	3 in. U.L. listed reinforced vermiculite concrete on ribbed steel floor units. Other details as specified in U.L. listing[c], under Floor or Roof, and Ceiling Constructions—Design No. 1-1½ HR.	1½ hrs
	Any construction described under "Floor and Ceiling Constructions."	Same as Floor Rating

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Combustible Members Framed in Wall[a] — Minimum Thickness[b], Inches for Ratings of				Members Framed in Wall: None or Noncombustible — Minimum Thickness[b], Inches for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.	4 hrs.	3 hrs.	2 hrs.	1 hr.
Brick (clay, shale, concrete or sand-lime)	Solid walls plastered one side or unplastered. (1, 2, 3, 93)	12	12	8	8	8	8	8	4
	Solid walls plastered each side with ½ in. 1:3 gypsum and sand or portland cement and sand plaster, or ⅝ in. 1:2½ portland cement and sand or lime and sand plaster. (1, 2, 3, 93)	12	12	8	8	8	8	4	4
	Hollow "Cavity" type walls; ¼ in. round metal ties spaced 2 ft. horizontally every 6th course. (9, 93)	—	—	—[d]	10	10	10	10	10
		U=units C=cells				See Note g			
Hollow Tiles (clay or shale) Load bearing	Unplastered. (4)	16^{2U}_{4C}	16^{2U}_{4C}	12_{3C}	12^{h}_{3C}	12^{2U}_{4C}	12^{2U}_{3C}	12_{3C}	8_{2C}
	Plastered one side[i] with ⅝ in. 1:3 gypsum and sand plaster. (4)	16^{2U}_{4C}	12_{3C}	12^{h}_{2C}	8_{2C}	12^{2U}_{3C}	12_{3C}	8_{3C}	8_{2C}
	Plastered each side as above. (4)	16^{2U}_{4C}	12_{3C}	12^{h}_{2C}	8_{2C}	12_{3C}	8_{2C}	8_{2C}	8_{2C}
Hollow Tile, Brick-faced	Hollow clay (or shale) load-bearing *tile of thickness shown,* bonded to 4 in. brick facing, unplastered. (9)	—	—	8	4	8	4	4	4
	Same as above with tile side plastered with ⅝ in. 1:3 gypsum and sand plaster. (4, 9)	—	12	8	4	4	4	4	4

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Brick (Cored)	6 in. units 76% solid, unplastered; with noncombustible or no members framed into the wall. (93)	2½ hrs.
Brick (Hollow)	8 in. units 71% solid, plaster on both sides with ⅝ in. 1:3 gypsum and sand plaster: (64)	
	With noncombustible or no members framed into wall.	4 hrs.
	With combustible framed[a] in members fully embedded in mortar.	3 hrs.
	With unembedded combustible members framed[a] into wall.	2 hrs.
	8 in. units 71% solid, unplastered: (64)	
	With noncombustible or no members framed into wall.	3 hrs.
	With combustible framed[a] in members fully embedded in mortar.	2 hrs.
	With unembedded combustible members framed[a] into wall.	1½ hrs.
Clay Tile	8 in. wall constructed of U.L. listed clay tile. Regular courses made with 3¾ in. thick units; bonding course made with 1¾ and 5¾ in. thick units located every fourth course, with wide and narrow tile alternated on opposite faces. Other details as specified in U.L. listing[c] under Walls and Partitions—Design No. 3-3 HR.	3 hrs.*
	6⅜ in. partition with two units in wall thickness, one unit 3⅞ in., other 1¾ in. thick, with ¾ in. joint between filled with mortar. Position of units reversed on alternating courses. Tile cored not to exceed 25% in 4 in. unit, and not to exceed 15% in 1¾ in. unit. (13)	3 hrs.*
	6 in. partition consisting of 4 in. tile cored not to exceed 41%, faced on fire exposed side with 1¾ in. tile cored not to exceed 15% with ⅜ in. mortar filled joint between, and plastered on opposite side with ¾ in. 1:3 gypsum and sand plaster. (12)	3 hrs.*
	4 in. facing tile cored not to exceed 25%, plastered on back side with ¾ in. 1:3 gypsum and sand plaster. (14)	2 hrs.*
	4 in. facing tile cored not to exceed 30%, plastered on back side with ¾ in. gypsum-vermiculite plaster composed of 3½ cu. ft. vermiculite to 100 lbs. gypsum. (16)	2 hrs.*
	4 in. hollow tile of medium burned clay, not less than 60% solid, two cells in thickness; both sides plastered with ⅝ in. 1:3 gypsum and sand plaster. (9, 59)	2 hrs.*

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Clay Tile	6 in. hollow tile of medium burned clay, not less than 45% solid, two cells in thickness; both sides plastered with ⅝ in. 1:3 gypsum and sand plaster. (9, 59)	2 hrs.*
	6 in. hollow tile of medium burned clay, not less than 30% solid; plastered on both sides with ⅝ in. gypsum and sand plaster. (9, 59)	1½ hrs.*
	3 in. hollow tile not less than 40% solid, or 4 in. hollow tile not less than 40% solid, of medium burned clay; plastered on both sides with ⅝ in. 1:3 gypsum and sand plaster. (9, 59)	1 hr.*
	4 in. facing tile cored not to exceed 47%, plastered on back side with ¾ in. 1:3 gypsum and sand plaster. (30)	1 hr.*
	4 in. hollow tile plastered each side with ¾ in. 1:3 gypsum and sand plaster. (5)	1 hr.*
	6 in. hollow tile plastered each side with ⅝ in. 1:3 gypsum and sand plaster. (9)	1 hr.*
	4 in. hollow tile having 2 cells in wall thickness plastered each side with ⅝ in. 1:3 gypsum and sand plaster. (9)	1 hr.*
Composite Blocks	4½ in. wall consisting of 3 in. U.L. listed composite blocks, plastered on both sides with ¾ in. 1:1, 1:2 gypsum sand plaster. Other details as specified in U.L. listing[c] under Walls and Partitions—Design No. 2-3 HR.	3 hrs.*
	4½ in. wall consisting of 3 in. U.L. listed composite blocks, (tongue and groove joints—without mortar but with 4 in. strips of metal lath nailed over joints), plastered on both sides with ¾ in. plaster. Scratch and brown coats 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c] under Walls and Partitions—Design No. 4-3 HR.	3 hrs.*
	3 in. blocks of shredded wood bound with magnesium oxysulfate cement, plastered each side with ½ in. 1:3 gypsum and sand plaster. (9)	2 hrs.*
	2 in. blocks as above, plastered as above. (9)	1 hr.*
Concrete Masonry Units	8 or 12 in. U.L. listed concrete blocks, laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 1-4 HR.	4 hrs.†
	8 or 12 in. U.L. listed concrete blocks; cells filled with loose, dry expanded slag and laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 1-3 HR or No. 1-2 HR.	4 hrs.†
	4 in. U.L. listed concrete blocks; cells filled with perlite mortar and laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 2-4 HR.	4 hrs.*

* Nonbearing. † Rated as load bearing with noncombustible or no members framed into wall.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
	8 or 12 in. U.L. listed concrete blocks, laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 1-3 HR.	3 hrs.†
	8 or 12 in. U.L. listed concrete blocks, laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 1-2 HR.	2 hrs.†
	8 or 12 in. U.L. listed concrete blocks with combustible members framed in wall, and plastered on face opposite framing with ¾ in. portland cement stucco or gypsum plaster; laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 1-4 HR, No. 1-3 HR, or No. 1-2 HR.	1½ hrs.
	8 or 12 in. U.L. listed concrete blocks with combustible members framed in wall; laid as specified in U.L. listing[c], under Walls and Partitions—Design No. 1-4 HR or No. 1-3 HR or No. 1-2 HR.	1 hr.

Type	Type of Aggregate	Minimum Face Shell and Web Thicknesses, Inches.§					
		2 hrs.		3 hrs.		4 hrs.	
		Face Shell	Web	Face Shell	Web	Face Shell	Web
Concrete Masonry Units (8 or 12 in. units)	Natural, by-product, and processed, except those listed below. (96)	1¼	1	1½	1	2⅜	1½
	Burned clay or shale. (96)	1⅛	1	1⅜	1		
	Expanded slag. (96)	1⅛	1	1⅜	1	1⅝	1
	Pumice. (96)					1¼	1

† Rated as load bearing, with noncombustible or no members framed into wall.

§ The minimum face shell for the largest core hole at the thinnest point (this may be the average of the two face shells in the same core). The end and internal webs in each core hole to be measured at the thinnest point.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Concrete Masonry Units	**Expanded Shale Aggregate.**	
	10 in. units 60% solid; unplastered. (9, 60)	4 hrs.†
	8 in. units, minimum face shell thickness 1½ in., minimum end shell thickness 1 5/16 in. and minimum interior web thickness 3 1/16 in., unplastered. Concrete studs built into wall on 2 ft. centers by filling every third cell along the length of the wall. Each stud reinforced with one ½ in. round bar. (74)	2 hrs.*
	4 in. units 76% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (60)	2 hrs.*
	6 in. units 61% solid; unplastered. (9, 60)	1½ hrs.*
	3 in. units 76% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60)	1½ hrs.*
	Expanded Slag Aggregate.	
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 60)	4 hrs.‡
	6 in. units 76% solid; unplastered. (9, 60)	3 hrs.†
	6 in. units 61% solid; unplastered. (9, 60)	2 hrs.*
	6 in. units 50% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60)	2 hrs.*
	4 in. units 76% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60)	2 hrs.*
	3 in. units 76% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60)	2 hrs.*
	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum sand and plaster. (9, 60)	1½ hrs.*
	4 in. units 63% solid; unplastered. (9, 60)	1 hr.*
	Pumice Aggregate.	
	10 in. units 60% solid; unplastered. (60)	4 hrs.†
	4 in. units 63% solid; unplastered. (9, 60)	1 hr.*
	Calcareous Gravel Aggregate.	
	8 in. unplastered units, 78% solid. (61)	3 hrs.†
	8 in. unplastered units, 57% solid. (61)	2 hrs.†
	4 in. units 63% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 61)	1½ hrs.*
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 61)	1 hr.†

* Nonbearing. † Rated as load bearing with noncombustible or no members framed into wall.

‡ With combustible members framed[a] into the wall, the rating is 2 hrs.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Concrete Masonry Units	**Cinder Aggregate.**	
	10 in. unplastered cavity wall of two 4 in. wythes 2 in. apart; units 63% solid. (9, 60)	3 hrs.‡
	6 in. units 61% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster. (9, 60)	2 hrs.*
	6 in. units 50% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 60)	2 hrs.*
	6 in. units unplastered, 61% solid. (9, 60)	1½ hrs.*
	Siliceous Gravel Aggregate.	
	12 in. unplastered wall, consisting of 8 in. units 57% solid and 4 in. units 67% solid. (9, 61)	4 hrs.‡
	12 in. units 58% solid; plastered both sides with ½ in. 1:3 gypsum and sand plaster. (61)	4 hrs.§
	4 in. units 74% solid; plastered on both sides with ½ in. 1:3 gypsum and sand plaster. (9, 61)	1 hr.*
Concrete Masonry Units, Brick-faced	**Expanded Shale Aggregate.**	
	6 in. units 61% solid; unplastered; faced with 2¼ in. brick. (9, 60)	4 hrs.†
	Expanded Slag Aggregate.	
	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster; other side faced with 3¾ in. brick. (9, 60)	4 hrs.†
	Pumice Aggregate.	
	4 in. U.L. listed concrete blocks, alternate courses reinforced; unplastered; faced with 4 in. brick. 1 in. air space between block and brick. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 7-4 HR.	4 hrs.†
	Cinder Aggregate.	
	4 in. units 63% solid; plastered on one side with ½ in. 1:3 gypsum and sand plaster; other side faced with 3¾ in. brick. (9, 60)	4 hrs.†
	6 in. unplastered units, 61% solid; faced with 2¼ in. brick. (60)	4 hrs.†
Gypsum Block Partitions	4 in. hollow blocks plastered each side with ½ in. 1:3 gypsum and sand plaster. (6, 83)	4 hrs.*
	3 in. hollow blocks plastered each side as above. (6, 82)	3 hrs.*
	3 in. solid blocks, unplastered. (6)	3 hrs.*
	4 in. hollow blocks plastered on either side with ½ in. 1:3 gypsum and sand plaster. (45, 89)	3 hrs.*
	3 in. hollow blocks plastered on one side with ½ in. 1:3 gypsum and sand plaster. (44)	1½ hrs.*
	2 in. solid blocks, unplastered. (6, 9)	1 hr.*
	3 in. hollow blocks, unplastered. (9)	1 hr.*

* Nonbearing. † Rated as load bearing with noncombustible, or no members, framed into the wall.
‡ With combustible members framed[a] into the wall, the rating is 2 hrs.
§ With combustible members framed[a] into the wall, the rating is 2½ hrs.
Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Gypsum Plank Partitions	3 in. gypsum plank with tongue and groove joints grouted with gypsum, surfaced one side with 20 gauge corrugated steel panels bolted to gypsum at top and bottom with ½ in. bolts 6 in. on centers. Plank made with 10 per cent wood sawdust, and reinforced with 2 in. wire mesh placed ½ in. from each face. (34)	4 hrs.*
	4¼ in. gypsum plank with tongue and groove joints grouted with gypsum. Plank cast on 22 gauge corrugated (V beam) sheets which form one face. Plank made with 10 per cent wood sawdust, and reinforced with 4 in. wire mesh placed ½ in. from gypsum face. (35)	4 hrs.*
	2 in. gypsum planks with tongue and groove joints grouted with plaster. Planks cast on 22 gauge galvanized sheets which form one face, and made with 10% wood sawdust, reinforced with 4 in. wire mesh placed ½ in. from gypsum face. (68)	1 hr.*
Monolithic Cement	8 in. monolithic wall of U.L. listed cement, steel reinforced, constructed as specified in U.L. listing[c] under Walls and Partitions—Design No. 4-4 HR and as described in detail in U.L. report R 3208 dated July 2, 1951.	4 hrs.
Partition Panel Units	3¾ in. wall composed of rockwool lined steel panels and a middle layer of asbestos cement boards, secured to steel channels at floor, wall and ceiling. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 8-1 HR.	1 hr.*
Precast Concrete Wall Sections	8 in. hollow units of expanded slag concrete, 52% solid, minimum wall and web thicknesses 1½ in., unplastered. Units laid vertically on lintel with flange of ring anchors in center groove of units at the joints on the lintel. 3 in. paper tubing set on top of ring anchors and pressed into joint. Joints grouted to paper tubing. ¾ in. horizontal reinforcing rod inserted through the exposed section of ring anchors and tied in place. Floor strap anchors tied to reinforcing rod. All steel covered with concrete. (98)	4 hrs.
	2 in. precast concrete slabs of expanded shale aggregate, 16 in. by 8 ft. laid horizontally and attached each side of 8 in. steel columns spaced on 8 ft. centers. Horizontal joints shiplap type, sealed with mastic. Vertical joints butt type centered over columns and calked with asbestos wicking and sealed with mastic. (77)	2½ hrs.*

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Shotcrete	6⅛ in. solid wall composed of 1:4 portland cement and perlite concrete aggregate mixture, applied with spray gun equipment to paper-backed wire fabric, and reinforced with 16 gauge 2 in. by 2 in. welded wire mesh fastened to 3⅝ in. steel channel studs. Other details as specified in U.L. listing[c] under Walls and Partitions—Design No. 5-4 HR.	4 hrs.
	4¼ in. solid wall composed of 1 cu. ft. portland cement to 4 cu. ft. U.L. listed vermiculite plaster aggregate, applied with spray machine equipment to paper-backed wire fabric. Wall reinforced with 1½ in. steel channel studs 2 ft. on centers and spaced 1¾ in. from paper-backed wire fabric. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 6-5 HR.	4 hrs.*
	6 in. solid wall composed of 1:4 portland cement and sand mixture, applied with spray gun equipment. Wall reinforced with ½ in. round bars on 12 in. centers each way at the mid-thickness of the wall. (72)	3 hrs.*
	2½ in. total thickness of 4½:1:7 portland cement, sawdust and sand mortar sprayed on 4 in. by 4 in. welded wire fabric on steel studs. (9, 81)	1 hr.*
Solid Gypsum Board Partitions (Without steel framing)	2 in. total thickness consisting of 1 in. U.L. listed interlocking laminated gypsum coreboard placed vertically and set in floor and ceiling runners made of 20 gauge sheet metal. ½ in. U.L. listed wallboard applied to the coreboard vertically and secured to the coreboard by an adhesive coating. Wallboard joints butted and staggered with joints of coreboard. Outside joints covered with tape and joint finisher. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 3-2 HR.	2 hrs.*
	1¾ in. minimum total thickness consisting of 1 in. U.L. listed laminated gypsum coreboard erected vertically and set in floor and ceiling runners made of 20 gauge sheet metal. Vertical joints of coreboard butted and held with steel tee clips. Outer layer of ¾ in. or ½ in. U.L. listed wallboard applied vertically or horizontally and secured to adhesive coated coreboard. Vertical joints in wallboard butted and staggered with joints of coreboard. Outside joints covered with tape and joint finisher. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 9-1 HR.	1 hr.*

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Solid Plaster Partitions (Steel framing embedded in plaster)	2½ in. neat gypsum plaster on metal lath attached to ¾ in. or 1 in. steel channels. (9)	2½ hrs.*
	2½ in. total thickness of gypsum-perlite plaster, on metal lath attached to ¾ in. steel channels. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. U.L. listed perlite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c] under Walls and Partitions—Design No. 2-2 HR.	2 hrs.*
	2½ in. total thickness of gypsum-vermiculite plaster on metal lath attached to ¾ in. steel channels. Plaster mix: scratch coat 2 cu. ft. and brown coat 3 cu. ft. of vermiculite to 100 lbs. gypsum. (79)	2 hrs.*
	2 in. total thickness of unsanded, wood-fibered gypsum plaster on metal lath on steel studs. (94)	2 hrs.*
	2½ in. total thickness of 1:½, 1:½ gypsum and sand plaster on metal lath on steel studs. (9)	2 hrs.*
	2 in. total thickness of 1:½, 1:½ gypsum and sand plaster on metal lath attached to ¾ in. or 1 in. steel channels. (9)	1½ hrs.*
	1½ in. gypsum-perlite plaster on metal lath attached to ¾ in. steel channels. Plaster mix for scratch and brown coats 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (66)	1 hr.*
	2¼ in. total thickness of ¾ in. plaster of 86 parts gypsum, 12 parts sawdust and 2 parts asbestos fiber each side ¾ in. asbestos lath (medium), with sheet-steel H supports. (7)	1 hr.*
	2½ in. total thickness of 1:2, 1:3 gypsum and sand plaster on metal lath on steel studs. (7, 9)	1 hr.*
	2 in. total thickness of 1:2, 1:2 gypsum and sand plaster on metal lath on steel studs. (40)	1 hr.*
	2⅛ in. total thickness of ⅞ in. 1:1 gypsum and sand plaster each side of ⅜ in. gypsum lath; steel stud supports. (15)	1 hr.*
	2½ in. total thickness of ¾ in. 1:2½ gypsum and sand plaster each side 1 in. board of shredded wood bound with magnesium oxysulfate cement, with sheet steel H supports. (7, 9)	1 hr.*
	2 in. total thickness of 1:1 gypsum and sand plaster on metal lath on steel studs. (9)	1 hr.*
Solid Plaster Partitions (Without steel framing)	2½ in. total thickness consisting of ½ in. gypsum lath, faced on both sides with 1 in. gypsum-vermiculite plaster. Scratch coat 2 cu. ft. and brown coat 3 cu. ft. vermiculite to 100 lbs. fibered gypsum. (79)	2 hrs.*
	2 in. total thickness consisting of ½ in. gypsum lath, faced on both sides with ¾ in. gypsum-perlite plaster. Scratch coat 2 cu. ft. and brown coat 3 cu. ft. of perlite to 100 lbs. gypsum. (63)	1½ hrs.*

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Solid Plaster Partitions (Without steel framing)	2 in. total thickness consisting of ½ in. gypsum lath, faced on both sides with ¾ in. gypsum and sand plaster. Top of lath attached to steel ceiling runner, and bottom engaged in groove of a wooden floor runner inpregnated with fire retardant chemicals. Plaster mix for scratch coat 1:1 and brown coat 1:2 gypsum and sand. (54)	1 hr.*
	2 in. total thickness of 1:2 gypsum and sand plaster, applied equally each side of metal lath attached top and bottom to steel runners. (67)	1 hr.*
	2 in. total thickness consisting of ½ in. U.L. listed gypsum lath, faced on both sides with ¾ in. 1:1 gypsum and sand plaster. Lath set into steel channels at floor, ceiling and abutting walls, as specified in U.L. listing[c] under Walls and Partitions—Design No. 4-1 HR.	1 hr.*
	2 in. thickness of 13/16 in. 1:1, 1:2 gypsum and sand plaster each side ⅜ in. gypsum lath inserted at top and bottom in steel runners. (37)	1 hr.*
	2 in. total thickness of ¾ in. 1:1, 1:2 gypsum and sand plaster each side ½ in. gypsum lath inserted at top and bottom in steel runners. (41)	1 hr.*
Steel Stud Brick-Veneered Walls[z]	One side sheathed with paper-backed wire lath and 3¼ in. brick veneer secured by filling 1 in. space between brick and lath with mortar. Other side faced with 1 in. paper-enclosed mineral-wool blanket weighing 0.6 lb. per sq. ft. attached to studs; metal lath laid over blanket and attached to studs, covered with ¾ in. 1:2, 1:3 gypsum and sand plaster. (9)	4 hrs.
	One side with ½ in. gypsum sheathing nailed to 2 5/16 in. studs, and 3¼ in. brick veneer secured with metal ties to studs every fifth course. Other side ½ in. 1:2 gypsum and sand plaster on ½ in. perforated gypsum lath. (78)	2 hrs.
	One side sheathed with 1 in. magnesium oxysulphate wood fiberboard attached to studs, 1 in. air space and 3¼ in. brick secured with metal ties to studs every fifth course. Other side faced with ⅞ in. gypsum-vermiculite plaster on metal lath secured directly to studs. (9)	2 hrs.
	One side sheathed with 1 in. magnesium oxysulphate wood fiber board attached to studs, 1 in. air space, and 3¼ in. brick secured with metal ties to studs every fifth course. Other side faced with ⅞ in. 1:2 gypsum and sand plaster on metal lath secured directly to studs. (9)	1½ hrs.

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Steel Stud Brick-Veneered Walls[z]	One side sheathed with ½ in. wood fiberboard sheathing next to studs; ¾ in. air space formed with ¾ in. by 1⅝ in. wood strips placed over the fiberboard and secured to the studs; paper-backed wire lath nailed to these strips, 3¾ in. brick veneer held in place by filling ¾ in. space between brick and paper-backed lath with mortar. Inside facing of ¾ in. neat gypsum plaster on metal lath attached to 5/16 in. wood strips secured to edges of the studs. (9)	1½ hrs.
Steel Stud Hollow Partitions, Plastered Finished each side as noted	⅞ in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	2 hrs.*
	1 in. 1:½, 1:½ gypsum and sand plaster on metal lath. (9)	2 hrs.*
	1 in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	2 hrs.†
	1⅛ in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1⅝ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 3.7 cu. ft. perlite. (70)	2 hrs.*
	1⅛ in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1½ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 4 cu. ft. perlite. (71)	2 hrs.*
	1 in. gypsum-perlite plaster on metal lath attached to 4 in. studs, and sufficient plaster pushed through the lath to give an average total thickness of 1⅛ in. Plaster mix for scratch and brown coats, 100 lbs. fibered gypsum to 3.75 cu. ft. perlite. (73)	2 hrs.*
	1 in. (measured from face of lath) gypsum-perlite plaster, on metal lath attached to 4 in. studs. Plaster mix: scratch coat 2 cu. ft. and brown 3 cu. ft. of perlite to 100 lbs. fibered gypsum. (55)	2 hrs.*
	¾ in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	1½ hrs.
	⅞ in. 1:½, 1:½ gypsum and sand plaster on metal lath. (9)	1½ hrs.*
	⅞ in. 1:1/30:2, 1:1/30:3 portland cement, asbestos fiber and sand plaster on metal lath. (9)	1 hr.*
	⅞ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	¾ in. 1:2 portland cement and sand plaster in the scratch coat, 1:3 gypsum and sand plaster in the brown coat, on metal lath. (7)	1 hr.*

* Nonbearing. † For partitions loaded not to exceed 5,120 lbs. per sq. in. of stud area the rating is 2½ hrs.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Steel Stud Hollow Partitions, Plastered Finished each side as noted	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	3¼ in. wall (total thickness) consisting of ¾ in. gypsum and sand plaster on ½ in. U.L. listed gypsum lath attached tightly to ¾ in. channel frame by wire ties. ¾ in. channels spaced 30 in. on centers horizontally and 5 ft. on centers vertically; tied at intersections. Channel frame attached to ¾ in. runner channels at ceiling, floor and wall edge. Plaster mix: scratch coat 100 lbs., brown coat 200 lbs. sand to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 10-1 HR.	1 hr.*
	½ in. 1:1 gypsum and sand plaster on ⅜ in. gypsum lath on steel studs providing 1¼ in. central air space. (15)	1 hr.*
	½ in. cement-asbestos board on 3 in. steel studs; interior space filled with mineral wool under air pressure. (21)	1 hr.*
	½ in. 1:2 gypsum and sand plaster on ⅜ in. perforated gypsum lath attached securely to 3¼ in. studs by metal clips, abutting ends of lath secured to each other with metal finger clips. (46)	1 hr.*
	½ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath attached securely to 4 in. studs by metal clips and with abutting ends of lath secured to each other with metal finger clips. Plaster mix for scratch and brown coats, 100 lbs. gypsum to 2½ cu. ft. perlite. (48)	1 hr.*
Steel Stud Hollow Partitions Without Plaster Finished each side as noted	⅝ in. gypsum wallboard[cc] attached to 3⅝ in. steel studs, with 2 in. cement coated nails spaced about 7 in. on centers. Joints covered with fiber tape and cement. (87)	1 hr.
	⅝ in. U.L. listed gypsum wallboard[cc] attached to 3⅝ in. steel studs with 2½ in. nails spaced 8 in. on centers. Joints and nail heads covered wtih fiber tape and cement. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 2-1 HR.	1 hr.*
Steel Stud Wall (Steel framing encased in plaster)	6 in. wall consisting of 4 in. perlite-portland cement plaster on paper-backed wire fabric and encasing steel framing members on one face; 1 in. gypsum-perlite plaster applied on paper and aluminum foil-backed wire fabric on other face, with furring channels forming 1 in. air space between the two sections. Plaster mix for 4 in. face, 4 cu. ft. U.L. listed perlite to 94 lbs. portland cement, 3 lb. asbestos fiber, and 1 fluid ounce air entraining solution; for other face, scratch coat 3½ cu. ft. and brown coat 4 cu. ft. U.L. listed perlite to 100 lbs. gypsum. Other details as specified in U.L. listing[c] under Walls and Partitions—Design No. 3-4 HR.	4 hrs.*

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Protection	Rating
Wood Partitions, Solid	6 in. partition of 2 by 6 lumber; pieces nailed together flatwise; in vertical position if load bearing. (36)	1 hr.
Wood Stud Exterior Walls Studs 2 x 4 in. or larger.	One side sheathed with ½ in. gypsum sheathing covered with wood drop siding; other side faced with ½ in. 1:2 gypsum and sand plaster on ⅜ in. perforated gypsum lath. (39)	1 hr.
Wood Stud Partitions, Plastered Studs 2 x 4 in. or larger. Finished each side as noted	1 in. unsanded, wood fibered gypsum plaster on metal lath. (9)	bb2 hrs.*
	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath; stud spaces filled with mineral wool. (7, 9)	1½ hrs.
	¾ in. unsanded, wood-fibered gypsum plaster on metal lath. (7, 9)	1½ hrs.
	⅞ in. 1:2, 1:3 gypsum and sand plaster on metal lath; stud spaces filled with mineral wool. (9)	1½ hrs.
	½ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath; plaster mix: 2½ cu. ft. perlite to 100 lbs. fibered gypsum. (49)	1 hr. or 1½ hrs.*
	½ in. gypsum-vermiculite plaster on ⅜ in. perforated gypsum lath. Plaster mix, 2½ cu. ft. vermiculite to 100 lbs. fibered gypsum. (50)	1 hr. or 1½ hrs.*
	¾ in. 1:1½, 1:3 gypsum and sand plaster on ⅜ in. diamond mesh expanded metal lath of 26 U. S. gauge attached by 1½ in. 4-penny nails 6 in. apart or by equivalent staples. Studs 2 x 2 in. if nonbearing. (10)	1 hr.
	½ in. 1:2, 1:3 gypsum and sand plaster on wood lath; stud spaces filled with mineral wool. (7, 9)	1 hr.
	½ in. 1:2, 1:2 gypsum and sand plaster on ⅞ in. flame-proofed fiberboard plaster base. (7, 9)	1 hr.
	½ in. 1:2 gypsum and sand plaster on ⅜ in. perforated gypsum lath, one ¾ in. diam. hole or larger for each 16 sq. in. of lath. (7, 9)	1 hr.
	½ in. unsanded, wood-fibered gypsum plaster on ⅜ in. plain gypsum lath. (9)	1 hr.
	⅞ in. plaster, on metal lath attached to studs. Plaster mix for scratch and brown coats, 1:2 fibered gypsum plaster and pumice aggregate containing air entraining agent. (76)	1 hr.
	¾ in. gypsum-vermiculite plaster on metal lath. Plaster mix: scratch coat 2 to 2½ cu. ft. and brown coat 3 to 3½ cu. ft. U.L. listed vermiculite plaster aggregate to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 3-1 HR.	1 hr.

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Stud Partitions, Pastered Studs 2 x 4 in. or larger. Finished each side as noted	½ in. 1:2, 1:2 gypsum and sand plaster on ⅜ in. plain gypsum lath attached by nails fitted with 1½ x 1¼ in. metal lath pads folded over heads, spaced 8 in. vertically, 16 in. horizontally. (7, 9)	1 hr.
	½ in. 4:1 gypsum and sand plaster on ⅜ in. plain gypsum lath; 3 in. strips of metal lath over all joints. (8)	1 hr.
	⅞ in. 1:2, 1:3 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	¾ in. 1:2, 1:2 gypsum and sand plaster on metal lath. (7, 9)	1 hr.
	¾ in. 1:2 gypsum and sand plaster on U.L. listed wire lath (paper-backed fabric) as specified in U.L. listing[e], under Walls and Partitions—Design No. 1-1 HR.	1 hr.
	9/16 in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath. Plaster mix for scratch and brown coats, 2 to 3 cu. ft. U.L. listed perlite to 100 lbs. fibered gypsum. Other details as specified in U.L. listing[e], under Walls and Partitions—Design No. 7-1 HR.	1 hr.
	½ in. gypsum-perlite plaster on ⅜ in. perforated gypsum lath, securely attached by metal clips. Plaster mix: 2½ cu. ft. perlite to 100 lbs. gypsum. (47)	1 hr.
	⅞ in. 1:1/10:1/30:2 portland cement, lime, asbestos fiber, sand and 1:3 gypsum and sand plaster on metal lath. (7)	1 hr.
	⅞ in. 1:1/30:2, 1:1/30:3 portland cement, asbestos fiber and sand plaster on metal lath. (7, 9)	1 hr.
Wood Stud Partitions Without Plaster Studs 2 x 4 in. or larger. Finished each side as noted	Two layers ⅝ in. gypsum wallboard[ee]. First layer attached with 2 in. cement coated nails, spaced 9 in. on centers; second layer attached with 2½ in. cement coated nails spaced 7 in. on centers. Vertical joint between boards on same stud for each layer. Joint to fall on adjacent stud on opposite side. Joints covered with fiber tape and cement. (86)	2 hrs.[bb]
	Two layers ⅝ gypsum wallboard[ee]. First layer applied vertically with edge joints on the studs and attached with 1⅞ in. cement coated nails spaced 6 in. on centers; second layer applied horizontally with edge joints off the studs and attached with 1⅞ in. cement coated nails spaced 12 in. on centers. All joints and nailheads covered with tape and joint finisher. Other details as specified in U.L. listing[e], under Walls and Partitions—Design No. 4-2 HR.	2hrs.[bb]

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Fire Resistance Ratings Based on Standard Fire Tests

Type	Details of Construction	Rating
Wood Stud Partitions, Without Plaster Studs 2 x 4 in. or larger. Finished each side as noted	Two layers ½ in. gypsum wallboard. First layer attached with 1⅝ in. nails having 7/32 in. heads; second layer attached with 1⅞ in. nails having ¼ in. heads. Outside joints taped and pointed and nail heads covered with joint cement. (38)	1 hr. or 1½ hrs.*
	Two layers of ½ in. gypsum wallboard applied horizontally with end joints of both layers on studs. First layer attached with 1⅝ in. nails having 7/32 in. heads; outer layer with 2⅜ in. nails having 17/64 in. heads. All joints of finish layer taped, filled, and sanded. (56)	1½ hrs.
	Two layers of ½ in. gypsum wallboard, the inner layer applied vertically with edge joints off the studs, and attached with 1⅝ in. nails having 7/32 in. heads; outer layer applied horizontally with end joints on studs, attached with 2⅜ in. nails having 17/64 in. heads. All joints of finish layer taped, filled, and sanded. (75)	1 hr. or 1½ hrs.*
	3/16 in. asbestos-cement sheets over ½ in. gypsum wallboard. (80)	1 hr. or 1½ hrs.*
	Two layers ⅜ in. U.L. listed wallboard[cc], glued together and nailed to studs with 1⅞ in. nails; joints and nailheads covered with tape and joint finisher. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 6-1 HR.	1 hr.
	⅝ in U.L. listed wallboard[cc], nailed to studs with 1⅞ in. nails; joints and nailheads covered with tape and joint finisher. Other details as specified in U.L. listing[c], under Walls and Partitions—Design No. 5-1 HR.	1 hr.
	Two layers ⅜ in. gypsum wallboard. First layer applied vertically and nailed to studs with 1½ in. cement coated nails on 8 in. centers. Back of second layer cemented and nailed to face of first layer, placed horizontally and nailed with 1¾ in. cement coated nails on 8 in. centers. Joints cemented and taped. (97)	1 hr.
	4 in. strips of ⅜ in. gypsum board over edges of studs under facing of 3/16 in. cement-asbestos board; filling of mineral wool bats. (9)	1 hr.
	3/16 in. cement-asbestos boards over ⅜ in. gypsum wallboard. (9)	1 hr.
	5/32 in. cement-asbestos shingles laid over 14 lb. per 100 sq. ft. asbestos felt over ¾ in. wood sheathing on one side; 4 in. strips of ½ in. gypsum board over edges of studs under facing of 3/16 in. cement asbestos board on other side; filling of mineral wool bats. (9)	1 hr.
	½ in. gypsum wallboard, stud spaces filled with mineral wool bats nailed in place. (7, 9)	1 hr.

* Nonbearing.

Letter superscripts refer to notes, page 44.

WALLS AND PARTITIONS—Continued

Estimated Ratings

Type	Details of Construction	Members Framed in Wall: None or Noncombustible[f] — Minimum Equivalent Thickness[e] Inches, for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Concrete Masonry Units	Coarse aggregate, expanded slag, or pumice. (43)	4.7	4.0	3.2	2.1
	Coarse aggregate, expanded clay or shale. (43)	5.7	4.8	3.8	2.6
	Coarse aggregate, limestone, cinders or unexpanded slag. (43)	5.9	5.0	4.0	2.7
	Coarse aggregate, calcareous gravel. (43)	6.2	5.3	4.2	2.8
	Coarse aggregate, siliceous gravel. (43)	6.7	5.7	4.5	3.0

Type	Details of Construction	Minimum Thickness[b], Inches for Ratings of			
		4 hrs.	3 hrs.	2 hrs.	1 hr.
Plain Concrete	Solid walls. (11, 33)	7½	6½	5½	4*
Reinforced Concrete	Solid walls, unplastered:				
	Group 1 Aggregates[k], ¾ in. maximum size. (11)	6½	6	5	3½
	Group 2 Aggregates[k], ¾ in. maximum size. (11, 33)	7½	6½	5½	4*
	Solid walls plastered each side with ¾ in. portland cement stucco or portland cement or gypsum plaster:				
	Group 1 Aggregates[k], ¾ in. maximum size. (11)	5	4	3*	3*
	Group 2 Aggregates[k], ¾ in. maximum size. (11)	6	5	4	3*
Stone Masonry	Solid walls	12	12	12	8

* Nonbearing. See note [e] for definition of equivalent thickness.

Letter superscripts refer to notes, page 44.

NOTES

[a] The ratings for walls with combustible members framed into the wall, apply for members framed in not over 4 inches.

[b] Thicknesses given do not include the thickness of plaster where plaster is specified.

[c] See "Fire Protection Equipment List" published annually by Underwriters' Laboratories, Inc. The use of materials listed by Underwriters' Laboratories, Inc., provides reasonable assurance that the materials conform to the standard for such materials established by the Laboratories in connection with the listing.

[d] A 10-in. wall may be used for this rating if hollow spaces near combustible members are filled with fire resistive material for the full thickness of the wall and for 4 inches or more above, below and between the combustible members.

[e] Equivalent thickness is the average thickness of the solid material in the wall. It may be found by taking the total volume of a wall unit, subtracting the volume of core spaces, dividing this by the area of the face of the unit. Where walls are plastered or faced with brick the thickness of plaster or brick may be included in determining the equivalent thickness.

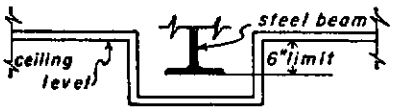
[f] Where combustible members are framed into the wall, the wall must be of such thickness or be so constructed that the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, will be not less than 93% of the thickness shown in the table.

[g] The ratings of load bearing hollow clay tile depend in certain cases on the number of cells and units in the wall thickness. These are shown in the table along with the total thickness (in inches) of the wall, "2U" representing for example, two units and "4C" representing four cells in the wall thickness.

[h] An 8-inch tile wall may be used for this rating if hollow spaces are filled as in Note [d].

[i] With combustible structural members framed into the wall, plaster is effective in increasing the fire resistance (over that for a similar wall or partition unplastered) only when applied on the side opposite that on which the structural members are framed in, and only with respect to fire exposure from the plastered side.

[j] Ratings given are applicable where there is no combustible material or construction in the enclosed ceiling space. Ceiling to be at such a level that the beams, girders or trusses to be considered as protected by the ceiling, will not extend below the level of the ceiling more than 6 in. (as illustrated below), unless otherwise specified. This depth at any point, to be considered as the average depth on the two sides. Ratings are for protection only from fire beneath the ceiling.



[k] Group 1 and group 2 aggregates are defined in the "Standard Specifications for Concrete and Reinforced Concrete" of the 1940 "Joint Committee Report" as follows:

"Group 1. Blast-furnace slag, limestone, calcareous gravel, trap rock, burnt clay or shale, cinders containing not more than 25% of combustible material and not more than 5% of volatile material, and other materials meeting the requirements of these specifications and containing not more than 30% quartz, chert, flint, and similar materials.

"Group 2: Granite, quartzite, siliceous gravel, sandstone, gneiss, cinders containing more than 25%, but not more than 40% of combustible material and not more than 5% of volatile material and other materials meeting the requirements of these specifications, and containing more than 30% of quartz, chert, flint, and similar materials."

[l] Thicknesses given are of the protection around the outside of the steel column, beam, girder or truss, or cast iron column, and outside of the reinforcing steel in reinforced concrete columns, beams, girders and trusses. They do not include thickness of plaster except where the protection consists only of metal lath and plaster.

[m] The fire resistance of columns varies with the area of solid material in the cross section of the column—the larger the column the greater the fire resistance, for a given thickness of protection around the structural or reinforcing steel. The column dimensions given are the outer cross sectional dimensions of the steel or cast iron columns and the outside cross sectional dimensions of reinforced concrete columns. Columns smaller than those listed may require greater thicknesses of protection for the same degree of fire resistance. For columns which are not square the protection should correspond to that for the square column having the same or next smaller cross sectional area.

[n] Calcareous aggregate containing a combined total of not more than 10% quartz, chert and flint for the coarse aggregate.

[o] Cinders contained not over 10% unburned coal and not over 5% ash.

[p] Wire ties consisted of No. 5 B. & S. gauge (0.18 in. diam.) steel wire wound spirally around the steel column on a pitch of 8 in.

[q] Outside wire ties consisted of No. 12 B. & S. gauge (0.08 in. diam.) steel wire tied around the outside of each course of tile at the middle.

[r] Tested with covering of ¾ in. gypsum and sand plaster, on which the rating was 7 hours.

[s] The aggregates used contained 60% or more of quartz, chert, or granite.

[t] Tested with covering of ½ in. gypsum and sand plaster, on which the rating was 6 hours.

[u] The "Standard Methods of Fire Tests of Building Construction and Materials" fix a temperature limit for wood members such as sleepers set into the top slab of a floor construction. Except where test data are available to show that wood members may be embedded in the top slab a certain depth without developing temperatures higher than the standard specifies, or except as otherwise specifically indicated, the rating of floor and ceiling constructions are based on the assumption that no wood sleepers or other combustible members will be embedded in the specified top covering of concrete or gypsum. Such members may rest on top of the specified thickness of concrete or gypsum with additional concrete or gypsum fill between sleepers.

[v] The thickness of concrete floor slab given is the minimum thickness over the joists. Between joists the thickness will be greater due to sagging of the metal lath. Tests at the National Bureau of Standards have indicated that this additional thickness between joists is necessary if the specified fire resistance is to be assured. If the normal sag between joists is not present the average thickness of slab should be ¼ in. greater. Concrete plank may be used for the top slab if joints are thoroughly grouted and the plank is at least ¼ in. thicker than the specified thickness for the top slab.

[w] Metal lath of approved weight serving as form for poured top slab may be considered as reinforcement.

[x] Siliceous gravel contained 100% clear quartz.

[y] These ratings apply to columns with standard ties or spirals, and to columns without spirals if designed on the basis that the protective concrete covering carries no load. If the design load is based on the gross column area and the column does not have adequate ties or spirals the actual fire resistance will be considerably lower.

[z] Ratings given are for fire exposure from the plastered side. Somewhat higher ratings were obtained with brick face exposed to fire.

[aa] Wire ties of No. 8 SWG (0.16 in. diam.) steel wire wound spirally around steel column on a pitch of 8 in.

[bb] This construction is not acceptable for use where a 2-hour construction is required to be of noncombustible materials, as is specified for all two-hour partitions in the National Building Code.

[cc] Wallboard or coreboard with a specially formulated core which provides greater fire resistance than regular wallboard or coreboard of the same thickness.

[dd] Portions of this concrete slab not containing electrical raceways and junction boxes may consist of a 3 in. concrete slab.

[ee] Portions of this concrete slab not containing electrical raceways and junction boxes may consist of a 2 in. concrete slab.

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