

AMERICAN NATIONAL STANDARD

FOR

HIGH SECURITY CYLINDERS

SPONSOR

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC.

Committee review copy

Tests in the CEN Standard for Mechatronic Cylinders were checked against the applicable BHMA Standards to ensure coverage, added or raised as necessary; as a result a rap test was added to cover the “hits” test in the CEN.

Developed a definition of “high security cylinders” as shown in the draft.

The definition of “audit trail” was revised as suggested.

Revised the definition of “mechanical cylinders”.

In 7.3 added “or manipulation”.

Added a definition for “picking”.

- In 4.5, changed the standard bitting to random.
- In 7.5.1, increased the maximum key torque to 23 in.-lbf.
- Added a 3 in.-lbf load to the cycle test.
- The wording of the failure criteria in the magnet test was questioned and revised as shown in the draft.

Recirculation with proposed revisions based on comments from Canvass 1

- Updating the UL 437 reference to the 2013 edition
- Revising the overvoltage test to 25,000 volts for all levels, based on the lack of test equipment at 50,000.

AMERICAN NATIONAL STANDARD

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive the current information on all standards by calling or writing the American National Standards Institute.

Published by
BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC.
355 Lexington Avenue New York, New York 10017
www.buildershardware.com

Copyright © 2014 by the
Builders Hardware Manufacturers Association, Inc.

Not to be reproduced without
specific authorization from BHMA

Printed in the USA

The Builders Hardware Manufacturers Association, Inc first published this Standard in 2003. ANSI approval was secured under the Canvass Method. BHMA was accredited on 21 March 1983 by ANSI as a sponsor using the Canvass Method.

FOREWORD (This Foreword is not a part of ANSI/BHMA A156.30)

The general classification of builders hardware includes a wide variety of items which are divided into several categories. To recognize this diversity, a sectional classification system has been established. High Security Cylinders is one such section and this Standard is the result of the collective efforts of members of the Builders Hardware Manufacturers Association, Inc. who manufacture this product. The total Product Standards effort is, therefore, a collection of sections, each covering a specific category of items.

Performance tests, and, where necessary, dimensional requirements, have been established to ensure safety, security and stability to which the public is entitled. There are no restrictions on design, except for those dimensional requirements imposed for the reasons given above. It is also required that some hardware items fit certain specified cutout dimensions.

This Standard is not intended to obstruct, but rather to encourage, the development of improved products, methods, and materials. The BHMA recognizes that errors will be found, items will become obsolete, and new products, methods, and materials will be developed. With this in mind, the Association plans to update, correct, and revise these Standards on a regular basis. It shall also be the responsibility of manufacturers to request such appropriate revisions.

In most cases, products have been described in grades related to performance and security. Choice of grades and specific product is made on the basis of utility, aesthetics, security objectives and end use desired. This Standard describes products in terms of High Security *Levels* rather than *Grades*.

The BHMA numbers, which indicate types of hardware do not identify grade, finish, or design and are not intended to be used without necessary supplementary information. Individual manufacturers' catalogs are consulted.

Users of this Standard consult applicable local building codes as to requirements affecting the functions of locks used on fire doors and doors within a means of egress.

ORDERING INFORMATION

BHMA standards, publications, and matchplates can be ordered at:

www.buildershardware.com - Search entire catalog, order printed or electronic versions, and download electronic versions right to your computer.

Call our Fulfillment Partner, Techstreet, at:

Toll-free (800) 699-9277 (U.S. and Canada)

Ph. (734) 302-7801 Fax (734) 302-7811

E-mail: service@techstreet.com

Send mail to:

BHMA c/o Techstreet

1327 Jones Drive

Ann Arbor, MI 48105 USA

To find products that are third-party certified to this standard and other ANSI/BHMA standards please visit

www.buildershardware.com.

The Builders Hardware Manufacturers Association (BHMA) Certification Program was developed as a means for producers of builders hardware to indicate compliance with American National Standards sponsored by BHMA. Participating manufacturers certify compliance with the standards based on a continuing program of passing the prescribed tests. Third party testing is performed by a Nationally Recognized Test Laboratory. The program is open to all manufacturers of builders hardware whether or not they are members of BHMA.

TABLE OF CONTENTS

1. SCOPE..... 6

2. DEFINITIONS 6

3. GENERAL..... 8

4. TEST METHODS AND SAMPLES 8

5 KEY CONTROL 10

6 DESTRUCTIVE TESTS 11

7 SURREPTITIOUS ENTRY RESISTANCE TESTS..... 13

8 EXPLANATION OF IDENTIFYING NUMBERS FOR SECURITY LEVELS..... 17

APPENDIX (NOT PART OF A156.30) 18

1. SCOPE

1.1 This Standard includes security performance based requirements for both mechanical and electrified high security cylinders. For the purpose of this Standard, High Security Cylinder includes mechanical lock cylinders, electromechanical cylinders, and the electronic lock sub assemblies that are analogous to the cylinder assemblies. Cylinders include their keys or electronic credentials; their retainers (mechanical pins, levers, discs) or electronic control device; and their cylinder tailpiece or cam or electronic output port.

1.2 Tests described in this Standard are performed under laboratory conditions. In actual usage, results vary because of installation, maintenance and environmental conditions.

1.3 Levels and Grades

1.3.1 **Levels** Manufacturers shall indicate the high security level of their cylinders. Cylinders shall meet all the tests for their level listing, indicated in accordance with Section 8. Levels indicate special security features and are separate from Grades. A lockset mated with a cylinder having no Grade listing, even though the cylinder has a high security level is considered ungraded.

1.3.2 **Grades** To obtain cylinder Grade listings, and for the mating lock to retain its Grade listing, cylinders must be tested in accordance with ANSI/BHMA A156.5 for Auxiliary Locks and Associated Products. Assemblies take the grade of the lowest graded component. Electrified products shall also meet the requirements of A156.25 for Electrified Locking Devices to obtain a grade listing.

2. DEFINITIONS

2.1 **Audit Trail** A retrievable, recorded chronology of the individual valid keys inserted into the electrified cylinder; may also include invalid keys.

2.2 **Biometrics** A method to identify a user from within a population of possible users, according to a characteristic, or multiple characteristics which can be reliably associated with a particular individual, without an identity being explicitly claimed by the user.

2.3 **Cam** In this Standard, a component fastened to the back of a mortise cylinder plug or mortise cylinder turn. When rotated, it engages the lock mechanism.

2.4 **Controlling Device** A device which processes the input signal and gives instructions to the output device to perform certain functions.

2.5 **Credentials** The key media containing the combination code that identifies a user.

2.6 Cylinders

2.6.1 **Cylinder Body** The portion of a cylinder that surrounds the plug and contains the tumbler mechanism. The cylinder body is sometimes called a cylinder shell.

2.6.2 **Cylinder Guard** That portion that surrounds the otherwise exposed portion of a cylinder to protect the cylinder from wrenching, cutting, pulling or prying.

2.6.3 **Cylinder Housing** The portion of a lock that surrounds and retains the cylinder body. It is often part of a lock case.

2.6.4 **Cylinder Plug** A component of the cylinder within the body, which is actuated when the correct key is used.

2.6.5 **Electrified Cylinder or Input Device** The components of an electrically powered lock containing the input device which decodes the key or user input, and is connected to or includes the controlling device or output device.

2.6.6 **High Security Cylinders** Cylinders meeting the requirements of A156.30, and provide increased resistance to entry through destructive or surreptitious means.

2.6.7 **Mechanical Cylinder** The subassembly of a lock containing a plug with keyway and a body with movable retainers.

2.7 **Decoding** Obtaining the dimensions of a key or cylinder without disassembling the cylinder.

2.8 **Dynamic Authentication** Requires the code that is transmitted to be different in every usage.

2.9 **Effective Changes** Differences between cylinders of similar designs, achieved only by the movable retainer, which allows each cylinder to be operated only by its own key. The number of effective changes is equal to the number of theoretical changes after deduction of the changes suppressed by the manufacturer due to technical constraints. Also called differs.

2.10 **ESD (Electrostatic Discharge)** A transfer of electric charges between bodies of different electrostatic potential in proximity or through direct contact.

2.11 **Interchangeable Core (IC)** A cylinder that is removed from the lock with a designated key.

2.12 **Interchangeable Core (IC) Mortise Cylinder** The combination of a mortise IC housing, integrated with a corresponding interchangeable core cylinder.

2.13 **Interchangeable Core (IC) Rim Cylinder** The combination of a rim cylinder IC housing, integrated with a corresponding interchangeable core cylinder.

2.14 **Input/Output Terms**

2.14.1 **Input Device** The device that activates or communicates with a controlling device or the output device.

2.14.2 **I/O Conducting Terminals** The electrical inputs or outputs that conduct signals with keys or other user interface devices.

2.14.3 **Output Device** The electrified locking device that locks or unlocks the door.

2.14.4 **Output Port** Conductors connecting the controlling device to the output device.

2.15 **Key** A properly combined device specifically intended to operate a corresponding cylinder.

2.16 **Movable Retainer** Part of the mechanism of the cylinder which first should be moved by the key into a predetermined position before the key or plug can release.

2.17 **Picking** Manipulating tumblers in a keyed lock mechanism through the keyway, without obvious damage, by means other than the specifically designed key.

2.18 **Tailpiece** A bar projecting from the back of a rim, bored lock cylinder or a push button mechanism engaging the lock mechanism and when rotated by the key or turn either locks or unlocks the lock.

2.19 **Theoretical Key Changes** The total possible mathematical biting combinations, usually reduced in practice.

2.20 **Time Zoning** The ability to control the acceptance of some or all keys, based on the real time of the key's use.

2.21 **Visual Key Control (VKC)** A specification that all keys and the visible portion of the front of all lock cylinders be marked with standard keying symbols.

3. GENERAL

3.1 Where cylinders are referenced, mechanical and electrified types are included.

3.2 **Tolerances and Values.** Required values in this Standard are given in US units. The SI (metric) equivalents are approximate. All values which do not carry specific tolerances or are not marked maximum or minimum shall have the following tolerances: Linear dimensions shall be $\pm 1/16$ in (1.6 mm). Pounds or pound force shall be $\pm 5\%$. Angular measurements shall be ± 4 degrees. Voltage measurements shall be $\pm 5\%$. Temperature measurements shall be ± 4 degrees F (± 2 degrees C). Where only minus tolerances are given, the dimensions are permitted to be exceeded at the option of the manufacturers.

3.3 **Reference to other Standards.** The following standards are referenced in this standard:

ANSI/BHMA A156.25-2013, Electrified Locking Devices

ANSI/BHMA A156.5-2014 Auxiliary Locks

UL 437-2013 Standard for Key Locks

ASTM B 117-2011 Standard Practice for Operating Salt Spray (Fog) Apparatus

All referenced standards are available from www.buildershardware.com.

ANSI Standards are available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036

Consult the Lock Industry Standards and Training (LIST) Council, and the Associated Locksmiths of America (ALOA) for related publications.

4. TEST METHODS AND SAMPLES

4.1 Quantity of Sample Test Cylinders

Where compliance is by demonstration, documentation shall be furnished to the testing agency.

PARAGRAPH	QUANTITY
KEY CONTROL	
5.1, 5.2, 5.3, 5.4	None, by demonstration
DESTRUCTIVE TESTS	
6.1, 6.2, 6.3, 6.4	3 samples each test, 12 total
SURREPTITIOUS TESTS	
7.1, 7.2, 7.3A	None, by demonstration

7.3B	Level A only 5 samples, Levels B and C by demonstration
7.4	3 samples each test, 12 total
7.5	3 samples

4.2 Failure Criteria Failure of any one cylinder in any of the tests shall constitute a failure of the complete test. No lubrication other than the original factory applied, shall be applied to the test samples at any time during the tests except where specifically authorized. Tests are not applicable when they are attempted, but cannot be performed due to the product design.

4.3 Test Equipment

4.3.1 Impact Test Fixture See Figure 1. Comprised of a square steel frame made of 1inch (25.4mm), .19 (5mm) inch wall thickness angle iron which supports an 18 x 18 inch (457 x457mm) by 1.5 (38mm) thick aluminum plate. The frame is supported by four legs, one in each corner, made of 1.5 inch (38mm), .19 inch (5mm) wall thickness angle iron. Welded beneath each leg is a steel foot which rests directly on a concrete floor. Bolted flush at the center of the aluminum plate is a 5 by 5 inch (127 x 127mm) by .9 (23mm) thick hardened steel insert with a center hole. A 3/8 inch (9.5mm) steel rod guides a 5 lb (22N) weight for a 24 inch (610mm) free fall to a steel stop at the end of the rod. A nest is provided to support the cylinder housing and clear the plug.

4.3.2 Tension Loading Device Capable of delivering and measuring tensile forces up to 2,500 lbf (11000N).

4.3.3 Torque Loading Device Capable of delivering and measuring torque forces up to 300 in lbf (34Nm).

4.3.3 Screwdrivers Screwdrivers shall be commercially available types with blades not exceeding 6 in (152 mm) with an overall length of 10 in (254 mm) maximum.

4.3.4 Drill for Drill Resistance Test A 600 to 800 W (Input power) hand drilling machine with a speed of 700 to 900 RPM mounted on a sliding block.

4.3.5 Electrical Test Equipment See applicable electrical test sections for descriptions and methods.

4.3.6 Cycle Test Device See Security Tolerance Test for cycle test rig criteria.

4.4 Measuring Equipment All instruments and equipment used to conduct tests for recording data need to be calibrated and maintained for effectiveness and continued accuracy. Calibration of equipment shall be traceable to NIST. The frequency of calibration depends on the recommendation of the particular test equipment manufacturer with a minimum being once per year. Measuring equipment used shall have a known measurement error and be capable of qualifying the value being measured.

4.5 Mechanical Sample Test Cylinders Select 18 cylinder units from the manufacturer’s stock from regular production for each level of cylinder being tested. The cylinder shall be fully loaded as designed, with bittings randomly scrambled within the manufacturers normal parameters. Cylinders shall be tested with an individual key for each cylinder during destructive and surreptitious tests. Failure of a key constitutes failure of the cylinder. For cylinder types not able to be loaded as above, the cylinder load shall consist of the first position being loaded with the detainer corresponding to the

shallowest biting on the key, and the last position being loaded with the detainer corresponding to the deepest biting on the key. The intermediate position detainers shall be scrambled in dimensions at the option of the manufacturer. However, the intermediate positions shall include at least one detainer corresponding to mean key biting depth.

4.6 **Assemblies** Unless otherwise specified, cylinders and their electronic equivalents are intended to be tested independent of their mating assemblies. If the apparatus submitted for testing is part of a system, or can be connected to auxiliary apparatus, then the apparatus shall be tested while connected to at least the minimum configuration of auxiliary apparatus necessary to exercise the device in accordance with the test procedures. The configuration and mode of operation during measurement shall be precisely noted in the test report. Measurements shall be performed in well-defined and reproducible conditions for each type of attack and shall result in values in accordance with the manufacturer’s specifications. If the apparatus has a large number of terminals, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all different types of termination are covered. The tests shall be carried out somewhere within the specified operating environmental range for the apparatus and at its rated supply voltage, unless otherwise indicated in the basic standard. In cases where a manufacturer's specification specifically requires external protection devices or measures which are clearly specified in the user's manual or installation instructions, the test requirements of this standard shall be applied with the external protection devices or measures in place.

5 KEY CONTROL

5.1 This feature is intended to provide security by limiting the availability of unauthorized keys or unauthorized electronic credentials that would operate the locks.

5.2 Key Blank and Credential Control

Mechanical Requirements

Level C	Level B	Level A
Blanks are not available from a second source, only from the manufacturer. Manufacturers maintain internal procedures to protect keys.	Level C plus Blanks are protected by law.	Level B plus Factory cut keys are only provided by the manufacturer only after authorization.

Electronic Requirements

Level C	Level B	Level A
Credentials are not available from a second source, only from the factory or proprietary encoding formats are used. Internal procedures to protect credentials.	Level C plus Credentials or encoding formats or programs are protected by law.	Level B plus Factory only programmed credentials are provided by the manufacturer only after authorization; or dynamic authorization or biometric technology.

5.3 **Cylinder Marking Requirements** Visual key control identification of the cylinder shall not be permitted for high security cylinders.

5.4 Credential Marking Requirements Direct coding in the form of mechanical bitting or electrified combinations, or electrified credential serial numbers shall not be used on credentials.

5.5 Audit Trail Capability for Electronic Products Audit trail capability is intended to provide a record of lock activity that will identify the individual credential used to operate the cylinder. The manufacture shall demonstrate that the audit trail record is stored in a form of nonvolatile memory, or that the data is otherwise preserved during the removal of main power with the following requirements.

Requirements

Level C	Level B	Level A
Not Required.	Time stamped sequential key record; capacity of 100 records minimum.	Time stamped sequential key record; capacity of 500 records minimum.

5.6 Time Zoning Capability for Electronic Products

Time zoning is intended to provide security by limiting the time that a valid credential will operate the lock. The manufacturer shall demonstrate that the lock provides time zoning capability with the following requirements.

Requirements

Level C	Level B	Level A
Not Required.	Time zones are based on the time of day or clock variations.	Level B plus time zones based on the day of week or calendar variations.

6 DESTRUCTIVE TESTS

6.1 Forced Separation Tests, Static Load

6.1.1 Cylinder Plug Static Drill the keyway with a no. 20 (0.161in.) drill and insert a type AB no. 12 screw at least .75 in (19mm) deep. The hole diameter may be increased gradually to achieve adequate screw depth and holding strength. Apply the force specified below axially between the case and the installed screw. Failure occurs if the cylinder plug completely separates, or if the cylinder can be opened within five minutes of manipulation with screwdrivers. The specimen also passes if the test cannot be performed due to design features.

6.1.2 Electronic Cylinder Equivalents Static The device, installed per the manufacturer’s instructions, shall withstand the application of the required force. The means of force application shall be as appropriate for the individual device. Failure occurs if access to the output ports or output devices is gained.

Requirements

Level C	Level B	Level A
500 lbf (2200N)	1000lbf (4400N)	2500lbf (11000N)

6.2 Forced Separation Tests, Impact

6.2.1 Cylinder Plug Impact See 4.3.1. Attach the impact device to the plug in such a manner that an axial load is applied with a type A thread forming sheet metal screw threaded ³/₄ inch minimum into the keyway of the cylinder plug. Begin with the appropriate size screw from sizes 8, 10, or 12. Apply the force in the direction of pulling it out of its companion cylinder body or housing while the cylinder body is held firmly in a rigid steel mount using the fixture in Figure 1. Subject the test cylinder to the required impacts. If the screw pulls out, continue the test and count with the next larger size, but not larger than size 12. Failure occurs if the cylinder plug completely separates, or if the cylinder can be opened within five minutes of manipulation with screwdrivers. The specimen also passes if the test cannot be performed due to design features.

6.2.2 Electronic Cylinder Equivalents Impact The device, installed per the manufacturer’s instructions, shall withstand the application of the required force. The means of the force application attachment shall be as appropriate for the individual device. Apply the force in the direction of pulling it off while the main assembly is held firmly in a rigid steel mount using the fixture in Figure 1. Subject the specimen to the required impacts. Failure occurs if access to the output ports or output devices is gained.

Requirements

Level C	Level B	Level A
3 impacts	5 impacts	10 impacts

6.3 Cylinder Plug Torque Test

Prepare the plug face with a slot .094 in. ± 0.005 (2.4 mm ± 0.13) along the centerline of the keyway to a depth not to penetrate the first pinhole. Insert a hardened tool steel blade the width of the plug body -1/32 in. +0 (-0.8 mm +0). If this preparation is not possible, use an equivalent means to apply the torque directly to the face. The cylinder plug shall be loaded to the proof torque specified. Failure occurs if the plug rotates 45 degrees or allows access to the components to allow unlocking.

Requirements

Level C	Level B	Level A
120 lbf-in. (14 Nm)	150 lbf-in. (17 Nm)	300 lbf-in. (34 Nm)

6.4 Drill Resistance

The cylinders shall be mounted in a suitable fixture with provision for the fitting of any necessary reinforcements or protection devices supplied with the cylinder. A 600 to 800 W (input power) hand drilling machine with a speed of 700 to 900 RPM shall be mounted on a sliding block. A force of 70 lbf (300 N) shall be applied axially to the drill without shock to load the bit against the cylinder. High speed steel bits shall be used with a maximum diameter of 3/8 in. in. (10 mm). The test authority shall choose the actual diameter and the points of application to the face of the cylinder. A maximum of three bits per cylinder can be used.

Drilling shall continue for the appropriate maximum net drilling time within the total time allowed for each test, including time taken to attempt rotation of the cylinder, as follows: within the allowed total test time, it shall not be possible to rotate the lock driving element of the cylinder to the opening position by means of a suitable tool using a maximum torque of 44 lbf-in. (5 Nm). For electronic devices, failure occurs when allowing access to the output ports or output devices.

After testing, the lock driving element of the cylinders shall not rotate without the correct key, using a maximum torque of 44 lbf-in. (5 Nm). It is not necessary for the correct key to operate the cylinder after testing. The points of attack are to be determined by the tester based on tester judgment.

Requirements

Level C	Level B	Level A
Not Required	3 minute drill time 5 minute total test time	5 minute drill time 10 minute total test time

7 SURREPTITIOUS ENTRY RESISTANCE TESTS

7.1 Key Changes

This feature is intended to provide security by preventing picking, and key interchange. The theoretical mechanical key changes shall be based on the manufacturer's published information for each keyway in the system. Electrical key changes shall be based on design features demonstrating the capability. Electrified cylinders shall not accept more than 800 incorrect key changes per hour.

Requirements

Level C	Level B	Level A
Mechanical: 500000 theoretical	Mechanical: 1,000,000 theoretical	Mechanical: 10,000,000 theoretical
Electrical: 2^{26}	Electrical: 2^{64}	Electrical: 2^{128}

7.2 Mechanical Key Bitting

The maximum number of steps on the same level shall be as shown below. Only one row of movable retainers is not permitted to contain more than two adjacent steps on the same level.

Requirements

Level C	Level B	Level A
60% maximum steps; two adjacent	60% maximum steps; two adjacent	60% maximum steps; two adjacent

7.3 Mechanical Pick Resistance (parts A and B)

A. Decoding

Resistance to decoding is intended to provide protection from identifying the dimensions of the correct key by inspecting the detainers (or pins) through the keyway or other openings in the cylinder face. The manufacturer shall demonstrate that the lock provides decoding resistance with the following requirements.

Requirements

Level C	Level B	Level A
No significant variations in detainer color or shape are visible through the keyway.	Level C plus Cylinder contains components designed to limit the effectiveness of probes, shims or other manual measuring or manipulation tools.	Level B plus Cylinder contains components designed to limit the effectiveness of electronic measuring tools.

B. Pick Resistance

Resistance to picking is intended to provide protection from manipulating the detainers (or pins) through the keyway or other openings in the cylinder face. The manufacture shall demonstrate that the lock provides picking resistance with the following requirements.

Requirements

Level C	Level B	Level A
Incorporates all of the following or their equivalent: A) At least 2 pins, disks, levers, or other detainers are included that have false notches, mushroom shapes or other constructions that impede manual picking by disguising the correct opening position of the detainers. B) The contour of the key profile contacts or overlaps the center line at least twice, or all pins are not in the same row, same direction, or at the same level in the cylinder, or specially designed blocking elements are included in the cylinder to impede manual picking attempts or cylinders with more than one shear line through at least four pin chambers. C) The combined length of the detaining pins and their compressed springs in at least one position is greater than the depth in the bore for the pins, or in the case of disks, levers, or other detainers, the amount of motion on at least one detainer is less than	Incorporates all of the requirements of level C and additionally meets UL 437, paragraph 11.6 for pick resistance of door locks and locking cylinders.	Incorporates all of the requirements of level B and additionally it shall resist manual picking for 15 minutes. Cylinders submitted for picking tests shall be loaded with detaining elements utilizing the maximum ranges of sizes furnished by the manufacturer as defined in paragraph 4.5. Five cylinders shall be tested for picking, each by different ALOA registered locksmiths with at least five years experience, and the results shall be averaged for determining compliance. The pin, or detainer loading of each cylinder shall be the same. The tools used for this test shall be manual manipulation or picking tools that are commercially available to locksmiths.

that required to over lift it beyond the blocking element.		
--	--	--

7.4 Electrical Pick Resistance

Electronic lock input devices shall withstand an over-voltage attack test and an ESD attack test to the I/O conducting terminals without allowing an entry. The over-voltage and ESD attack must not cause the locking device to unlock, but unlike the ANSI/BHMA A156.25 tests, could cause the device to also fail to unlock for subsequent key operations without constituting failure of the test.

7.4.1 Over-voltage attack test

Each combination of conducting terminals within the keyway, for the purpose of interface to the key, or other sockets exposed on an installed device for interface to other external devices, shall be subjected to over-voltage test. The power supply shall be capable of 500 ma at the test voltage in the table below. The power shall be applied both positively and negatively biased to each possible pair of conducting pins. Application of the voltage to these pins shall not cause the lock to unlock at any time.

Requirements

Level C	Level B	Level A
Two times rated voltage	Four times rated voltage	115 VAC

7.4.2 ESD Attack Test

All conducting terminals within the keyway, for the purpose of interface to the key, or other sockets exposed on an installed device for interface to other external devices, shall be subjected to a direct electrostatic discharge. The ESD source shall be discharged through a 150 pico-farad capacitor (the ISO human body model) with the case ground connected to earth ground and the ESD device referenced to earth ground. Application of the voltage to these pins shall not cause the locking device to unlock at any time.

Requirements

Level C	Level B	Level A
25,000 volts	25,000 volts	25,000 volts

7.4.3 Magnet Resistance Test

Using a magnet with a rated load capacity of 150lb, manipulate the locking device with a magnet in an attempt to open the cylinder. Application of the magnet shall not allow unlocking to occur during the test.

Requirements

Level C	Level B	Level A
two minute duration	two minute duration	two minute duration

7.4.4 Conductive Liquids Resistance Test

Use a standard laboratory wash bottle filled with 8 fluid ounces of neutral salt spray solution per ASTM B 117-2011. With the lock in its normal orientation, direct the spray into any normally exposed surfaces and openings of the device in an attempt to unlock the device. Application of the solution shall not cause the locking device to unlock at any time.

Level C	Level B	Level A
15 Minutes	15 Minutes	15 Minutes

7.4.5 Rap Test

This test is to verify that the electrified output device is resistant against surreptitious entry attacks caused by hits to a mounted device to move the blocking element without the correct key. The device shall be mounted in accordance to the normal installation on a block or simulated door. The hits shall be done with a combination, as selected by the lab, of plastic, metal, or rubber hammer weighing less than one pound and shall not leave permanent marking on the surfaces hit. The manual attack shall be performed for five minutes hitting against any surface exposed on the locked side while attempting to rotate the cylinder plug at any time during the hits. For cylinders, tools, or a key with a correct mechanical code but an incorrect electronic code, shall be allowed to be inserted into the keyway to attempt rotation of the cylinder plug at any time during the hits. The torque applied to the key, knob, or lever shall be no less or greater than the tester has found to be optimum based on his experience, and shall not cause deformation of components in the assembly. The electrified device shall not allow unlocking to occur during the test.

7.5 Mechanical Security Tolerance Test

7.5.1 Using the cylinders conditioned as in 7.5.2, the cylinders shall be fitted in a metal fixture having the means for applying a known torque to a key inserted in the cylinder. Verify function using the correct key at a torque of 9 lbf- in. maximum (1.5 Nm). Next, two different attempts shall be made to operate the cylinders up to a maximum torque of 23 lbf-in. (2.6 Nm), first, by one key bitted in one position above, as offered by the manufacturer in a single chamber. Second, repeat with another key bitted likewise below. The cylinders shall not operate with other than the correct key.

7.5.2 **Conditioning** Three test cylinders shall be installed in a suitable fixture and attached to a mechanically operated device which simulates normal operation of the cylinder or a push button mechanism. A constant torque load of 3 lbf-in. (.34 Nm) shall be applied at the “cam” end, releasing the load at the key extraction position. The cycle shall consist of:

- a) Fully inserting the key into the cylinder plug keyway, and
- b) Rotating the key and cylinder plug to within 5 degrees of 180 degrees rotation, and
- c) Returning the key and cylinder plug to the home position, and
- d) Retracting the key from the cylinder plug keyway until the tip no longer touches the front tumbler, or
- e) Entering the correct code into the push button mechanism using 5 or more push buttons.

The test fixture shall operate the cylinder unit or push button mechanism at a rate of not more than 30 cycles per minute. No lubrication other than the original factory applied is allowed for the first 40,000 cycles. Lubrication is allowed at 40,000 cycles and every 40,000 thereafter.

Requirements

Level C	Level B	Level A
One cycle	40,000 cycles	100,000 cycles

8 EXPLANATION OF IDENTIFYING NUMBERS FOR SECURITY LEVELS

The first Character is the letter M signifying BHMA Section M for High Security Cylinders

The second character signifies the Grade per ANSI/BHMA A156.5, or A156.25, 0 (none), 1, 2 or 3.

The third character signifies the Key Control Level Category A, B, or C.

The fourth character signifies the Destructive Test Level Category A, B, or C.

The fifth character signifies the Surreptitious Entry Resistance Level Category A, B, or C.

To declare level “A”, all features within the category must achieve level “A”. To declare level “B”, all features within the category must achieve at least a “B”; similar for Category “C”.

The minimum listing requires at least a “C” in each category.

The Suffix E (electrical) or M (mechanical) is applied to denote the type of cylinder.

EXAMPLE: M1ACAE is a grade 1 electrical cylinder meeting levels A, C, and A respectively.

APPENDIX (NOT PART OF A156.30)

A-1 CONFORMANCE CRITERIA

Certification that products offered meet the requirements of this Standard and conform to individual manufacturer's drawings, specifications, standards and quality assurance practices are available and in some circumstances are required. Buyer requirements determine the need for proof of conformance such as first article inspection, test laboratory reports, or listings. Specifiers requiring assertions of conformance utilize statements of conformance by individual manufacturers, or test reports acceptable to the buyer.

A-2 PRESERVATION, PACKAGING AND PACKING

Unless other arrangements between buyer and seller are made, preservation, packaging and packing shall be sufficient to protect containers and their contents under normal shipping and handling conditions from the source of supply to the destination point.

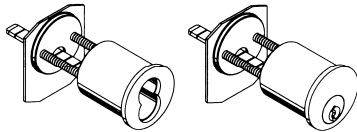
A-3 CYLINDERS AND INPUT DEVICES (From ANSI/BHMA 156.5)



Mortise Cylinder. Threaded cylinder. Regularly supplied with a cam. Consult manufacturers' catalogs for cylinder lengths and for cams and rings. The cylinder thread shall be 1.150 in.-32 NS-2A.

Mortise IC Housing E09251 E09252 E09253

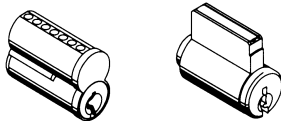
Mortise Cylinder E09211 E09211A E09212 E09213



Rim Cylinder. Has back plate with two attaching screws. Has flat type vertical or horizontal tail piece and raised trim ring. Consult manufacturers' catalogs for other tail pieces

Rim IC Housing E09261 E09262 E09263

Rim Cylinder E09221 E09221A E09222 E09223

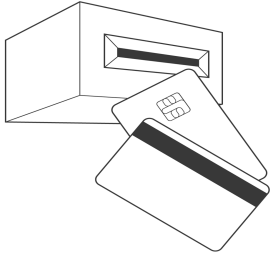


Cylinder and Interchangeable Core Cylinders. For tail pieces to suit locks consult manufacturers' catalogs.

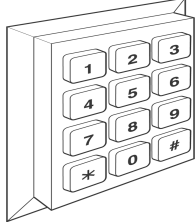
Interchangeable

Core (IC) Cylinder E09241 E09241A E09242 E09243

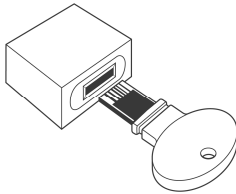
Cylinder E09231 E09231A E09232 E09233



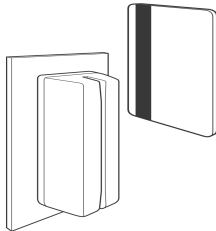
**Digital Input Stations
Insertion Card Reader**



Keypad



Electronic Key Reader



Swipe Card Reader

A-4 Many definitions were taken with permission from The Professional Glossary of Terms Relating to Cylinders, Keys and Master Keying, copyright 1982 – 1998 by the Lock Industry Standards and Training (LIST) Council and the ALOA Sponsored National Task Group for Certified Training Programs.

A-5 AUDIT TRAIL IN ELECTRONIC CYLINDERS

Electronic Cylinders are available with memory that will maintain an audit trail of the credentials that are presented to the cylinder. The object of the audit trail is to provide records of the cylinder's activity that can be evaluated after a problem has been discovered. The quantity and length of time that the records are preserved is the most important factor to consider when evaluating a cylinder's audit trail feature. It is possible that a thief's actions will not be discovered immediately, it might take several days until the incident is noticed, and the audit trail is reviewed. If the quantity of records stored in the audit is less than the number of people who have entered the area since the incident, then the records might not contain any useful data. Most cylinder manufacturers describe the cylinder's audit trail in terms of number of records that the cylinder will store; the higher the number, the more records that the cylinder memory will maintain. There are also many other methods manufacturers use to preserve valid audit data. For example some locks ignore multiple entries of the same credential, some locks only record valid openings, and some locks stop functioning when the audit trail buffer is

full, thus requiring the data to be downloaded before the lock will accept another credential. It is important for a lock purchaser to verify that the lock memory is capable of recording and holding sufficient records to provide audit trail capability for a particular time interval, for example 24 hours, one week or one month, based on their expected usage of the cylinder. Products with mechanical key override may also record use of mechanical key.

FIGURE 1 IMPACT TEST FIXTURE

