Designation: ~~C1629/C1629M – 18~~ C1629/C1629M – 18a

Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels[1]

This standard is issued under the fixed designation C1629/C1629M; 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.

1. Scope*

1.1 This standard establishes classifications of abuse resistance based on the abrasion resistance and impact resistance performance of nondecorated interior gypsum panel products and fiber-reinforced cement panels (abuse resistant wall panels).

1.1.1 This standard is a method of classifying gypsum panel product performance and is not intended to classify systems for abuse resistance.

1.2 The values stated in inch-pound and SI (metric) units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system shall be used independent of the other. Values from the two systems shall not be combined.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C11 Terminology Relating to Gypsum and Related Building Materials and Systems

C473 Test Methods for Physical Testing of Gypsum Panel Products

C840 Specification for Application and Finishing of Gypsum Board

C1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products

D1517 Terminology Relating to Leather

~~D4977~~D4977/D4977M Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion

D5420 Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

~~E695 Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading~~

2.2 *ISO ~~Documents:~~Document:*

ISO 6707-1 Building and Civil Engineering—Vocabulary—Part 1: General Terms

2.3 *Federal Specification:*

A-A-50197A Thread, Linen

2.4 *Voluntary Product Standard:*

PS20 American Softwood Lumber Standard

3. Terminology

3.1 Definitions of terms shall be in accordance with Terminologies C11 and C1154.

3.2 *Definitions of Terms Specific to This Standard:*

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[1] This classification is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.01 on Specifications and Test Methods for Gypsum Products.

Current edition approved ~~June 1, 2018~~July 15, 2018. Published ~~July 2018~~November 2018. Originally approved in 2005. Last previous edition approved in ~~2015~~2018 as ~~C1629/C1629M – 15.~~C1629/C1629M – 18. DOI: ~~10.1520/C1629_C1629M-18.~~10.1520/C1629_C1629M-18A.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

3.2.1 *failure (hard body impact), n*—test result constituted by the penetration or deformation of the wall cavity by the impact head establishing a residual deflection of the panel exceeding the nominal thickness of the test panel.

3.2.2 *structural failure (soft body impact), n*—a test result constituted by the penetration or deformation of the wall cavity by the soft body impact bag establishing a residual deflection of any area on the test panel that exceeds the nominal thickness of the test panel.

3.2.2.1 *deformation, n*—change of shape or dimension or both. **ISO 6707-1**

3.2.2.2 *surface damage, n*—pulverization of the core of the test panel at the point of impact, which is evidenced by cracking, creasing, or other visible damage short of failure as defined in 3.2.2.

3.2.3 *residual deflection, n*—permanent deformation of a building element, component, or structure after removal of applied force.

3.2.3.1 *Discussion*—

Also called permanent set or residual deformation.

4. Significance and Use

4.1 Each abuse/impact property of abuse resistant wall panels is divided into three classification levels. The three levels of classification are: Level I, Level II, and Level III, with Level I representing the lowest rating for any given property. The test methods specified are utilized to establish the abuse-resistance classification of an abuse resistant wall panel. Each classification level requires a minimum overall specified performance. Any classified abuse resistant wall panel can be used at a classification level which is rated lower than the highest level qualified.

5. Basis of Classification

5.1 Abuse resistant wall panels are classified into one of three levels of abuse resistance based on minimum performance when tested in accordance with test methods that evaluate surface abrasion, indentation, soft body impact, and hard body impact as specified in ~~6.1 – 6.4~~6.1 through 6.4.

5.2 Minimum requirements for each level are as shown in Tables 1-4.

TABLE 1 Performance Requirements
Surface Abrasion Resistance

Classification Level	Abraded Depth Maximum in. [mm]
1	0.126 [3.2]
2	0.059 [1.5]
3	0.010 [0.3]

TABLE 2 Performance Requirements
Indentation Resistance

Classification Level	Indentation Maximum in. [mm]
1	0.150 [3.8]
2	0.100 [2.5]
3	0.050 [1.3]

TABLE 3 Performance Requirements
Soft Body Impact Test

Classification Level	Soft Body Minimum ft-lbf [J]
1	90 [122]
2	195 [265]
3	300 [408]

TABLE 4 Performance Requirements
Hard Body Impact

Classification Level	Hard Body Minimum ft-lbf [J]
1	50 [68]
2	100 [136]
3	150 [204]

6. Test Methods

6.1 *Surface Abrasion Test*—This test is conducted in accordance with Test Method D4977D4977/D4977M using a total load of 25.0 lb [11.3 kg]. The specimen is conditioned to constant weight at 70°F [21°C] and 50 % relative humidity and subjected to 50 abrasion cycles. The abrasive motion on the specimen creates measurable surface wear or indentation which is measured to determine the level of surface abrasion resistance.

NOTE 1—It is especially important to prepare the apparatus and condition the brush as specified in Test Method D4977D4977/D4977M.

6.2 *Indentation Test*—This test, conducted in accordance with Test Method D5420 (Gardner Impact), utilizes procedure GC, with a ⅝-in. [15.9 mm] hemispherical head and a 72 in.-lb [12.6 J] impact energy. The depth of the indentation is measured to determine the level of indentation resistance.

6.3 *Soft Body Impact Test*—This test, test is conducted in accordance with Method E695, is performed with the use of thethe method described in Annex A2standard leather bag filled with steel pellets to a weight of 60.0 lb [27.2 kg] and dropped through an angular distance until the specimen is impacted. The point of impact shall be midway between studs at the mid-height of the test panel..

6.3.1 *Apparatus:*

6.3.1.1 *Wall Assembly*—A single 4 by 8 ft [1200 by 2400 mm] panel is mounted on a wood stud wall constructed of nominal 2 by 4 in. [38 by 89 mm] studs. The studs shall be spaced 16 in. [400 mm] on center, and the wall shall be constructed with the abuse resistant wall panel attached parallel to the framing members following methods outlined in Test Method C840 sections on "Application of Gypsum Board" and "System I: Application of Single-Ply Gypsum Board to Wood Framing Members."

6.3.1.2 *Measurement Tools*—A vernier or digital caliper style depth gauge capable of measuring not less than 2 in. [50 mm] at 0.0005 in. [0.01 mm] resolution shall be used to measure the depth of residual deflection. The depth gauge shall be attached to a base of sufficient width to span the 16 in. [400 mm] between the studs of the wall assembly. The base shall be sufficiently stiff to resist bending. A micrometer capable of measuring 1 in. [25 mm] at 0.001 [0.01 mm] resolution shall be used to measure the average thickness of the panel as specified in Test Method C473.

6.3.2 A single specimen is repeatedly impacted at a single point of impact in one cavity with the drop height being increased by 6 in. [150 mm] (30 lbf [133 N]) with each successive drop until structural failure as defined in 3.2.2 is achieved.

6.3.2.1 The level of energy, surface damage, deformation, and residual deflection at the point of impact are recorded following each impact. The residual deflection shall be measured from the face side of the panel.

(1) Residual deflection shall be visually evaluated to determine where the deepest deflection occurs. Three measures shall be made in this area to the nearest 0.001 in. [0.01 mm] and then averaged. This measurement shall be used to determine the depth of the residual deflection.

NOTE 2—Surface damage and deformation, which do not constitute structural failure, may compound the results.

6.3.3 Following structural failure in the initial cavity, the procedure described in 6.3.2 is repeated on the next cavity, beginning with a drop height of 6 in. [150 mm] higher than the drop height causing structural failure in 6.3.2.

6.3.3.1 If structural failure in the second cavity occurs with the first drop, the test is terminated and the level of energy required to cause the failure is calculated to determine the soft body impact resistance.

6.3.3.2 If structural failure in the second cavity occurs on the second or subsequent drop, repeat the procedure described in 6.3.3 in the next cavity, beginning with a drop height 6 in. [150 mm] higher than the drop height causing structural failure in the second cavity.

6.3.4 Repeat the procedures in 6.3.2 – 6.3.3.2 until structural failure occurs on a single drop in a fresh cavity, at which time the test is terminated and the level of energy required to cause the failure is calculated to determine the soft body impact resistance.

6.4 *Hard Body Impact Test*—This test is conducted in accordance with the method described in Annex A1 or with another apparatus equipped with an equivalent impact head that is capable of delivering equivalent impact loads.

~~ANNEX~~ANNEXES

(Mandatory Information)

A1. HARD BODY IMPACT TEST

A1.1 Scope

A1.1.1 The hard body impact test measures resistance to penetration of a wall panel when impacted by a rigid body. Failure in the hard body impact test is achieved when the impacting head completely penetrates through the test panel, or the depth of the indentation exceeds the thickness of the product being tested when measured from the face side following impact, or both.

A1.2 Summary of Test Method

A1.2.1 A nominal 2 ~~by~~× 2 ft [610 ~~by~~× 610 mm] specimen is mounted to the apparatus frame. A ramming arm impactor strikes the wall specimen while swinging in an arc. The impactor is dropped from a fixed height to impart specific design energy to the wall specimen. Weights are progressively added to the impactor to increase the design impact energy until specimen failure occurs. For each impact, a new test specimen is used.

A1.3 Significance and Use

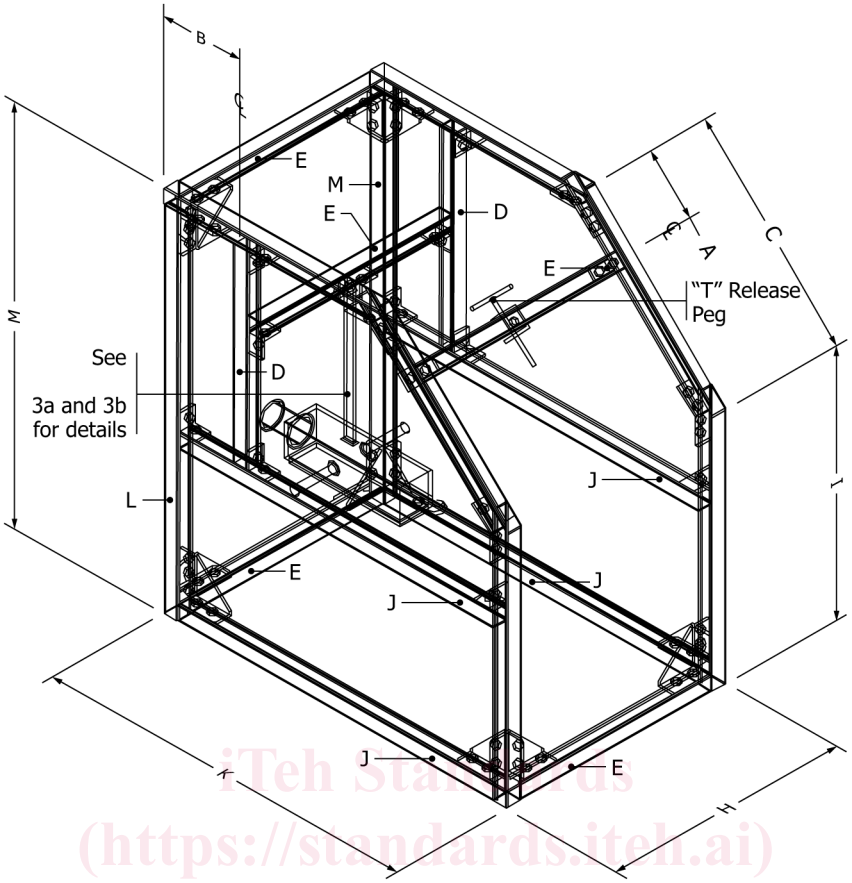
A1.3.1 The test method measures relative performance of interior wall panel materials. Although the test panel is mounted on framing and tested vertically as a wall assembly, the impact damage is normally limited to a small area. The method is not intended to evaluate the performance of studs used in wall construction.

A1.4 Apparatus

A1.4.1 The apparatus consists of a rigid frame with a ramming arm pinned to swing in an arc. See Figs. A1.1 and A1.2. The frame is constructed of 14 ga, 1 ⅝ ~~by~~× 1 ⅝ in. ~~[41 by 41 mm]~~[41 × 41 mm] B-Line B24 Regular Framing Channels.

TABLE A1.1 Weight (Mass) Schedule for the Components of the Ramming Arm Impactor

~~Component~~	~~Weight lb, ± 0.5 %~~	~~Mass kg, ± 0.5 %~~
Component	Weight lb, ±0.5 %	Mass kg, ±0.5 %
Structural Steel Tubing (square cross-section)	8.10	3.67
Steel Plate Pivot Arm	1.10	0.50
~~Front Square Steel Plate (end plate attached to the front of the structural steel tubing)~~	~~0.90~~	~~0.41~~
Front Square Steel Plate (end plate attached to the front of the structural steel tubing)	0.90	0.41
~~Rear Square Steel Plate (end plate attached to the back of the structural steel tubing)~~	~~0.90~~	~~0.41~~
Rear Square Steel Plate (end plate attached to the back of the structural steel tubing)	0.90	0.41
Cylindrical Steel Impact Head	1.90	0.86
Steel Round Bar (Weight Bar)	2.60	1.18
~~Bottom Rectangular Steel Plate (attached to the bottom of the structural steel tubing)~~	~~4.50~~	~~2.04~~
Bottom Rectangular Steel Plate (attached to the bottom of the structural steel tubing)	4.50	2.04



~~in.~~ ~~mm~~

	~~in.~~	~~mm~~		~~in.~~	~~mm~~
~~A~~	~~6 1/16~~	~~154.0~~	~~I~~	~~26 5/16~~	~~668.3~~
~~B~~	~~8 5/16~~	~~211.1~~	~~J~~	~~34 1/4~~	~~870.0~~
~~C~~	~~20 5/16~~	~~515.9~~	~~K~~	~~37 1/2~~	~~952.5~~
~~D~~	~~20 9/16~~	~~522.3~~	~~L~~	~~39 1/16~~	~~992.2~~
~~E~~	~~20 3/4~~	~~527.1~~	~~M~~	~~40 11/16~~	~~1033.5~~
~~H~~	~~24~~	~~609.6~~			

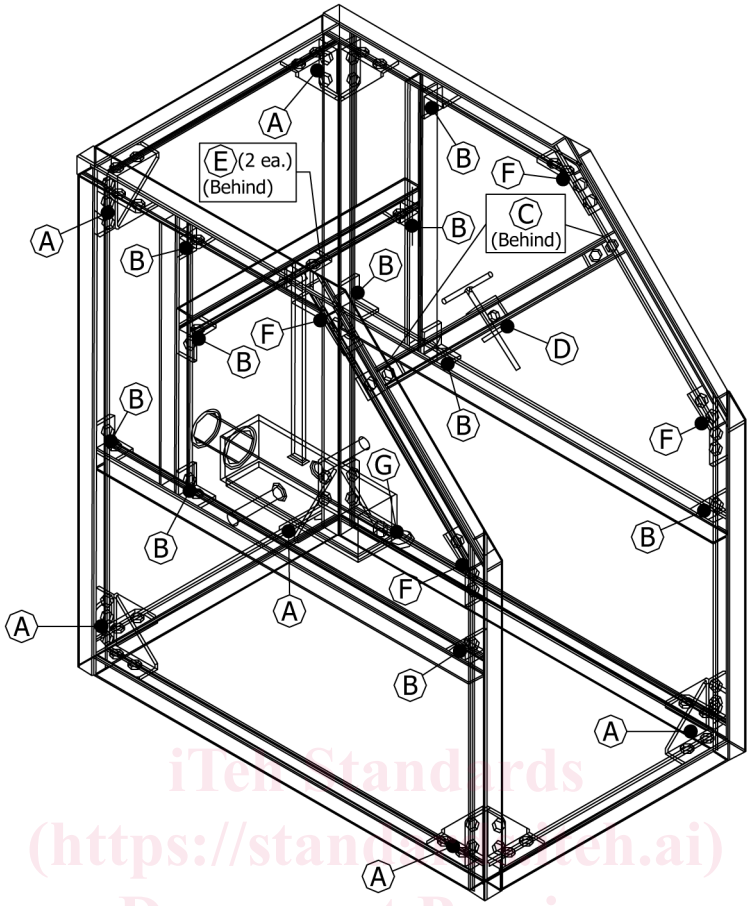
	in.	mm		in.	mm
A	6 1/16	154.0	I	26 5/16	668.3
B	8 5/16	211.1	J	34 1/4	870.0
C	20 5/16	515.9	K	37 1/2	952.5
D	20 9/16	522.3	L	39 1/16	992.2
E	20 3/4	527.1	M	40 11/16	1033.5
H	24	609.6			

NOTE 1—All framing members shall be B-Line B24 Regular Framing Channels cut to the specified dimensions in this sketch. These channels are ~~14 gauge~~ 14 gauge and have an outside dimension of ~~1~~ 1⅝ ~~by 1~~ × 1⅝ in. [41 ~~by~~ × 41 mm].

FIG. A1.1 Axonometric of Hard Body Apparatus Framing Members (not to scale)

A1.4.1.1 The dimensions and details of the ramming arm impactor are shown in Fig. A1.3. The ramming arm impactor consists of a cylindrical steel impact head (made by milling a round steel bar), a structural steel tubing with square cross-section, two square steel plates (front and rear end plates of the structural steel tubing), a steel plate pivot arm, a round steel bar (to add weights), and a rectangular steel plate attached to the bottom of the structural steel tubing. The total weight of the components of the ramming arm impactor is 20.0 lb [9.07 kg] ± 0.5 %, as shown in Table A1.1. The center of mass of the ramming arm impactor coincides with the location of the steel round bar (that is, the weight bar). Additional weights are attached to the weight bar to increase the impacting energy.

A1.4.1.2 The ramming arm impactor shall have a suitable mechanism to secure it at the top of the swing. An example of such a mechanism is a small eyebolt attached to the back of the impactor. When released from the top of the swing, the drop height of the center of mass of the ramming arm impactor shall be 12 in. [305 mm].



Fastener Schedule

A	B-Line Universal 90° Shelf Bracket B844
B	B-Line Two Hole 90° Corner Angle B230
C	B-Line Two Hole Flat Splice Plate
D	B-Line Beam Clamp B593 Clevis Swivel
E	Unistrut 90° Fitting P6281
F	B-Line Four Hole Open 45° Angle Fitting B248
~~G~~	~~Threaded steel eyebolts with a ½ in. [12.5 mm] threaded leg 3 in. [75 mm] long, and an eye interior diameter of ¾₁₆ in. [5 mm]~~
G	Threaded steel eyebolts with a ½ in. [12.5 mm] threaded leg 3 in. [75 mm] long, and an eye interior diameter of ¾₁₆ in. [5 mm]

NOTE 1—Use B-Line Hex Head Cap Screws HHCS ½ ~~by 1~~ × 1¼ in. [12.7 ~~by~~ × 31.8 mm], B-Line Flat Washers FW ½ in. [12.5 mm], and B-Line N225 Spring Nuts to secure all fasteners to framing members.

FIG. A1.2 Axonometric of Hard Body Apparatus Fasteners (not to scale)

A1.4.1.3 The ramming arm is located such that the face of the impactor head, when hanging free at the bottom of the arc, is in the same plane as the surface of the test specimen so that, when dropped, the impactor head strikes the surface of the specimen at the bottom of the arc.

A1.5 Test Specimen

A1.5.1 The support for the test specimen shall be constructed by attaching a 2 ~~by~~ × 2 ft [610 ~~by~~ × 610 mm] specimen of the interior wall panel material to a frame of ~~3~~ 3⅝ in. [92 mm] deep 0.0312 in. [0.792 mm] design thickness steel studs with Type S-12 bugle head screws spaced 8 in. [200 mm] o.c. as shown in Fig. A1.4. The length of the screws shall be ~~1~~ 1¼ in. [32 mm] for panels up