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Standard Performance Specification for Privacy Padlocks[1]

This standard is issued under the fixed designation F2348; 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 specification covers functional, operational, and security requirements for padlocks. Included are function descriptions, operational tests, forcing tests, and surreptitious entry tests.

1.2 This specification describes and grades various levels of performance to provide users of the specification with criteria upon which to select suitable padlocks.

1.3 Tests described are laboratory tests, and although they simulate field conditions as to attacks, they do not duplicate these conditions. Tests described are repeatable in the laboratory.

1.4 Some users of this specification may wish to use padlocks that have special attributes not related to security.

1.5 This specification describes and grades various levels of performance provided by limited dual custody operation.

1.6 The specific padlocks included have shackles of limited diameter, permitting attachment to existing zipper slides and zipper pulls and other devices provided for closure.

1.7 These padlocks are considered "privacy padlocks" offering limited protection to forced attack similar to that provided by tamper-indicative security seals. A successful forced attack would be indicated by the damage done to the padlock. For padlocks offering greater protection to forced attack, the user is directed to Performance Specification F883.

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

1.9 The following precautionary caveat pertains only to the test method portions, Sections 8 – 11, of this specification: *This standard does not purport to address 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]

F883 Performance Specification for Padlocks

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *acceptance testing, v*—to assure by documented testing that a padlock meets specific tests of Specification F2348 as agreed to by the buyer and seller.

3.1.2 *case, n*—housing or body of a lock or latch.

3.1.3 *certified, v*—to assure by documented testing that a padlock meets all test requirements appropriate to its grading.

3.1.4 *combination lock, n*—lock that is operated by local input of a specific series or sequence of numbers or letters.

3.1.5 *cylinder, n*—complete operating unit which usually consists of the plug, shell, tumblers, springs, plug retainer, a cam/tailpiece or other actuating device, and all other necessary operating parts.

3.1.6 *cylinder bitting, n*—group of numbers that represent the bitting of a key or the tumblers, or both, of a lock or cylinder.

3.1.7 *decode, v*—to determine a key combination by physical measurement of a key or cylinder parts, or both.

3.1.8 *heel, n*—part of a padlock shackle that normally is retained in the case when in the unlocked position.

3.1.9 *independent dual custody, adj*—function of a mechanism that allows access by two different people with different credentials.

3.1.10 *keyway, n*—the opening in a lock or cylinder that is shaped to accept a key bit or blade of a proper configuration.

3.1.11 *manipulate, v*—dialing process typically used with combination locks to determine operational status of the lock, potential combinations, or attempt to free the mechanism.

3.1.12 *manipulation, n*—opening method for mechanical combination locks that uses the tolerances of that lock to determine an opening combination.

[1] This specification is under the jurisdiction of ASTM Committee F12 on Security Systems and Equipmentand is the direct responsibility of Subcommittee F12.50 on Locking Devices.

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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.

3.1.13 *padlock, n*—detachable and portable lock with a shackle that locks into its case.

3.1.14 *pick, v*—to manipulate tumblers in a keyed lock mechanism through the keyway, without obvious damage, by means other than the specifically designed key.

3.1.15 *plug, n*—part of a cylinder that contains the keyway, with tumbler chambers usually corresponding to those in the cylinder shell.

3.1.16 *rap, v*—to unlock a padlock shackle from its case by striking the case to disengage the locking mechanism.

3.1.17 *removable cylinder, n*—cylinder that can be removed from a locking device by a key or tool, or both.

3.1.18 *shackle, n*—part of a padlock that passes through an opening in an object or fits around an object and is ultimately locked into the case.

3.1.19 *tamper-indicative device (tid), n*—mechanical device whose physical change in state is an obvious indication of tamper

3.1.20 *toe, n*—part of a padlock shackle that is normally released from the case in the unlocked position.

3.1.21 *tumbler, n*—movable obstruction of varying size and configuration in a lock or cylinder that makes direct contact with the key or another tumbler and prevents an incorrect key or torquing device from activating the lock or other mechanism.

3.1.22 *zipper slide, n*—movable device that opens and closes a zipper.

3.1.23 *zipper pull, n*—element attached to a zipper slide to facilitate movement.

4. Classification of Functions

4.1 *Types of Padlocks:*
4.1.1 *Type P01*—Key operated.
4.1.2 *Type P02*—Combination operated.
4.1.3 *Type P03*—Frangible element operated.
4.1.4 *Type P04*—Replaceable frangible element operated.
4.1.5 *Type P05*—Independent custody operated.

4.2 *Grades*—Four levels of performance are described in this specification with Grade 0 the lowest and Grade 3 the highest.

4.3 *Options:*
4.3.1 *Option A*—Key is captive in cylinder when padlock is unlocked.
4.3.2 *Option B*—Not used in this specification.
4.3.3 *Option C*—Non-changeable combination.
4.3.4 *Option D*—Combination operated with key control.

5. General Requirements

5.1 *Inferences*—Cylinder picking, rapping, and decoding are described in this specification. Since the skill of the person doing the testing has a direct bearing on the results of the tests, one of each test shall be conducted by three different persons having experience of not less than one year of approximately the same skill level and the results averaged for determining relative levels of performance.

5.2 *Tolerances:*
5.2.1 *Fixture Tolerances*—All tolerances shall follow standard machining practices unless otherwise specified.
5.2.2 *Test Setup Tolerances:*
5.2.2.1 *Force:* 0.5 % of working range.
5.2.2.2 *Height:* ±3 mm (0.12 in.)
5.2.2.3 *Torque:* 4.0 % of reading.

5.3 *Temperature*—All tests shall be conducted between 16 and 27°C (61 and 81°F).

5.4 *Test Reports*—All test reports shall be dated.

6. Test Specimens

6.1 Select specimens for test at random from the manufacturers' finished stock of each size and model being certified by the manufacturer.

6.2 Padlocks may be used for multiple tests if previous tests would not influence subsequent test results.

6.3 Select four padlocks for the forcing tests. For surreptitious entry tests, select five padlocks for each test required. Select one padlock for the cycle test.

7. Preparation of Apparatus

7.1 *Tensile Loading Device*—Provide a tensile loading device having a load and force measuring capacity of 1142 to 2855 mm/N (200 to 500 in./lb).

8. Test Methods

8.1 *Forcing Tests (see* Table 1*)*
8.1.1 *Tensile Test*
8.1.1.1 *Scope*—The subject privacy class of padlock is not a security padlock. Any can be forced using simple well-known attack methods. It is important that any successful forcing attack leaves clear evidence of the event.
8.1.1.2 *Significance and Use*—The forcing tests to be performed establish grade levels for tensile (pulling the shackle

TABLE 1

			Grade per ASTM F2348			
	Description	**Units**	**0**	**P1**	**P2**	**P3**
	Shackle Diameter	mm	<3.0	3.0	4.0	5.0
TABLE 1	**Forcing Tests Required Values**	**Units**	**0**	**F1**	**F2**	**F3**
Forcing tests	Tensile Test	lb	<200	200	350	500
	Shackle Cutting Test	lb	<500	500	1000	2000
	Evidence of Forced Attack		no	yes	yes	yes
	Non-Functioning after Forced Attack		no	yes	yes	yes

TABLE 2

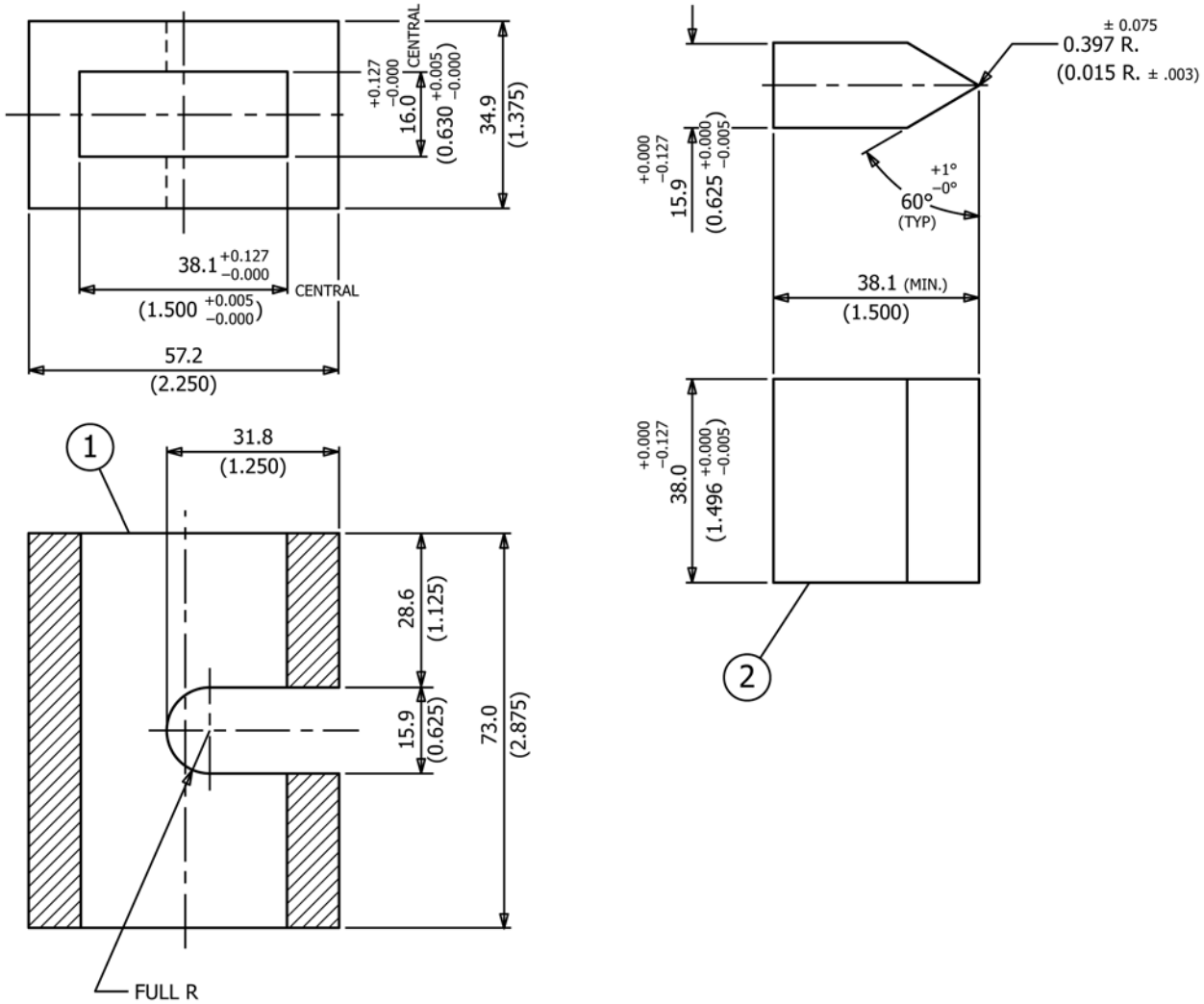
TABLE 2	Surreptitious Entry Tests Required Values	Units	0	S1	S2	S3
Surreptitious Entry Tests	Picking or Manipulating Test	s	<30	30	100	180
	Rap Test	s	<5	5	10	20

from the body) and shearing (cutting the shackle). These tests represent the vulnerability that should be demonstrated and graded (Table 1).

8.1.1.3 *Procedure (see 7.1)*—Support the locked padlock in a fixture bearing against the top surface of the case without interfering with the shackle or giving support through the top of the case to the shackle-retaining mechanism. Apply the required force slowly along the vertical centerline of the padlock in a direct and equal tension on each leg of the shackle. Failure occurs if the padlock opens and can be relocked.

8.1.1.4 *Precision and Bias*—The precision and bias of this test method are being determined and will be supplied within five years.

8.1.2 *Shackle Cutting Test (does not apply if test cannot be performed)*—Shackles shall withstand cutting through when two shearing blades made of a steel hardened to a minimum hardness of Rc 50, are used in conjunction with the blade positioning holder, is placed in a tensile loading device (see 7.1) having a compression load capability and compressed with the required force. See Fig. 1 for details. Failure occurs if the



NOTE 1—Item No. 1 may be made as a multi-piece part that could be assembled by either bolt or weld construction.

FIG. 1 (Sheet 1) Shackle Cutting Fixture and Blades (See Table 3 for Bill of Material)

shackle is cut through.

8.2 *Surreptitious Entry Tests (see* Table 2*)*

8.2.1 *Picking or Manipulating Test:*

8.2.1.1 *Scope*—Cylinders in padlocks shall resist picking (see 5.1) for the required time. Combination padlocks shall resist manual manipulation (see 5.1) for the required time.

8.2.1.2 *Significance and Use*—This test represents an additional vulnerability of these simple mechanisms. The criteria for time to defeat represents the realistic performance to be expected. The manufacturer must incorporate the appropriate mechanisms and materials to achieve the performance values found in Tables 1 and 2. The user can distinguish the levels of performance suitable to his application by use of the grades provided in Tables 1 and 2.

8.2.1.3 *Procedure*—Cylinders in padlocks submitted for test containing pin tumblers shall be loaded using one each of the longest and the shortest bottom pins furnished by the manufacturers with the remaining chambers loaded with other sizes. Cylinders in padlocks containing other tumbler elements shall be loaded using maximum ranges. If lock design and cylinders used are the same in several different sizes of padlocks submitted for testing, only a total of five samples of any size or sizes need to be tested.

8.2.1.4 The tools used for this test shall be manual manipulating tools required by the operator, providing no visible marks are left detectable by the unaided eye.

8.2.1.5 *Precision and Bias*—The precision and bias of this test method are being determined and will be supplied within five years.

8.2.2 *Rap Test:*

8.2.2.1 *Scope*—The purpose of the rap test is to determine if a lock with a spring bolt can be opened via a sharp impact to the lock case that will withdraw the spring bolt from the shackle through inertia. For the test to work, a degree of tensile force must be applied to the shackle or the lock body in the opening direction while the test is being conducted.

8.2.2.2 *Significance and Use*—Padlocks shall resist successful rapping on the cylinder and case (see 5.1) for the required time. The criteria for time to defeat represents the realistic performance to be expected. The manufacturer must incorporate the appropriate mechanisms and materials to achieve the performance values found in Tables 1 and 2. The user can distinguish the levels of performance suitable to his application by use of the grades provided in Tables 1 and 2.

8.2.2.3 *Procedure*—Use handheld tools. The amount of that force is critical to the test and will be determined in the following manner:

(1) With the shackle in the open position, the force required to push the shackle into the locked position should be measured. That measurement value shall be multiplied by 110 % to determine the optimum tensile force used on the shackle or lock body while the rap test is being conducted.

(2) With the shackle and body under the required tensile force in the unlocking direction, the body of the lock shall be struck with a plastic or rawhide mallet in a rapping motion in the unlocking direction of the spring bolt. This rapping action should have a force not less than ½ of the force required to push the shackle into the locked position and shall continue at a rate of impact not to exceed 1 impact per 1 s, and not less than 1 per 1.5 s.

8.2.2.4 If the shackle fails to unlock during this test, the lock passes.

8.2.2.5 *Precision and Bias*—The precision and bias of this test method are being determined and will be supplied within five years.

9. Acceptance Criteria

9.1 A failure of any one padlock in the forcing tests constitutes a failure of the complete test. See Section 8 for acceptance criteria for surreptitious entry tests.

9.2 Padlocks shall meet all the required values set forth in Tables 1 and 2 as applicable to qualify for the applicable grade level of 0 through 3.

9.3 In the tests described in Sections 8, a test failure will have occurred if the padlock can be relocked at the conclusion of the testing.

9.4 Users may want padlocks exceeding the required criteria of one or more of the tests in a given grade level. Manufacturers may identify the grade level and levels of performance exceeding the requirements for that class (see Appendix X1).

10. Precision and Bias

10.1 Where dimensions and weights are described for various test apparatus and no maximums or minimums are given, a combined bias of ±2 % is permitted.

11. Keywords

11.1 padlocks; privacy padlocks; security padlocks

TABLE 3 Bill of Material (Fig. 1)

Detail No.	No. Required	Description	Material[A]
1	1	body	steel
2	2	blade	steel (*Rc* 50 min)

[A] Note that all materials are suggested materials only. Substitutions are permitted when and if function and safe usage of the fixture are not affected.

APPENDIX

(Nonmandatory Information)

X1. USERS GUIDE

X1.1 Padlock Class Rating

X1.1.1 Padlocks meeting all the requirements of one of the Grades 0 through 3 shall be so rated.

X1.1.2 A padlock complying with one of the grades may exceed the requirements for that grade in the surreptitious entry test category or the forcing test category.

X1.1.3 A rating beyond 0 through 3 may be used by some manufacturers. For example, a padlock designated as Grade 3 may also have the parenthetical designation (F1S3). This would mean the padlock met the requirements for forcing test of Grade 1. Users of padlocks not overly concerned with forcing attack but wanting relatively high resistance to surreptitious entry would find such a padlock more useful than one rated Grade 3.

X1.2 Options

X1.2.1 Under the function description, several optional features are described, including frangible element operation, independent dual custody operation or TID.

X1.2.2 These should be specified by indicating the function required with optional feature(s) desired. For example: "Provide Function P01 with Options a, b, and c."

X1.3 Chains

X1.3.1 If chains attached to the padlock are required, they must be so specified.

X1.4 Keys

X1.4.1 Two keys are customarily furnished with each padlock. If more or less are required, they must be so specified.

X1.5 Hasps and attachments

X1.5.1 Hasps and attachments are not addressed in this specification. The strength and fastening system of a hasp must be compatible with the grade of padlock to maintain the integrity of the locking system. Zipper pulls may be attachment elements.

X1.6 Sizes

X1.6.1 *Privacy*—Padlocks are generally sized according to the diameter of the shackle. As the diameter of the shackle gets larger, its resistance to cutting attack because of greater mass becomes higher. Consequently, the same series of padlocks may have a low grade rating in a small size and an increasingly higher rating in subsequently larger sizes.

X1.7 Tests

X1.7.1 The forcing tests included in this specification were devised so as to be accurately repeatable in a laboratory environment. The nature of the forces and loads imposed are intended to encourage the production of a padlock that will withstand a balanced variety of attacks. Criteria selected are based on guarding against known attack methods used with the greatest frequency. Users of this specification with special needs may wish to impose additional cutting or forcing tests.