Designation: C 1629/C 1629M – 06

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

This standard is issued under the fixed designation C 1629/C 1629M; 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 minimum abuse-resistance performance of nondecorated interior gypsum panel products and fiber-reinforced cement panels (abuse resistant wall panels).

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 11 Terminology Relating to Gypsum and Related Building Materials and Systems

C 1154 Terminology for Non-Asbestos Fiber-Reinforced Cement Products

D 4977 Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion

D 5420 Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

E 695 Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading

2.2 *ISO Documents:*

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

3. Terminology

3.1 Definitions of terms shall be in accordance with Terminologies C 11 and C 1154.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *failure (hard body impact), n*—test result constituted either by the penetration of the wall cavity by the impacting head of the impacting arm or the denting of the panel resulting in an indentation of a depth that exceeds the thickness of the test panel.

3.2.1.1 *Discussion*—Depth of the indentation on the test panel is measured from the face side.

3.2.2 *failure (soft body impact), n*—a test result constituted either by the breaking of the wall cavity by the soft body impactor or the residual deflection of any area on the test panel that exceeds the thickness of the test panel.

3.2.2.1 *Discussion*—Deformation of the test panel in the form of residual deflection is measured from the face side.

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

3.2.2.3 *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

[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.

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[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.**

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 through 6.4.

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

6. Test Methods

6.1 *Surface Abrasion Test*—This test is conducted in accordance with Test Method D 4977 using a total load of 25.0 lb. The specimen is conditioned to constant weight at 70F 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 D 4977.

6.2 *Indentation Test*—This test, conducted in accordance with Test Method D 5420 (Gardner Impact), utilizes procedure GC, with a ⅝ in. 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, conducted in accordance with Method E 695, is performed with the use of the standard 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.

6.3.1 The specimen is mounted on nominal 2-by-4 wood studs 16 in. [400 mm] o.c. Point of impact is midway between studs at the mid-height of the test panel.

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. with each successive drop until structural failure as defined in 3.2.2 is achieved.

6.3.2.1 Surface damage and deformation are recorded following each impact, and the level of impact energy applied is calculated. The residual deflection shall be measured from the face side of the panel.

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]

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. 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 single impact penetration or excessive deformation 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. higher than the drop height causing structural failure in the second cavity.

6.3.4 Repeat the procedures in 6.3.2 through 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 single impact penetration or excessive deformation 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

(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.

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 5⁄8 by 1 5⁄8 in. [41.3 by 41.3 mm] B-Line B24 Regular Framing Channels.

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.

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

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
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

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 12.0 in. [305 mm].

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 test wall assembly 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 5⁄8 in. [92 mm] deep 20 ga 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 1⁄4 in. [32 mm] for panels up to 5⁄8 in. [15.9 mm] in thickness. For panels with thickness greater than 5⁄8 in. [15.9 mm], the length of the screws shall be at least 5⁄8 in. [16 mm] longer than the panel thickness.

A1.6 Preparation of Apparatus

A1.6.1 The apparatus shall be securely anchored to a level floor to prevent sliding or rocking of the apparatus during impact.

A1.7 Procedure

A1.7.1 The test wall assembly shall be securely clamped to the face of the apparatus so that the surface of the test specimen is in the same plane as the face of the impact head.

A1.7.1.1 A new test wall assembly shall be used for each impact.

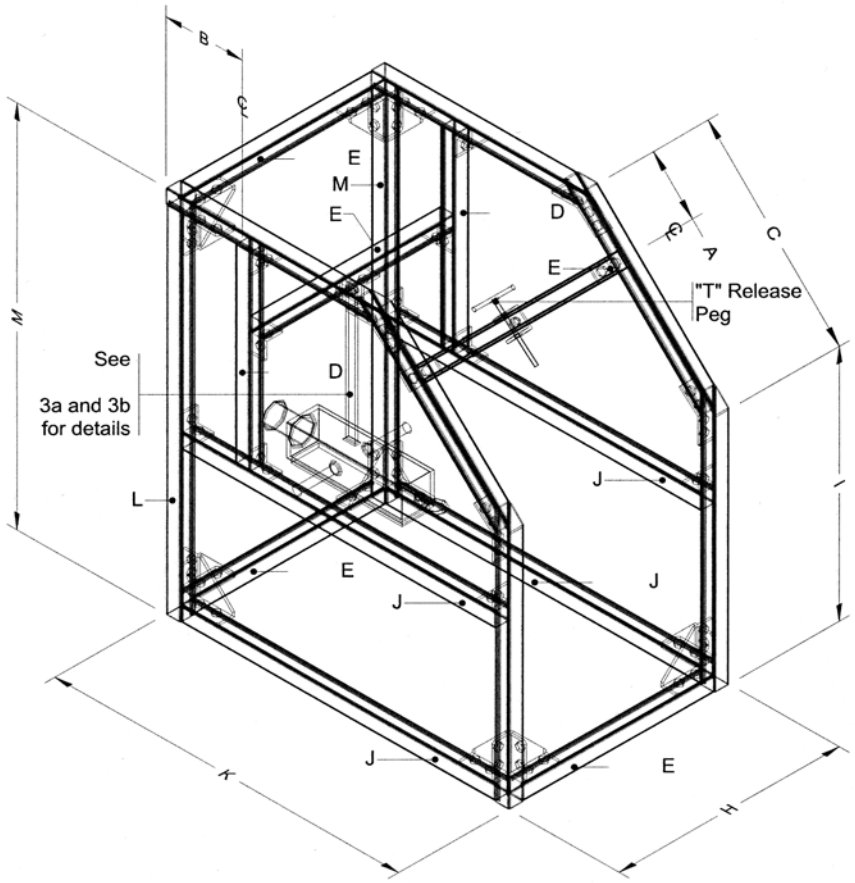
A1.7.2 The ramming arm is raised to the top or the arc and secured with a pin.

A1.7.3 The pin is removed, allowing the arm to swing freely and strike the test specimen.

A1.7.4 A new test wall assembly is mounted to the apparatus and the weight on the impactor is increased by adding 2.50 lb [1.10 kg] to the weight bar and the test repeated.

A1.7.5 The test shall be performed by incrementally increasing the barbell free weights on the impactor until a failure impact energy is achieved.

A1.7.5.1 The failure impact energy is defined as the minimum energy required for the impactor to penetrate through the face of the panel into the stud cavity, or when the depth of the indentation exceeds the thickness of the product being tested when measured from the face side.



	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—All framing members shall be B-Line B24 Regular Framing Channels cut to the specified dimensions in this sketch. These channels are 14 gauge and have an outside dimension of 1 5/8 by 1 5/8 in. (41.3 by 41.3 mm).

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

A1.7.6 Testing shall continue until the failure impact energy is confirmed on three identical assemblies for each wall panel material being tested.

A1.7.7 Impact energy and damage at each test shall be recorded.

A1.8 Calculation of Energy Impact

A1.8.1 Impact energy in ft-lb units is calculated as the product of the weight of the impacting instrument and the drop height:

$$E = (w \times h) \quad \text{(A1.1)}$$

where:
E = impact energy, ft-lb,
w = weight of impactor, lb, and
h = drop height of the center of mass of the impactor, ft.

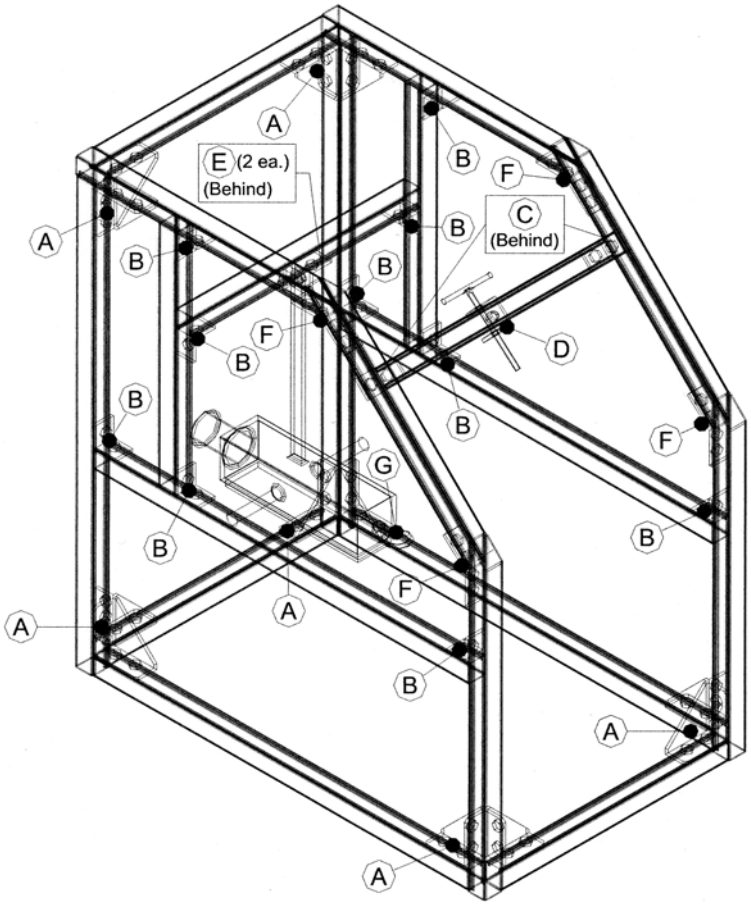
A1.8.2 Impact energy in SI units is calculated as the product of the mass of the following three quantities—the mass of the impactor, gravitational acceleration, and the drop height of the center of mass of the impactor:

$$E = (m \times g \times h) \quad \text{(A1.2)}$$

where:
E = impact energy, J,
m = mass of impactor, kg,
g = gravitational acceleration, 9.81 ms^{-2}, and
h = drop height of the center of mass of the impactor, m.

A1.9 Precision and Bias

A1.9.1 The precision and bias of this test method has not been determined.



	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 3⁄16 in. (5 mm)

NOTE—Use B-Line Hex Head Cap Screws HHCS ½ by 1 ¼ in. (12.7 by 31.8 mm), B-Line Flat Washers FW ½ in., 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)

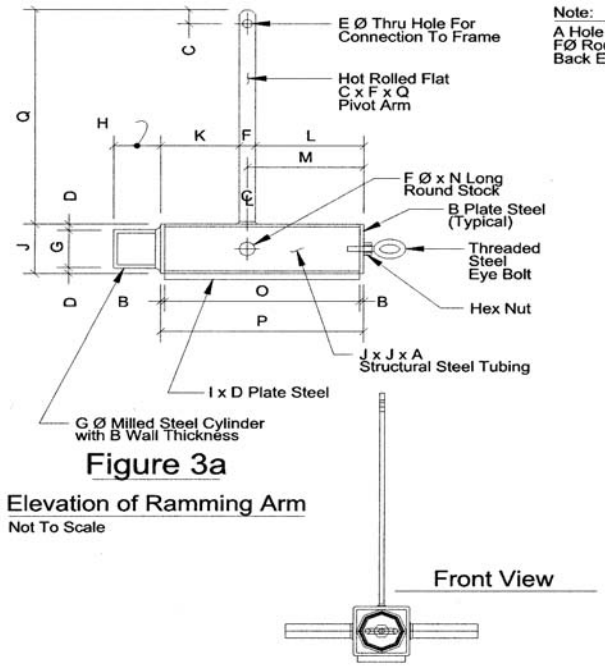


Figure 3a

Elevation of Ramming Arm

Not To Scale

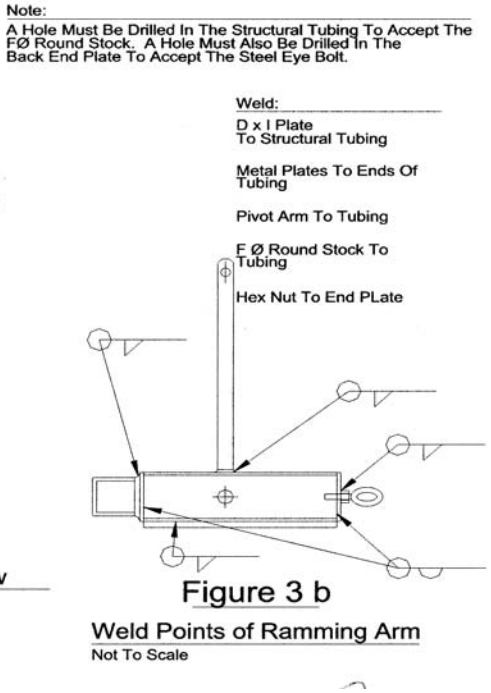


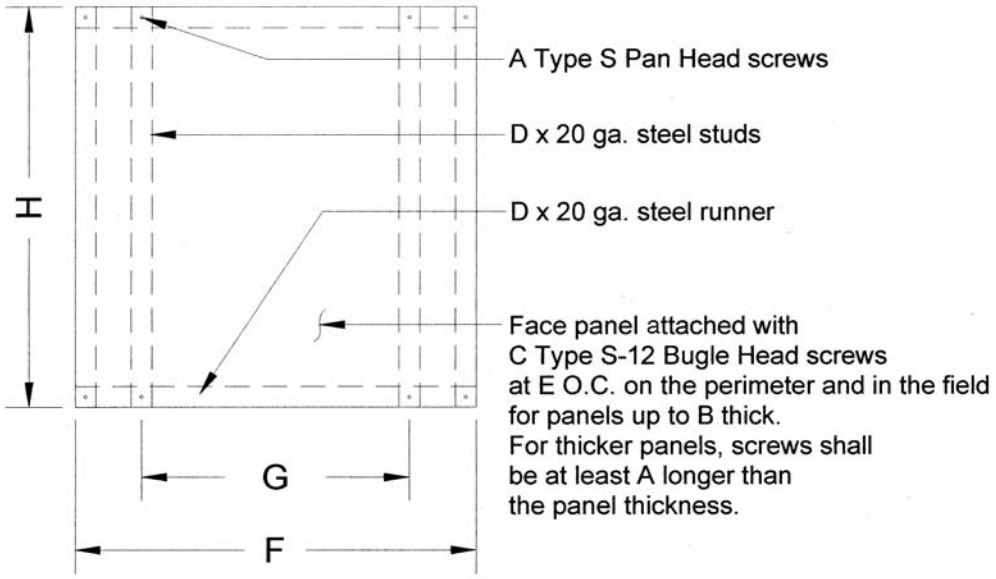
Figure 3 b

Weld Points of Ramming Arm

Not To Scale

	in.	mm		in.	mm
A	3/16	4.8	J	3 1/2	88.9
B	1/4	6.4	K	4 7/8	123.8
C	5/16	7.9	L	6 3/4	171.5
D	7/16	11.1	M	7 1/4	184.2
E	5/8	15.9	N	12	304.8
F	1	25.4	O	12 1/8	308.0
G	2 3/4	69.9	P	12 5/8	320.7
H	2 15/16	74.6	Q	15 1/4	387.4

FIG. A1.3 Ramming Arm



	in.	mm
A	⅜	9.5
B	⅝	15.9
C	1	25.4
D	3 ⅝	92.1
E	8	203.2
F	12	304.8
G	16	406.4
H	24	609.6

FIG. A1.4 Wall Assembly Specimen Construction Detail

SUMMARY OF CHANGES

Committee C11 has identified the location of selected changes to this classification since the last issue, C 1629/C 1629M – 05, that may impact the use of this classification. (Approved November 1, 2006)

(*1*) Revised the titles of Tables 1-4.
(*2*) Revised Section 3.
(*3*) Revised Section 6.