



## **STANDARD SERIES**

### **GLI-29:**

# **Card Shufflers and Dealer Shoes**

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## **ABOUT THIS STANDARD**

This Standard has been produced by **Gaming Laboratories International, LLC** for the purpose of providing independent certifications to suppliers under this Standard and complies with the requirements set forth herein.

A supplier should submit equipment with a request that it be certified in accordance with this Standard. Upon certification, Gaming Laboratories International, LLC will provide a certificate of compliance evidencing the certification to this Standard.

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# CHAPTER 1

## 1.0 STANDARD OVERVIEW

### 1.1 Purpose

**1.1.1 General Statement.** Gaming Laboratories International, LLC (GLI) has been testing gaming equipment since 1989. Over the years, we have developed numerous standards for jurisdictions all over the world. In recent years, many jurisdictions have opted to ask for technical standards without creating their own standards. In addition, with technology changing almost monthly, new technology is not being incorporated quickly enough into existing standards due to the long process of administrative rulemaking. This document, *GLI Standard 29*, will set forth the technical Standards for Card Shufflers and Card Shoes.

This standard and all others may be obtained by downloading it from our website at [www.gaminglabs.com](http://www.gaminglabs.com) or by writing to us at:

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### 1.2 Acknowledgment of Other Standards Reviewed

**1.2.1 General Statement.** These Standards have been developed by reviewing and using portions of the documents from the organizations listed below. We acknowledge the regulators who have assembled these documents and thank them:

- a) The Singapore Casino Regulatory Authority;
- b) The Manitoba Gaming Control Commission;
- c) The Pennsylvania Gaming Control Board;
- d) The New Jersey Division of Gaming Enforcement;
- e) The Colorado Division of Gaming;
- f) The Arizona Department of Gaming;

## 1.3 Purpose of Technical Standards

**1.3.1 General Statement.** The Purpose of this Technical Standard is as follows:

- a) To eliminate subjective criteria in analyzing and certifying Card Shufflers and Dealer Shoes.
- b) To establish the minimum integrity standards for card shufflers and card shoes that are technology neutral.
- c) To only test those criteria that impact the credibility and integrity of Card Shufflers and Dealer Shoes from both the revenue collection and player's play point of view.
- d) To create a standard that will ensure that the card shufflers and dealer shoes are fair, secure, and able to be audited and operated correctly.
- e) To distinguish between local public policy and laboratory criteria. At GLI, we believe that it is up to each local jurisdiction to set their own public policy with respect to gaming.
- f) To recognize that non-gaming testing (such as electrical testing) should not be incorporated into this standard but left to appropriate test laboratories that specialize in that type of testing.
- g) Except where specifically identified in the standard, testing is not directed at health or safety matters. These matters are the responsibility of the manufacturer, purchaser, and operator of the equipment.
- h) To construct a standard that can be easily changed or modified to allow for new technology.
- i) To construct a standard that does not specify any particular method or algorithm. The intent is to allow a wide range of methods to be used to conform to the standards, while at the same time, to encourage new methods to be developed.

**1.3.2 No Limitation of Technology.** One should be cautioned that this document should not be read in such a way that limits the use of future technology. The document should not be interpreted that if the technology is not mentioned, then it is not allowed. Quite to the contrary, as new technology is developed, we will review this standard, make changes and incorporate new minimum standards for the new technology.



## 1.4 Other Documents That May Apply

**1.4.1 Other Standards.** The following other GLI standards may apply, depending on the features of the Card Shufflers and Dealer Shoes and references throughout this document. All GLI standards are available on our website at [www.gaminglabs.com](http://www.gaminglabs.com):

- a) GLI-11 Gaming Devices in Casinos;
- b) GLI-24 Electronic Table Games Systems
- c) GLI-25 Dealer Controlled Electronic Table Systems

## 1.5 Card Shuffler and Card Shoe Terminology – Definitions

### 1.5.1 Definitions.

- a) Card Shuffler. A device that is designed, at a minimum, to have the capability to randomly rearrange a deck or decks of playing cards to eradicate any patterns introduced to the playing cards upon initial use or by prior game play.
- b) Shuffle. A procedure used to randomize a deck of playing cards to provide an element of chance in card games.
- c) Card Shoe or Dealer Shoe. A device used to hold playing cards for distribution by a dealer to each player of a card game.
- d) Program Storage Device. The media or an electronic device that contains the critical control program components.
- e) Role Based Access Control. Software control which allows different levels of access depending on the person accessing the device. For example, a dealer may only be able to access game history where a pit boss may be able to also access the device's configuration menus.

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# CHAPTER 2

## 2.0 SOFTWARE REQUIREMENTS

### 2.1 Random Number Generator (RNG) Requirements

**2.1.1 *Random Number Generator Requirements.*** The RNG and the physical mechanics of the shuffling device will mutually result in the production of random card outcomes. The results of multiple random card outcomes will be evaluated. The outcome shall:

- a) Be statistically independent;
- b) Conform to the desired random distribution;
- c) Pass various recognized statistical tests; and
- d) Be unpredictable.

**2.1.2 *Applied Tests.*** The test laboratory may employ the use of various recognized tests to determine whether or not the random values produced by the random number generator pass the desired confidence level of 99%. These tests may include, but are not limited to:

- a) Chi-square test;
- b) Overlaps test;
- c) Poker test;
- d) Coupon collector's test;
- e) Permutation test;
- f) Adjacency criterion tests;
- g) Runs tests (patterns of occurrences should not be recurrent);
- h) Interplay correlation test;
- i) Serial correlation test potency and degree of serial correlation (outcomes should be independent of the previous game).

**2.1.3 *Background RNG Activity Requirement.*** The RNG shall be cycled continuously in the background between shuffles at a speed that cannot be timed by the player.

**2.1.4 RNG Seeding.** The first seed shall be randomly determined by an uncontrolled event. After every game there shall be a random change in the RNG process (new seed, random timer, delay, etc.). This will verify the RNG doesn't start at the same value, every time. Alternatively, it is permissible not to use a random seed; however, the manufacturer must ensure that shuffles will not synchronize. The test laboratory shall approve any alternative method utilized.

**2.1.5 Scaling Algorithms.**

- a) If a random number with a range shorter than that provided by the RNG is required for some purpose within the device, the method of scaling, (i.e., converting the number to the lower range), is to be designed in such a way that all numbers within the lower range are equally probable.
- b) If a particular random number selected is outside the range of equal distribution of scaling values, it is permissible to discard that random number and select the next in sequence for the purpose of scaling.

## **2.2 Non-Volatile (NV) Memory Requirements**

**2.2.1 General Statement.** NV memory is used to store all data that is considered vital to the continued operation of the gaming device. The contents of NV memory may include, but is not limited to shuffling device configuration data (i.e. number of decks being used, different shuffle methods, etc.) and game configuration data (i.e. the type of game – Poker, Blackjack, etc. being played and any variant of the game – Draw Poker, Stud Poker, etc.).

**2.2.2 Maintenance.** NV memory storage shall be maintained by a methodology that enables errors to be identified and corrected in most circumstances. This methodology may include, but is not limited to signatures, checksums, partial checksums, multiple copies, and effective use of validity codes.

**2.2.3 Comprehensive Checks.** Comprehensive checks of NV memory shall be made following the initiation of the shuffling process, but prior to the start of the shuffle and upon completion of the shuffle prior to the cards being used for game play. The methodology shall detect failures with an extremely high level of accuracy.

**2.2.4 Unrecoverable NV Memory.** An unrecoverable corruption of NV memory shall result in an NV memory error. Upon detection, the device shall meet the requirements as specified in section 2.7, Program Interruption & Resumption, of this standard.

**2.2.5 Non-Critical Memory Space.** NV memory space that is not critical to the gaming device's security is not required to be validated.

## **2.3 Program Storage Device (PSD) Requirements**

**2.3.1 General Statement.** All program storage devices shall:

- a) Be secured behind a fully closed door, panel, or compartment so that it is not openly accessible and shall meet the requirements as specified in section 2.8, Cover/Lid Open/Close, of this standard.
- b) Contain sufficient information to identify the software and revision level of the information stored on the device, which may include but is not limited to physical labels or, if applicable, electronically stored and displayed via a display screen.

*NOTE: The process used in the identification of the software and revision level will be evaluated on a case-by-case basis.*

- c) Contain information to allow the device to validate the contents of the program storage device upon:
  - i. Power up after initial installation; and
  - ii. Processor reset.

**2.3.2 Non-Critical PSD Space.** PSD space that is not critical to the gaming device's security is not required to be validated.

## **2.4 Control Program Requirements**

**2.4.1 General Statement.** Each device shall contain a proven and robust mechanism which has the capability to internally authenticate the program files prior to use or loading. The control program shall ensure the integrity of all controlled program components during execution of said components. Control programs shall test themselves for possible corruption due to failure of the program storage media.

**2.4.2 Authentication Method.** It is recommended that the device utilize an integrity check method with a secured hashing algorithm of at least 128 bits (i.e. MD5). However, Cyclic Redundancy Check (CRC) calculations must be used at a minimum (at least 16 bit). The test laboratory shall approve any other methodologies implemented.

**2.4.3 Authentication Mismatch.** If unexpected data or inconsistencies are found, the device shall meet the requirements as specified in section 2.6, Error Conditions, of this standard.

**2.4.4 Independent Control Program Verification.** The device shall have the ability to allow for an independent integrity check of the device's software from an outside source and is required for all control programs that may affect the integrity of the device. This must be accomplished by being authenticated by a third-party device, which may be embedded within the shuffler software (see NOTE below), by having an interface port for a third-party device to authenticate the media, or by allowing for removal of the media such that it can be verified externally. This integrity check will provide a means for field verification of the software to identify and validate the program. The test laboratory, prior to device approval, shall approve the integrity check method.

*NOTE: If the authentication program is contained within the device software, the manufacturer must receive written approval from the test laboratory prior to submission.*

## **2.5 Communications Protocol**

**2.5.1 General Statement.** For devices that are required to communicate with another system (e.g. prior game result display device, electronic card table, etc.), the device must accurately function as indicated by the communication protocol that is implemented.

**2.5.2 Display of Game Results.** For devices that have the capability to communicate results of the game with another device or system (e.g. prior game result display device, electronic card table, etc), it shall do so with a very high degree of accuracy.

*NOTE: If any inaccuracy occurs, a dealer override feature may be permissible to correct the inaccuracy. If the device does not support a dealer override feature, then the device must meet the requirements as specified in section 2.6, Error Conditions, of this standard.*

*NOTE: Please refer to GLI-24 – Electronic Table Game Systems, and GLI-25 - Dealer Controlled Electronic Table Systems for additional regulations, as applicable.*

**2.5.3 Protection of Sensitive Information.** The device must not allow any information contained in communication to or from another system that is intended by the communication protocol to be protected, or which is of a sensitive nature, to be viewable through any display mechanism supported by the device. This includes, but is not limited to validation information, secure PINs, credentials, or secure seeds and keys.

## **2.6 Error Conditions**

**2.6.1 General Statement.** Shuffling devices shall be capable of detecting error conditions which shall cause the device to lock up and there shall be an appropriate indicator (e.g. audible alarm or light) to notify the operator. If a display screen is present, a message describing the type of error shall be displayed.

## **2.7 Program Interruption & Resumption**

**2.7.1 Interruption.** After a program interruption (e.g., processor reset, or any error condition), the shuffling device shall enter a lock-up condition and the shuffle or deal shall be nullified. Upon detection, the device shall meet the requirements as specified in section 2.6, Error Conditions, of this standard.

**2.7.2 Restoring Power.** If the shuffling device is powered down while in an error condition, then upon restoring power, the specific error message shall still be displayed and the gaming device shall remain locked-up. This is unless power down is used as part of the error reset procedure, or if on power up or cover/lid closure, the gaming device checks for the error condition and detects that the error is no longer in existence.

**2.7.3 Simultaneous Inputs.** The program shall not be adversely affected by the simultaneous or sequential activation of the various inputs and outputs, which might, whether intentionally or not, cause malfunctions or invalid results.

**2.7.4 Resumption.** Upon program resumption, the device shall meet the requirements as specified in section 2.4, Control Program Requirements, of this standard.

## **2.8 Cover/Lid Open/Close**

**2.8.1 Cover/Lid Open Procedures.** There shall be mechanisms in place to detect the opening of the cover, lid, or access to any other critical portion of the shuffling device which may affect the integrity and the security of the unit. Upon detection, the device shall meet the requirements as specified in section 2.6, Error Conditions, of this standard. Critical portions of the shuffling device include, but are not limited to, areas that contain:

- a) The program storage media; and
- b) The cards after the shuffling process has been initialized.

## **2.9 Levels of Certification**

**2.9.1 General Statement.** All devices must pass the requirements set forth as specified in sections 2.1 through 2.8. In addition, each shuffling device must meet the requirements under, at least, one (1) of the sections as specified below. A shuffling device may qualify as being compliant with multiple levels of certification if it meets the requirements of more than one (1) of the sections as specified below.

**2.9.2 Type 3 Certification.** The shuffling device must pass Section 2.1.2, Applied Tests, where the statistical tests applied shall consider each card uniquely even though they may be considered indistinguishable to the player (i.e. each card will be treated as a unique card).

*NOTE: Due to the inherent mechanical limitations of shuffling devices, if the submission components do not meet the requirements set forth in this section, the requirements for Type 2 Certification, below, will be applied, if allowed by the rules of the intended game(s) with which the device will be used.*



**2.9.3 Type 2 Certification.** The shuffling device must pass Section 2.1.2, Applied Tests, where the statistical tests applied shall consider cards that are imperceptible to the player as indistinguishable (i.e. each card does not need to be treated as a unique card). For example, when shuffling eight standard 52-card decks, the ace of spades from the first deck is indistinguishable from the ace of spades from any of the other seven decks.

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# CHAPTER 3

## 3.0 *DEVICE REQUIREMENTS*

### 3.1 **Hardware Requirements**

**3.1.1 Device Identification.** Each electronic shuffling device or card shoe shall bear, at minimum, the following information:

- a) The name of manufacturer;
- b) A unique serial number;
- c) The model number; and
- d) The date of manufacture.

**3.1.2 Electro-Static Interference.** Protection against static discharges requires that the electronic shuffler or card shoe device's conductive housing be earthed in such a way that static discharge energy shall not permanently damage, or permanently inhibit the normal operation of the electronics or other components within the device. The devices may exhibit temporary disruption when subjected to a significant electro-static discharge greater than human body discharge, but they shall exhibit a capacity to recover and complete any interrupted play without loss or corruption of any control or critical data information associated with the device. The tests will be conducted with a severity level of a maximum of 27KV air discharge.

**3.1.3 Machine Safety.** Electrical and mechanical parts and design principals of the device may not subject a person to any physical hazards. The gaming test laboratory shall not make any finding with regard to Safety and Electromagnetic Compatibility (EMC) testing, as that is the responsibility of the manufacturer of the goods or those that purchase the goods. Such Safety and EMC testing may be required under separate statute, regulation, law, or Act and should be researched accordingly, by those parties who manufacture or purchase said devices. The Gaming Test Laboratory shall not test for, be liable for, nor make a finding relating to these matters.

## 3.2 Device Functionality

**3.2.1 Card Shuffler Functionality.** Card shufflers must be designed so that:

- a) They can completely eradicate any pattern(s) introduced to the playing cards before being placed into the shuffler that would affect the outcome of the next game.
- b) Their operation cannot be interfered with or interrupted, other than by turning off the power, without being detected.
- c) During normal operation, the card shuffler must have the ability to dispense playing cards and not leave any marks, scuffs or abrasions, or cause any damage to the cards making any of the cards identifiable to the player.
- d) The card shuffler may not provide any real time information, for the current game being played, that can be used to aid in the:
  - i. Projection of the outcome of a game;
  - ii. Tracking of the cards played and cards remaining to be played;
  - iii. Analyzing the probability of the occurrence of an event relating to a game; or
  - iv. Analyzing the strategy for playing or betting to be used in a game.
- e) The card shuffler may utilize ancillary devices to assist in meeting the requirements in section 3.2.1 of this standard. Ancillary devices shall have no effect on the outcome of the shuffle or on the outcome of the cards being dealt.

*NOTE: Ancillary devices shall perform according to the manufacturer's design and operating specifications.*

**3.2.2 Shoe Functionality.** The requirements set forth in this section pertain to the specific portion of the device which is used for collecting cards to be distributed by a dealer to the players of the game. Shoes are devices that are designed and constructed to maintain the integrity of the game. There shall be mechanisms and controls in place to prevent the tampering of any card loaded into the card shoe. Card shoes, if supported, must be designed to:

- a) Facilitate the dealing of cards without revealing their face value.
- b) Have a cover that serves to obscure the back of the cards in the shoe.

*NOTE: The back of the cards do not need to be completely obscured, but may be exposed to the extent necessary to permit the cards to be dealt from the shoe.*

- c) Shall not leave any marking(s) on the cards that may assist, help or otherwise allow any person to predict or project the outcome of a game.
- d) Shall not contain any hidden compartments.

**3.2.3 Card Recognition.** If card recognition software is used, it shall:

- a) Ensure a very high degree of accuracy in identifying the value and suit of the card.
- b) Not provide any information that may be used to compromise the cards contained in the current shuffle or dealing shoe.
- c) Not interfere with or modify the device's behavior beyond what functionality is associated with that software.
- d) If supported, have Role Based Access Control to restrict access to the history of game(s) played.

**3.2.4 Card Count.** If card count technology is used, the card shuffler must provide an accurate count.

*NOTE: Card count in this section refers to the number of cards, not the technique or strategy known as 'card counting' utilized during card games, such as Blackjack.*

**3.2.5 Hand Formation.** If cards dealt technology is used, then the device shall:

- a) Ensure all hands dealt meet section 2.1 Random Number Generator Requirements of this standard; and
- b) Ensure the correct number of playing cards per hand with a very high degree of accuracy to ensure that extra cards are not dealt to players.

**3.2.6 Game History.** If the device is capable of displaying the history of the game results, it shall do so with 100% accuracy.

*NOTE: Voided rounds, due to any machine malfunction, are not required to be included in the game history.*

**3.2.7 Multi-Game.** If the device is capable of shuffling or dealing more than one type of game, the device shall give an indication (i.e. if capable, display the game and variant on the display screen, sequence of lights, etc.) to the current game being shuffled or dealt.