



Designation: F 883 – 97

Standard Performance Specification for Padlocks¹

This standard is issued under the fixed designation F 883; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification contains environmental, functional, operational, and security requirements for padlocks. Included are function descriptions, cycle tests, operational tests, environmental tests, forcing tests, and surreptitious entry tests. No effort has been made to include criteria for specially made padlocks used by the Department of Defense or others in highly sensitive locations.

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

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

1.4 Some users of this standard may wish to use padlocks that have special attributes not related to security. These are found in 4.3.

1.5 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.

1.6 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:

- B 117 Practice for Operating Salt Spray (Fog) Apparatus²
- G 53 Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials³

¹ This specification is under the jurisdiction of ASTM Committee F-12 on Security Systems and Equipment and is the direct responsibility of Subcommittee F12.50 on Locking Devices.

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² Annual Book of ASTM Standards, Vol 03.02.

³ Annual Book of ASTM Standards, Vol 14.02.

2.2 ANSI Standard:

- A 156.5 Standard for Auxiliary Locks and Associated Products⁴

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 F 883 as agreed to by the buyer and seller.

3.1.2 *cam, n*—a flat actuator or locking bolt attached to the rear of the cylinder perpendicular to its plug and rotated by the key.

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

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

3.1.5 *clevis, n*—a fastener attached to a padlock case or shackle for connection of a chain, designed to prevent displacement of a padlock.

3.1.6 *cylinder, n*—a 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.

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

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

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

3.1.10 *impression technique, v*—a means of fitting a key directly to a locked cylinder by manipulating a blank in the keyway and cutting the blank where the tumblers have made marks.

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

3.1.12 *padlock, n*—a detachable and portable lock with a shackle that locks into its case. Components performing the

⁴ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

same purpose of a shackle but differing in design are sometimes used instead of a shackle.

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

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

3.1.15 *plug retainer*, *n*—the cylinder component that secures the plug in the shell.

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

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

3.1.18 *shackle*, *n*—the 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 *shroud*, *n*—material on a padlock body specifically added to protect the shackle from physical attack.

3.1.20 *tailpiece*, *n*—an actuator attached to or part of the rear of the cylinder.

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

3.1.22 *tumbler*, *n*—a 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.

4. Classification of Functions

4.1 *Types of Padlocks*:

4.1.1 *Type P01*—Key operated.

4.1.2 *Type P02*—Combination operated.

4.2 *Grades*—Six levels of performance are described in this specification with Grade 1 the lowest and Grade 6 the highest.

4.3 *Options*:

4.3.1 *Option A*—Key is captive in cylinder when padlock is unlocked.

4.3.2 *Option B*—Removeable cylinder.

4.3.3 *Option C*—Changeable combination.

4.3.4 *Option D*—Combination operated with key control.

4.3.5 *Option E*—Corrosion resistant.

4.3.6 *Option F*—Provided with nonferrous shackles.

4.3.7 *Option G*—Environmental resistant.

5. General Requirements

5.1 *Inferences*—Cylinder picking, impressioning, rapping, decoding, and shackle shimming 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 five different persons having experience of not less than three years 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 Set up 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.

5.2.2.4 *Weight*: ± 10 g (0.02 lbs).

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.

6.4 When appropriate, select one padlock for the salt spray test (Option E) and three for the environmental tests (Option G).

7. Preparation of Apparatus

7.1 *Tensile Loading Device*—Provide a tensile loading device having a load and force measuring capacity of 44 500 N (10 000 lbf).

7.2 *Shock Impactor*:

7.2.1 Provide a fixture as illustrated in Fig. 1 which allows the weights described in (7.2.2) to be properly guided to strike the anvil rod which will be placed in direct contact with the top surface of a padlock using the mounting block described in (7.2.3).

7.2.2 Make a set of weights as shown in Fig. 1, with a central hole in each that allows the weight selected to free fall and strike the top surface of the anvil rod.

7.2.3 Make a mounting block that will support the specimen on the mounting block when being subjected to the required shock load (see Table 1).

TEST METHODS

8. Forcing Tests (see Table 1)

8.1 *Tensile Test* (Does not apply if test cannot be performed) (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.

8.2 *Shock Test*—Using the impactor (7.2) drop the weight the required number of times on the top of the locked padlock case. Failure occurs if the padlock opens.

8.3 *Plug Pulling Test*—Drill the keyway with a No. 20 (0.161 in.) diameter drill and insert a Type AB No. 12 screw at least 19 mm (0.75 in.) deep. Apply the required tension (7.1) axially between the case and the installed screw. Failure occurs if the cylinder plug or cylinder assembly completely separates from the case or if the padlock can be opened by manipulation with a screwdriver at the conclusion of the test.

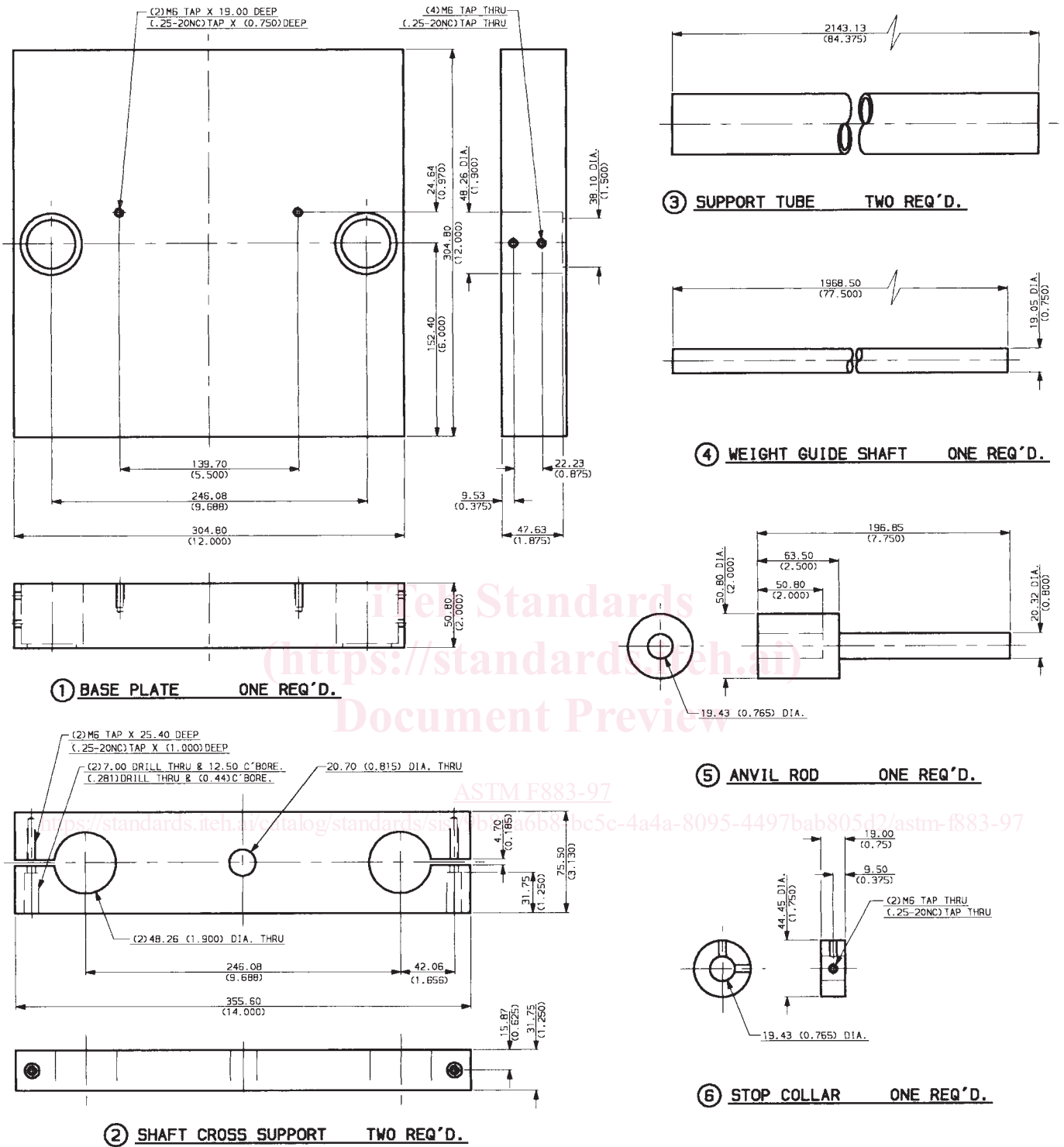


FIG. 1 (Sheet 1) Shock Impactor (See Table 5 for Bill of Material)

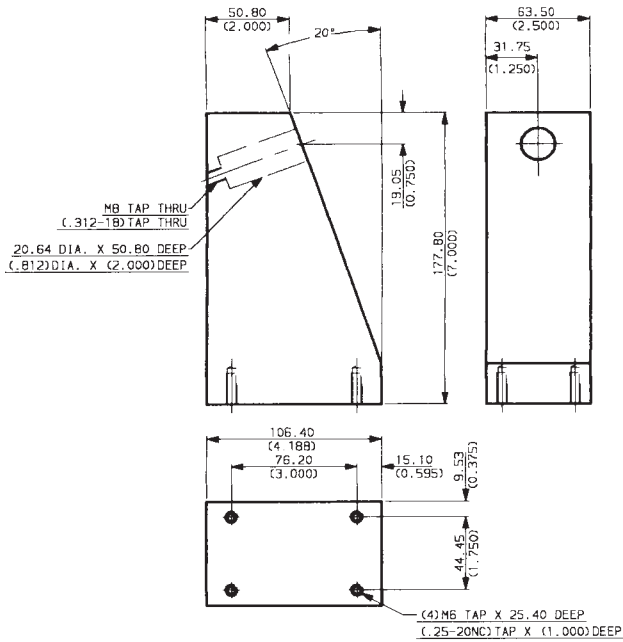
NOTE 1—Some cylinders are of a configuration such that a different attachment may be needed in order to apply the required loads.

8.4 Plug Torque Test:

8.4.1 Install the padlock in a rigid fixture such as a vise to support it firmly but not restrict free rotation of the plug in the cylinder.

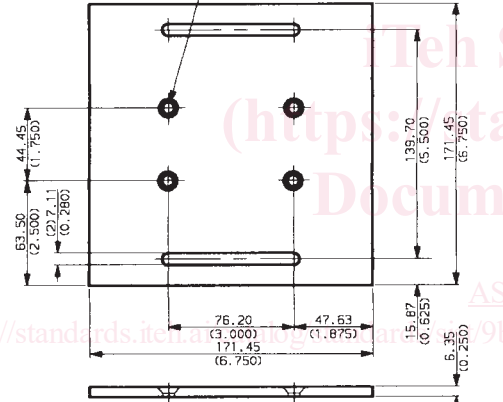
8.4.2 Insert a blade type tool into the keyway, so that a torque load can be applied to the plug. Failure occurs if the padlock opens.

8.5 Shackle Cutting Test (Does not apply if test cannot be performed)—Shackles shall withstand cutting through when 2 shearing blades made of a steel hardened to a minimum

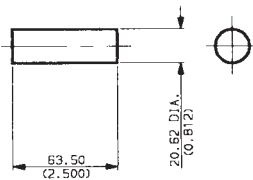


⑦ MOUNTING BLOCK ONE REQ'D.

(4) DRILL AND C'SINK. FOR
M6 (.25) MACHINE SCREW



⑧ MOUNTING BLOCK BASE ONE REQ'D.



⑨ MOUNTING PIN ONE REQ'D.

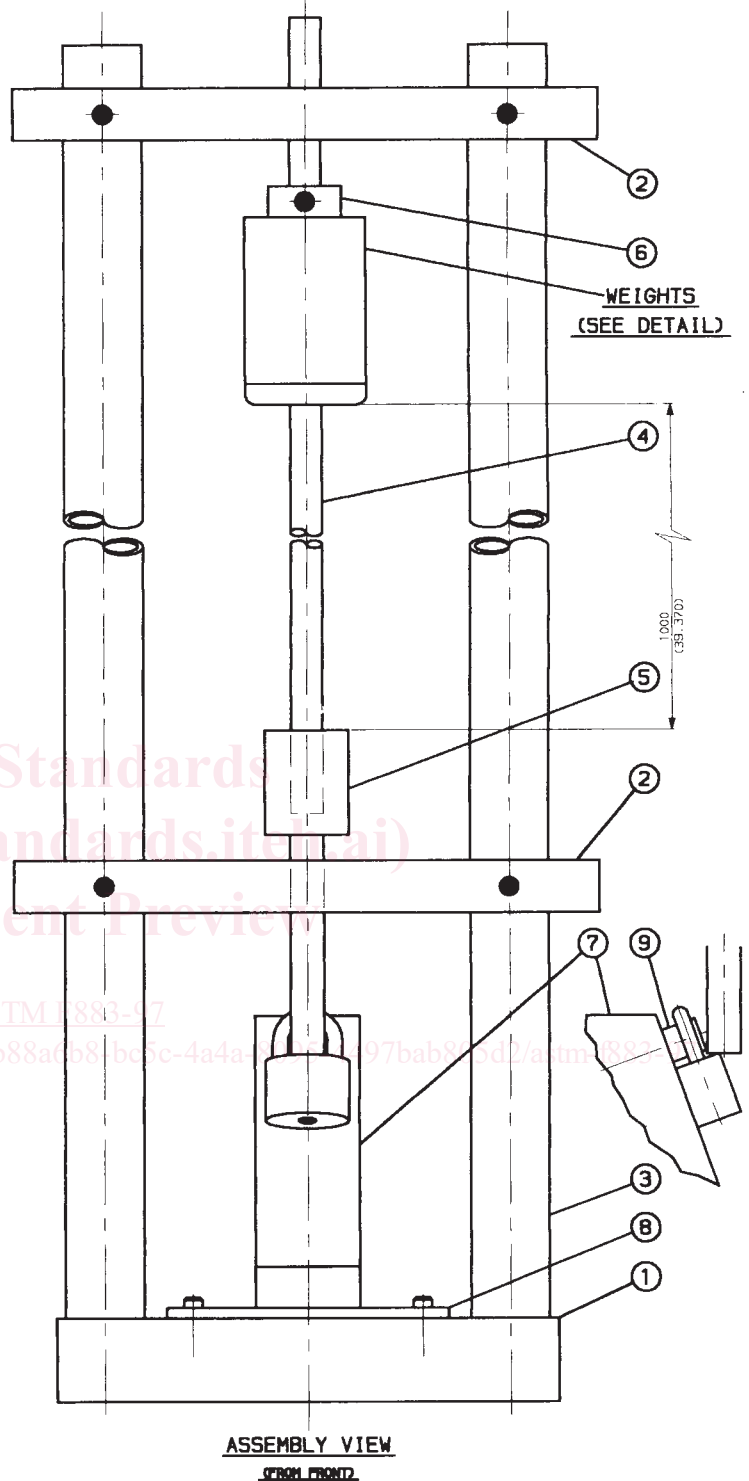


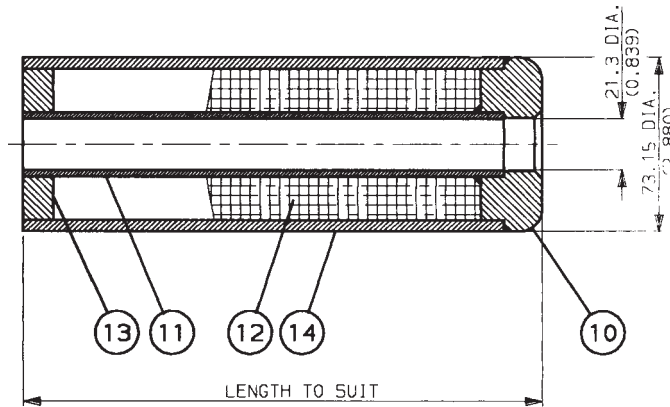
FIG. 2 (Sheet 2) Shock Impactor (See Table 5 for Bill of Material)

hardness of Rc 50, are used in conjunction with the blade positioning holder, is placed in a tensile loading device (7.1) having a compression load capability and compressed with the required force. See Fig. 4 for details. Failure occurs if the shackle is cut through. Padlocks specified with Option F are not subject to 8.6.

9. Surreptitious Entry Tests (See Table 2.)

9.1 Picking or Manipulating Test:

9.1.1 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.



DEAD BLOW WEIGHT SIX REQ'D.

FIG. 3 (Sheet 3) Shock Impactor (See Table 5 for Bill of Material)

TABLE 1 Forcing Tests Required Values

Forcing Tests	Units	Grades					
		1 (F1)	2 (F2)	3 (F3)	4 (F4)	5 (F5)	6 (F6)
Tensile Force	newtons (lbf)	1000 (225)	2500 (560)	5000 (1125)	9000 (2000)	20 000 (4500)	40 000 (9000)
Shock test blows		5	5	5	5	5	5
Shock test weights	kilograms (lbs)	1 (2.2)	2 (4.4)	3 (6.6)	4 (8.8)	5 (11.0)	6 (13.2)
Shock test heights	meters (in.)	1 (39.4)	1 (39.4)	1 (39.4)	1 (39.4)	1 (39.4)	1 (39.4)
Plug pull test	newtons (lbf)	1000 (225)	1500 (337)	2000 (450)	3000 (675)	6000 (1350)	12 000 (2700)
Plug torque test	newton-meters (lbf-in.)	10 (89)	15 (133)	20 (177)	25 (221)	30 (266)	35 (310)
Shackle cutting force test	newtons (lbf)	4450 (1000)	9000 (2000)	13 500 (3000)	18 000 (4000)	31 000 (7000)	45 000 (10 000)

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9.1.2 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.

9.1.3 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.

9.2 Cylinder Impressioning and Decoding Tests:

9.2.1 Cylinders shall resist successful impressioning and decoding (see 5.1) for the required time.

9.2.2 Padlocks with cylinders submitted for test shall be loaded in accordance with 9.1.2.

9.3 Shackle Shimming Test—Insert any shim stock selected (see 5.1) that can be inserted in the clearance between the shackle and the case in either or both of the case shackle holes of a locked padlock and manipulate for the required time.

9.4 Cylinder Drilling and Shimming Test:

9.4.1 Use hand-held tools.

9.4.2 Load cylinders in accordance with 9.1.2.

9.4.3 Cylinders in locked padlocks hanging from a hasp shall resist drilling and shimming for the required time. Results of the drilling test shall not be obvious to the unaided eye.

9.5 Rap Test:

9.5.1 Use hand-held tools.

9.5.2 Padlocks shall resist successful rapping on the cylinder and case (see 5.1) for the required time.

10. Cycle Test (see Table 3.)

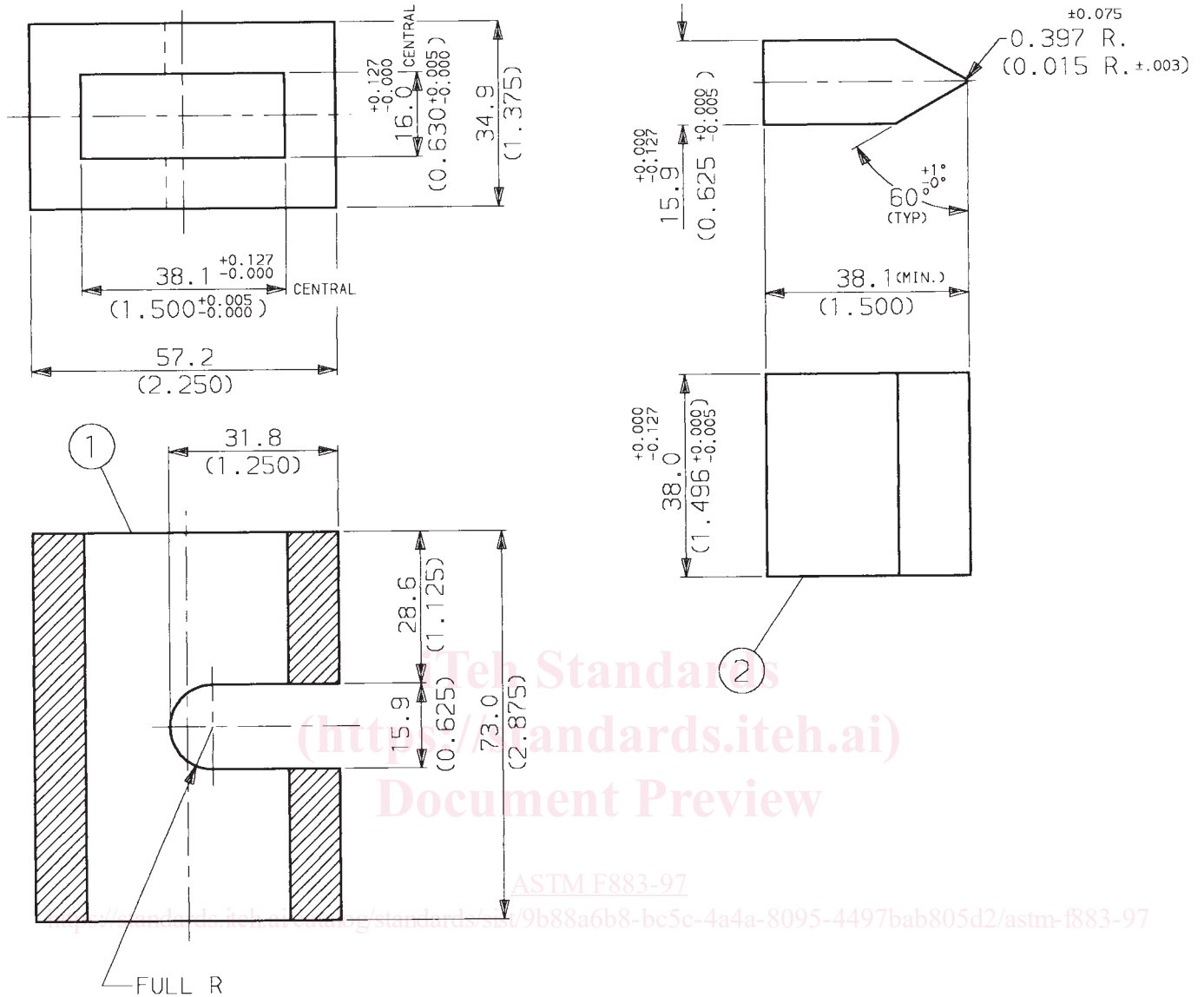
10.1 Keyed Padlocks:

10.1.1 Prior to conducting the cycle test, insert key into each padlock cylinder 25 times and manually rotate both clockwise and counterclockwise (if possible, otherwise in the direction of opening) after each insertion.

10.1.1.1 Operate the required number of cycles at a rate not to exceed 10 cycles/min. Lubrication shall not be added during the test.

10.1.1.2 At the beginning and the end of the cycle test, cylinders shall meet the operational tests as described in ANSI A 156.5. The required values for these tests are expressed in Table 3 of this specification and are not the same as in A 156.5.

10.1.2 Non-Key Retaining Padlocks—In a test fixture which will horizontally hold the padlock and mechanically operate the key, activate through a cycle consisting of the following:



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

FIG. 4 (Sheet 1) Shackle Cutting Fixture and Blades (See Table 6 for Bill of Material)

TABLE 2 Surreptitious Entry Tests Required Values

Surreptitious Entry Tests	Grades					
	1 (S1)	2 (S2)	3 (S3)	4 (S4)	5 (S5)	6 (S6)
Picking or Manipulation, min	½	1	2	4	8	15
Impressioning or Decoding min	0	0	2	4	8	15
Shackle Shimming Test min	½	1	2	4	8	15
Drilling and Shimming min	0	0	0	4	8	15
Rapping min	0	0	2	4	8	15

10.1.2.1 Fully inserting the key in the keyway.

10.1.2.2 Rotating the key and cylinder plug the necessary number of degrees to open the padlock either clockwise or counterclockwise.

10.1.2.3 Allowing the shackle to extend, if spring loaded, or not, moving the shackle to its full extension.

10.1.2.4 Retracting the key from the plug until the key tip no longer touches the front tumbler.

10.1.2.5 Reengaging the shackle to the locked position.

10.1.3 *Key Retaining Padlocks*—In a test fixture that will hold the padlock horizontally and mechanically operate the key, activate through a cycle consisting of the following: