Designation: F 1090 – 87 (Reapproved 1997)ε1

Standard Classification for Bank and Mercantile Vault Construction[1]

This standard is issued under the fixed designation F 1090; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Keywords were added editorially in July 1998.

1. Scope

1.1 This classification is for the use and guidance of those who purchase, design, construct, install, approve, or modify storage vault enclosures, intended for the protection of assets against loss due to forced entry.

1.2 This classification is a systematic arrangement of constructed products, based on similar intrusion resistance characteristics, as derived from available test data.

1.3 This classification does not address fire resistivity.

1.4 This classification does not address the methods of interfacing vault components.

1.5 Nothing in this classification is intended to prevent the use of systems, methods, or devices that provide a level of intrusion resistance equivalent to that prescribed herein.

1.5.1 Any system, method, or device different from that detailed herein may be examined, in accordance with the intent of this standard, and if found equivalent, may be included.

1.6 Nothing in this classification shall be construed to prohibit better or safer conditions than the requirements specified herein.

1.7 Each standard designation cited shall be meant to be the edition in effect on the date this classification was published.

1.8 A rationale is given in Appendix X1.

NOTE 1—For more information on the construction of bank and mercantile vaults, refer to the following documents: ASTM Specifications A 184/A 184M, A 615, A 615M, A 635, C 33, C 94, C 150, C 494, C 618, C 685; American Concrete Institute Building Requirements ACI 318, and American Welding Society Structural Welding Code D 1.4.

1.9 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are given for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

A 184/A 184M Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement[2]

A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement[2]

A 615M Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement [Metric][2]

A 635 Specification for Steel, Sheet and Strip, HeavyThickness Coils, Carbon, Hot-Rolled[3]

C 31 Practice for Making and Curing Concrete Test Specimens in the Field[4]

C 33 Specification for Concrete Aggregates[4]

C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens[4]

C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete[4]

C 94 Specification for Ready-Mixed Concrete[4]

C 150 Specification for Portland Cement[5]

C 172 Practice for Sampling Freshly Mixed Concrete[4]

C 192 Practice for Making and Curing Concrete Test Specimens in the Laboratory[4]

C 494 Specification for Chemical Admixtures for Concrete[4]

C 496 Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens[4]

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete[4]

C 685 Specification for Concrete Made by Volumetric Batching and Continuous Mixing[4]

2.2 *Underwriters Laboratories Standards:*

UL 608 Burglary-Resistant Vault Doors and Modular Panels[6]

UL 680 Emergency Vault Ventilators and Vault Ventilating Ports[5]

2.3 *American Concrete Institute Document:*

ACI 318 Building Code Requirements for Reinforced Concrete[7]

2.4 *American Welding Society Document:*

[1] This classification is under the jurisdiction of ASTM Committee F-12 on Security Systems and Equipmentand is the direct responsibility of Subcommittee F12.80on Protective Containment Structures.

Current edition approved Dec. 14, 1987. Published January 1988.

[2] *Annual Book of ASTM Standards*, Vol 01.04.

[3] *Annual Book of ASTM Standards*, Vol 01.03.

[4] *Annual Book of ASTM Standards*, Vol 04.02.

[5] *Annual Book of ASTM Standards*, Vols 04.01 and 04.02.

[6] Available from Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.

[7] Available from American Concrete Institute, P.O. Box 19150, Redford Station, Detroit, MI 48219.

D 1.4 Structural Welding Code Reinforcing Steel[8]

3. Description of Terms Specific to this Standard

3.1 *alternate construction*—a substitute method of fabrication.

3.2 *classification*—a systematic rating of products based on testing, according to approved criteria.

3.3 *door, vault*—a movable barrier assembly constructed of intrusion-resistant materials by which a passageway is closed or opened.

3.4 *emergency ventilator*—a device constructed of intrusion-resistant materials for the introduction of fresh air.

3.5 *equivalent*—a term applied to two or more methods, procedures, materials, devices, etc., expected to give the same average results.

3.6 *generic construction*—commonly available construction materials not protected by trademark registration.

3.7 *heating, ventilating and air conditioning (HVAC) port*—a device constructed of intrusion-resistant materials providing an opening for intake or exhaust of air.

3.8 *intrusion-resistant*—constructed to prevent a successful penetration by means and techniques as described in UL 608.

3.9 *manhole size opening*—a 96-in.^{2} (620-cm^2) opening, the smallest dimension of which is not less than 6 in. (15 cm).

3.10 *modular panel*—wall, floor, or ceiling components, manufactured of intrusion-resistant material, intended for assembly at the place of use, and capable of being disassembled and relocated.

3.11 *vault*—an intrusion-resistant enclosure, intended for the safekeeping of valuables, and sized to allow entry by at least one person.

4. Significance and Use

4.1 This classification is meant to be a guide for the selection of a vault.

4.2 This classification is intended to assist users in availing themselves of various prefabricated and generically constructed products, while maintaining continuity in the selected intrusion-resistance level.

4.3 This classification is not meant to recommend or prefer the use of any single product or any type level, or its application.

5. Basis of Classification

5.1 The vault shall be rated as a unit and that rating shall be determined by the component having the lowest classification.

5.2 Components of a building shall not be used as part of the vault unless constructed to provide the equivalent intrusion resistance.

5.3 Vaults shall be classified into four types: Type M, Type 1, Type 2, and Type 3 (refer to Fig. 1).

5.3.1 *Type M Vault*—Type M vault shall be constructed using:

5.3.1.1 Nine-inch (23-cm) reinforced concrete, as specified in 5.4-5.4.2, or

5.3.1.2 Modular panels bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Panel, Class M," and

5.3.1.3 Vault door(s) bearing the label: "Underwriters Laboratories Inc. Burglary Resistant Vault Door, Class M."

5.3.2 *Type 1 Vault*—Type 1 vault shall be constructed using:

5.3.2.1 Twelve-inch (30-cm) reinforced concrete, as specified in 5.4-5.4.2, or

5.3.2.2 Modular panel bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Panel, Class 1," and

5.3.2.3 Vault door(s) bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Door, Class 1."

5.3.3 *Type 2 Vault*—Type 2 vault shall be constructed using:

5.3.3.1 Eighteen-inch (46-cm) reinforced concrete, as specified in 5.4, or

5.3.3.2 Modular panel bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Panel, Class 2," and

5.3.3.3 Vault door(s) bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Door, Class 2."

TABLE 1 Placement of Grids

Class Type	Thickness of Concrete	Minimum Number of Grids for Deformed Bars	Minimum Number of Grids for Expanded Steel
M	at least 9 in. (22.9 cm)	2	2
1	at least 12 in. (30.5 cm)	3	2
2	at least 18 in. (45.7 cm)	4	3
3	at least 27 in. (68.6 cm)	5	4

5.3.4 *Type 3 Vault*—Type 3 vault shall be constructed using:

5.3.4.1 Twenty-seven-inch (68-cm) reinforced concrete, as specified in 5.4-5.4.2, or

5.3.4.2 Modular panel bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Panel, Class 3," and

5.3.4.3 Vault door(s) bearing the label: "Underwriters Laboratories, Inc. Burglary-Resistant Vault Door, Class 3."

5.4 *Generic Vault Construction*:

5.4.1 Concrete used in vaults shall be reinforced using:

5.4.1.1 Deformed steel bars, Number Five Imperial Type or Number Fifteen Metric type (⅝-in. (16-mm) diameter, Grade 40), placed in horizontal and vertical rows, in each direction, to form a grid not more than 4 in. (10 cm) on center, or

5.4.1.2 Expanded steel mesh weighing at least 6 lb/ft^2 (30 kg/m^2) having a diamond pattern not more than 3 by 8 in. (8 by 20 cm), placed parallel to the face of the slab.

5.4.1.3 Grids of either reinforcing material shall be located not less than 4 in. (10 cm) apart, shall be offset in two directions in the same plane (refer to Fig. 2), and shall be placed as stated in Table 1.

5.4.2 Concrete used in vaults shall have a minimum 28-day compressive strength of 4000 psi (280 kg/cm^2), as tested in accordance with the requirements of Test Method C 39.

5.5 *Permissible Opening*:

[8] Available from American Welding Society, 550 NW 42nd Ave., Miami, FL 33126.

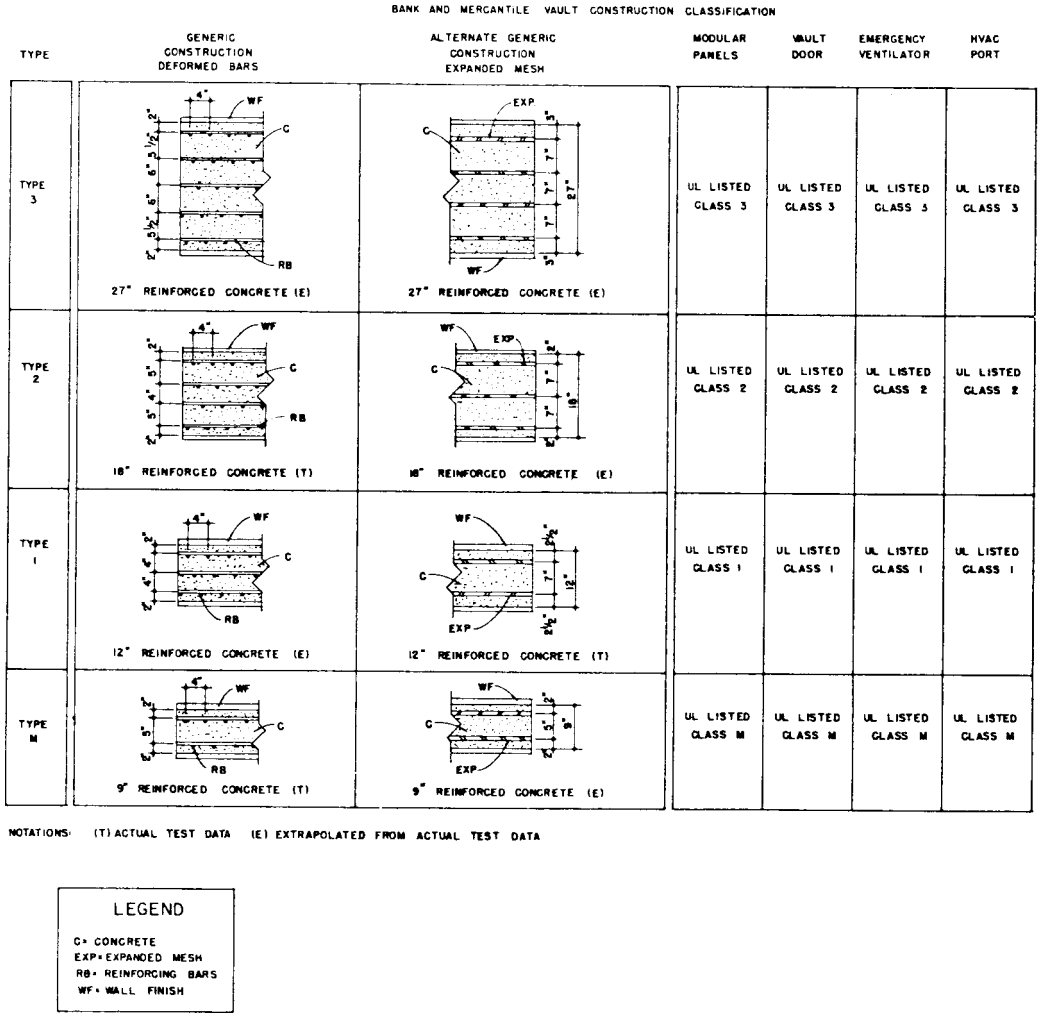

FIG. 1 Bank and Mercantile Vault Construction Classification

5.5.1 Vault shall be invalidated by any opening in the structure, except for:

5.5.1.1 Doors, as specified in 5.3.

5.5.1.2 Underwriters Laboratories, Inc. listed emergency ventilators or ventilating (HVAC) ports.

5.5.1.3 Individual conduit when used in generic construction, shall not exceed 1½ in. (38 mm) in diameter. Multiple conduit entries and exits shall not be within 18 in. (46 cm) of each other. Conduit penetrating the vault shall have at least two bends, and entry in the outer face shall be at least equal radial inches apart from exit in the inner face, as the thickness of the component it penetrates.

5.5.2 Vault resistance levels shall be invalidated by the installation of any door, ventilator, or port whose manufacturer's specified installation instructions have not been followed.

6. Keywords

6.1 asset protection; bank vault; forced entry; intrusion resistance; mercantile vault; storage vault; vault enclosure

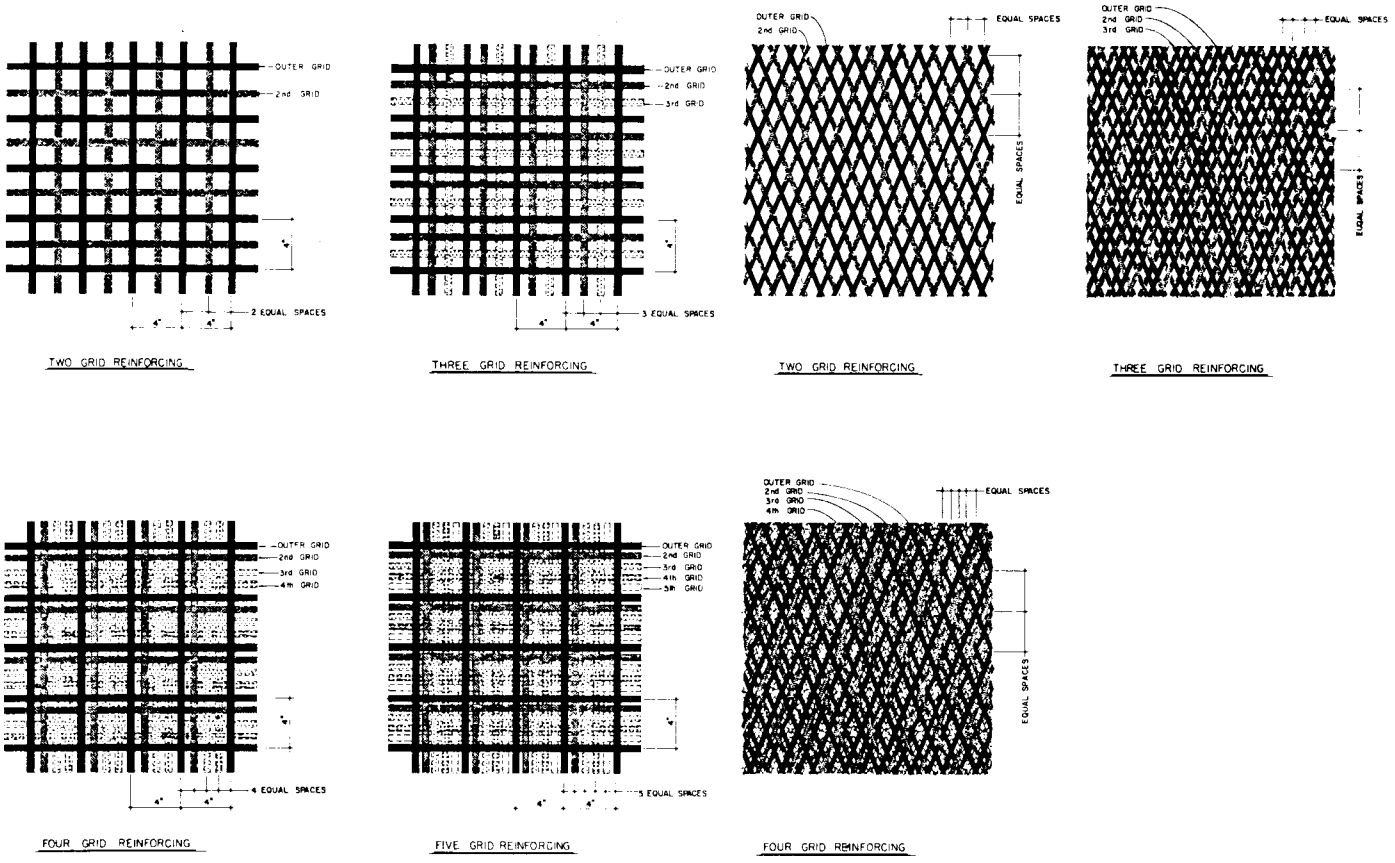

FIG. 2 Grid Patterns

APPENDIX

(Nonmandatory Information)

X1. RATIONALE

X1.1 Determination as to intrusion resistance is based upon the criteria for testing as detailed in UL Standard 608 (Third Edition), and Standard 680.

X1.2 Testing procedures were performed on a representative sample using two basic techniques. First, a portable coring machine equipped with diamond embedded matrix bit core was used to drill a manhole size opening through the sample. Second, electric hammers, acetylene cutting torch, and various hand tools were used, in combination, to create a manhole size opening through an untouched portion of the sample.

X1.3 Actual testing was restricted to one test team, consisting of two skilled operators and one non-participating assistant.

X1.4 Testing procedures recorded net working time, which is only the time during which the attack is actively in progress.