



澳門特別行政區政府
Governo da Região Administrativa Especial de Macau
博彩監察協調局
Direcção de Inspecção e Coordenação de Jogos



DIRECÇÃO DE INSPECÇÃO E COORDENAÇÃO DE JOGOS
"DICJ"
(Macau)

EGM TECHNICAL STANDARDS
VERSION 1.1

With effect from 01, July, 2014



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EXECUTIVE SUMMARY

This document describes DICJ's minimum technical requirements for Electronic Gaming Machines for operation in Macau Casinos.

This standard covers requirements for Electronic Gaming Machines only and does not cover technical requirements for Multi Terminal Gaming Machines and Server Based/Supported Gaming Machines.

This Standard should be read together with Section B of Macau's Minimum Internal Control Requirements.

DICJ accepts no responsibility whatever for errors or omissions within this Standard. In particular, it accepts no responsibility for actual or consequential loss which may be claimed by any person to be attributable to compliance with the Standard, whether such loss is due to negligence on its part, or not. Electronic gaming machine manufacturers and approved testing laboratories may seek clarification of any matter contained within the Standard, but any such clarification shall be provided by DICJ in writing, and shall be subject to the same limitation of liability.

Software change which **materially alters** the operation, fairness, security, reliability or auditability of the affected machine or game, especially game changes must comply with the requirements specified in this Standard. While DICJ will consider any submission made by an authorized EGM manufacturer regarding the nature of a software change, it will make a binding determination as to whether the software change constitutes a material alteration.

To the extent any inconsistency exists between this Standard and a law, regulation, dispatch, executive order or binding Instruction concerning gaming machines ("other law"), which may be operative in Macau before, or after, the commencement date of this Standard(as prescribed in the accompanying DICJ Instruction), the relevant provisions of the other law will prevail.



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1 INTRODUCTION

1.1 Purpose

This document describes DICJ's minimum technical requirements for Electronic Gaming Machines. This standard should be read in conjunction with Macau legislative requirements.

1.2 Objectives

The intent of this document is to specify sufficient requirements and controls to ensure that gaming on Electronic Gaming Machines occurs in a manner that is:

1. Fair;
2. Secure;
3. Reliable;
4. Auditable.

It is not the intent of this document to unreasonably:

5. Mandate a single solution or method of realizing an objective;
6. Limit technology application to gaming equipment;
7. Limit creativity or variety of choice;
8. Limit marketability;
9. Advantage any supplier or manufacturer of equipment; or
10. Preclude research and development into new technology, equipment or innovative solutions.

Hence, this document specifies what the minimum technical requirements for Electronic Gaming Machines are instead of how the requirements should be met and is not intended to mandate a particular solution or method as the means to realize the requirement.

The DICJ is the regulatory authority that supervises and regulates the activities of casinos in Macau. Concessionaires are required to be licensed by law and their gaming machines deployed on the casino floor shall comply with the technical requirements stated in this document before they can be lawfully operated in the Macau jurisdiction.

1.3 Certification

Certification of gaming machines and devices submitted for approval by DICJ must be undertaken by approved testing laboratories which shall be required to determine compliance with the technical requirements provided in these technical standards. Scope of any non-compliance shall be reported in the certification report. A copy of all certification reports must be lodged with DICJ at the time of application for Approval.

1.4 Regularity of Interpretation

DICJ acknowledges that the technical standards may be subject to different interpretations by gaming machine manufacturers, gaming operators and, testing laboratories. Thus, any comment where different interpretations may be applied to these technical standards should be referred to DICJ for clarification.



2 HARDWARE

2.1 Objective

This section describes the physical features of a gaming machine, its components and its inner functions. The goal is to provide Macau specific standards for gaming manufacturers to ensure that all conforming electronic gaming platforms can be operated in a reliable, honest, secure and, auditable manner.

2.2 Cabinet Identification

An Electronic Gaming Machine shall have an identification badge that is permanently affixed to the exterior of the cabinet by the manufacturer and shall include the following information:

1. The name of the manufacturer;
2. A unique serial number;
3. The gaming machine model number/name; and
4. The date of manufacture.

The identification plates must be reasonably resistant to scratching, to prevent them being defaced or fraudulently altered.

2.3 Cabinet Security

2.3.1 Locked Areas

1. The entirety of an Electronic Gaming Machine which does not form part of the player's input interface (e.g. buttons) must be stored within one or more locked areas of the Electronic Gaming Machine.
2. All locked areas must be equipped with access detection devices / switches, to detect access to all locked areas.
3. It must not be possible to disable a door open sensor without first opening the door using the designed manner (e.g. key) or leaving physical evidence of forced entry.
4. It must not be possible to reset the door open state by software means, if the door open sensor indicates that the door is still open.

2.3.2 Program or Logic area

The program or logic area is a locked compartment area (with its own independently locked door), within the cabinet, that houses electronic components that have the potential to significantly influence the operation of the Electronic Gaming Machine. There may be more than one (1) such logic area in an Electronic Gaming Machine.

Provision must be made for a physical seal on the logic area door which must be broken on entrance or removal of the logic area.

2.4 Electrical - Cabinet Wiring

1. The Electronic Gaming Machine shall be designed so that power and data cables into and out of the Electronic Gaming Machine can be routed so that they are not accessible to the general public.
2. Security related wires and cables that are routed into a logic area must not be able to be removed without unlocking the logic area door.



2.5 Tower Light (Candle)

Where practicable, the gaming machine shall have a light visibly located on top of its cabinet. The light shall automatically illuminate whenever

1. A player has won an amount, or is redeeming credits, that the machine cannot itself pay;
2. An error situation has occurred (including “door open”); or
3. A “call attendant” situation has been triggered by the player.

If it is impracticable, due to the design of a machine, to locate a light on top of its cabinet (e.g. “bar-top” style machines), the requirement may be satisfied either by an audible alarm, or by a machine (paging) communication system, which communicates real time machine event alerts directly to a floor attendant. This requirement is additional to that contained in clause 2.13 below.

2.6 Interference

All electrical testing of Electronic Gaming Machines is to be conducted while the devices are fully operational and installed as they would be in the venue. This kind of electrical testing of an EGM may be conducted by appropriate test labs, such as UL or CE.

2.6.1 Electromagnetic Radiated Emissions

The Electronic Gaming Machine shall comply with the CISPR 22 Class A or equivalent specifications.

2.6.2 Electrostatic Discharge (ESD)

1. Gaming machines shall exhibit total immunity to human body model electrostatic discharges on all areas exposed to player contact. The tests shall be conducted according to IEC 61000-4-2 with a severity level of $\pm 7.5\text{kV}$ contact discharge.
2. Gaming machines may exhibit temporary disruption when subjected to a more significant electro-static discharge, but they shall recover and complete any interrupted play without loss or corruption of any control or data information associated with the gaming machine. The tests shall be conducted according to IEC 61000-4-2 with a severity level of $\pm 20\text{kV}$ air discharge.

2.6.3 Radio Frequency Interference (RFI)

Gaming machines shall not be affected in any way by the application of RFI at a frequency range from 27MHz to 1000 MHz with a field strength of 3 volts per meter.

2.6.4 Electrical safety

The Electronic Gaming Machine shall comply with the IEC 60335-2-82 or equivalent specifications.

2.7 Environmental

Electronic Gaming Machines can be expected to operate in a variety of extreme environments. The manufacturer shall specify the environmental conditions under which the Electronic Gaming Machine will operate within full specification.

1. Performance of Electronic Gaming Machines shall not degrade while operating within manufacturer's specified range of environmental parameters.
2. In the event that the operating conditions exceed the environmental parameters specified by the manufacturer, and the Electronic Gaming Machine is incapable of continued operation, it shall perform an orderly shutdown without loss of current status, accounting and security event data.
3. Electronic Gaming Machines shall be robust enough to withstand destructive power by human being (a man without destructive tool).



2.8 Power Supplies

1. Electronic Gaming Machines must operate from electric mains power of nominally 220V 50Hz.
2. Electronic Gaming Machines shall comply with the requirements of IEC 61000-3-2 class D for harmonic currents when operated at nominal mains voltage.
3. Electronic Gaming Machines shall be unaffected by Electrical Fast Transients as defined by IEC 61000-4-4. Criteria shall be 2.5kV both polarities, each conductor, 5ns rise, 50ns duration, 5kHz, one minute.
4. Electronic Gaming Machines shall be unaffected by continuous operation when supplied with mains electric power that deviates from the nominal voltage by $\pm 10\%$.
5. Electronic Gaming Machines shall either be unaffected by or shall recover from:
 - a. A surges or dip of $\pm 20\%$ of the supply voltage that lasts for 600 seconds;
 - b. Voltage dips and interruptions as defined in IEC 61000-4-11, 30% dip 500ms;
 - c. Electrical surge as defined in IEC 61000-4-5 2kV line to line and 2kV line to earth;
 - d. Repeated switching on and off of the AC power supply; and
 - e. Jiggling the AC cord at the wall outlet.

In each case, it shall be acceptable for the equipment to reset provided no damage to the equipment or loss or corruption of data is experienced.

2.9 Liquid Spills

Liquid spills applied to the outside of an Electronic Gaming Machine must not affect the normal operation of the machine, or affect the integrity of the material or information stored inside the cabinet (or affect the safety of the patrons operating the equipment). It is recognized that as a result of a liquid spill some peripheral components such as touch screen, coin validator, button, button panels and, bill validator may lose normal operation until the surface dries or the component replacement.

2.10 Circuit Boards

1. Each Printed Circuit Board (PCB) in an Electronic Gaming Machine shall be identifiable by a name (or number) and revision level that is permanently displayed on the board.
2. The circuit board assemblies, used in gaming machines, shall conform functionally to the documentation of the PCBs that were submitted to the recognized testing laboratory.
3. All patch wires and track cuts shall be documented in the relevant service manual and submitted to the recognized testing laboratory.
4. All switches and jumpers shall be fully documented for evaluation by an approved testing laboratory.
5. Switches or jumpers that have the potential to affect the security, integrity or the game result (e.g. percent return) of the gaming machine shall not be permitted.

2.11 Critical Memory

2.11.1 Maintenance of Critical Memory

1. All critical data must be stored using a fault tolerant methodology that enables errors to be identified and corrected in most circumstances;
2. Critical memory data storage shall be capable of reliably preserving its memory contents for at least thirty (30) days with the mains power switched off. A rechargeable or non- rechargeable backup power source may be used to meet this requirement;



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3. A proven and reliable mechanism shall be implemented to check for any corruption of critical memory locations used for crucial gaming machine functions.

2.11.2 Contents of Critical Memory

Critical memory shall maintain all data that is considered vital to the continued operation of an Electronic Gaming Machine. This includes, but is not limited to:

1. All soft meters required in section 3.5 including last bill data, last voucher In and voucher Out data;
2. Information pertaining to the play and final outcome of the most recent game & the last nine games prior to the most recent game;
3. Last drawn random number generator outcome;
4. Credits available for play; and
5. The last software state of the Electronic Gaming Machine before interruption.

2.11.3 Detection of Corrupted Memory

1. Comprehensive checks of the relevant contents of the Electronic Gaming Machine's critical memory shall be undertaken at least after:
 - a. Every restart of the device; and
 - b. When the main or logic door is closed;
2. After an Electronic Gaming Machine restart (e.g. power off and on), the device must complete its validity check of the entire critical memory storage area and then perform a comparison check of all good logical copies of critical memory.
3. Any failure of a validity check is to be considered either:
 - a. A recoverable memory corruption if at least one copy of critical memory is established to be good, or
 - b. An unrecoverable memory corruption.

2.11.4 Writeable Disc

Writeable disc may be used for storage of critical memory provided that the following requirements are met.

1. Critical memory stored on a disc must be recoverable after any form of restart of the Electronic Gaming Machine.
2. The critical memory files are to be protected against accidental or malicious access / damage by threads / programs outside the critical memory maintenance software.
3. Suitable hash values or other such means must be used to enable corrupted disc files to be identified.

2.11.5 RAM Reset

1. Following the initiation of a RAM reset procedure utilizing a recognized RAM Clear method, the game program shall execute a routine, which initializes each and every bit in critical memory to the default state. For games that allow for partial RAM clears, the methodology in doing so must be accurate and the game must validate the un-cleared portions of critical memory.
2. Clearing non-volatile memory shall only be able to be undertaken by accessing the logic area in which it is housed.

2.11.6 Program Storage Media

1. All removable program storage media, including but not limited to ROM, EPROM, FLASH ROM, CD-ROM and, DVD shall be clearly marked with sufficient information to identify the software and revision level of the information stored in the devices.



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2. All removable program storage media shall maintain an internal hash / signature of the contents of the media, using a secured hashing method such as SHA1. This value shall be stored on the storage media. Verification of the contents of the entire program storage media is to be performed after every restart and, if the verification fails, the equipment must enter a “fatal error” state.
3. All EPROMs (and Programmable Logic Devices (PLDs) that have erasure windows) shall be fitted with covers over their erasure windows.
4. Employ a mechanism which tests unused or unallocated areas of the alterable media for unintended programs or data and tests the structure of the media for integrity. The mechanism must prevent further play of the gaming device if unexpected data or structural inconsistencies are found.
5. A CD, DVD or Blue-ray devices shall not be used as a re-writeable disc.
6. When the CD-ROM, DVD-ROM or Blue-ray device is created, the write cycle must be “finished” such that it is not possible to write any further data to the CD.
7. Writeable program storage, such as hard disc or flash disc may be used provided that it:
 - a. Employs a mechanism which verifies that all control program components, including data and graphic information, are authentic copies of the approved components. The verification mechanism must have an error rate of less than 1 in 10 to the 38th power and must prevent the execution of any control program component if any component is determined to be invalid. Any program component of the verification or initialization mechanism must originate from a secure location that must be capable of being authenticated using commercially available tools.
 - b. Employs an integrity check method to verify that there are no additional or missing program(s) or fixed data records/files on the storage device. The mechanism must prevent further play of the gaming device if unexpected data or structural inconsistencies are found.

2.12 Information Displays

1. The default reel position after a RAM reset shall not be the top award on any selectable line.
2. Electromechanically controlled display devices such as spinning reels shall have a sufficiently closed loop of control so as to enable the software to detect a malfunction, or an attempt to interfere with the correct operation of that device. This requirement is to ensure that if a reel is not in the position it is supposed to be in, an error condition shall be generated and the device shall become inoperable.
3. Reel assemblies must have a clearly identifiable reference point at which the start of the strip symbol artwork is located.

2.13 Audible Alarm

1. A suitable audible alarm in the Electronic Gaming Machine shall be provided for effectively signaling any of the error or security features required by this standard.
2. There may be a method whereby legal access can be made into the internal area of the Electronic Gaming Machine (by authorized personnel via an audit mode or other accountable method) where the audible alarm is not activated.
3. A technique may be provided to enable authorized personnel to adjust the volume level (without the need to enter the logic area). However the adjustment of the volume shall not allow the alarm output to be below a threshold level whereby the alarm cannot be heard with the door shut in a typical gaming environment.
4. The duration of the alarm when activated shall be at least 3 seconds.



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2.14 Printers

1. If an Electronic Gaming Machine is equipped with a printer, it must be located inside locked cabinet of the Electronic Gaming Machine.
2. A printer must have mechanisms to allow software to interpret and act upon the following conditions:
 - a. Out of paper / Paper low;
 - b. Printer jam/failure; and
 - c. Disconnected.

2.15 Bill Acceptor Devices

2.15.1 General

1. The bill input system must be constructed in a manner that protects against vandalism, abuse or fraudulent activity.
2. The acceptance device(s) must be electronically based and be configured to ensure that it only accepts valid bills of MOP/HKD plus valid coupons, paper tokens, or other approved casino script and rejects all others.
3. All accepted valid bills of legal tender plus valid coupons, paper tokens, or other approved casino script are to be deposited into the secure bill storage area (stacker).
4. All invalid or unauthorized bills are to be rejected and returned to the player.
5. Interconnecting cables from the bill acceptor device to the Electronic Gaming Machine must not be exposed external to the Electronic Gaming Machine or readily accessible to unauthorized staff.

2.15.2 Functional

1. Acceptance of bills for crediting to the credit meter shall only be possible when the Electronic Gaming Machine is enabled for play. Other states such as door open states, fault conditions and audit mode must cause the disabling of the bill acceptor system (other than in Bill Acceptor (BA) self test mode, if supported).
2. Under no circumstances shall credits be lost if bills are accepted by the Electronic Gaming Machine (Except if a power failure occurs during acceptance of a bill or other note, the bill validator shall give proper credits or return the note, notwithstanding that there may be a small window of time where power may fail and credit may not be given. In this case, the window shall be less than one (1) second).
3. The Electronic Gaming Machine shall register credits only when the bill/ticket is stacked.
4. Bill acceptors shall accept only one single currency (i.e. MOP or HKD).

2.15.3 Bill Stacker

1. The bill acceptor device shall have a 'stacker full' sensor.
2. The stacker shall be locked independently of the main cabinet and logic area.
3. The stacker must be fitted with sensors that indicate stacker door open/close or stacker removed.
4. A separate lock shall be required to remove the bills from the stacker.
5. There must be a sensor which detects and reports to the software whenever there is access to the bill door or the stacker has been removed.



2.16 Communication with Bill Acceptors

The bill acceptor device must employ a reliable, bi-directional protocol based means of communicating with the Electronic Gaming Machine. Pulse stream interface or serial communication must have error detection. A message with error must either be corrected or rejected.

2.16.1 Bill Acceptor Self Test

The bill acceptor device must perform a self test at each power up. In the event of a self test failure, the bill acceptor must automatically disable itself until the error state has been cleared.

2.16.2 Bill Acceptor Error Conditions

Each gaming device and/or bill acceptor shall have the capability of detecting and displaying the following bill acceptor error conditions:

1. Bill-in Jam;
2. Bill Acceptor Door Open;
3. Stacker Door Open or Stacker Removed.

2.17 Coin Input Systems

The coin input system must be constructed in such a way that it protects the Electronic Gaming Machine against vandalism, abuse, or fraudulent activity. The coin input system shall have the following capabilities:

1. The ability to deliver the coin to the correct area of the Electronic Gaming Machine;
2. The ability to accurately detect and account for all valid inserted coins (and it must effectively detect and reject invalid coins);
3. The ability to detect stringing (coin pullback);
4. The coin input system must be able to prevent manipulation by the insertion of foreign objects; and
5. The coin input system shall be capable of handling rapidly-fed coins or piggy backed coins.

2.18 Coin Validators

1. Acceptance of coins or tokens for crediting to the credit meter shall only be possible when the Electronic Gaming Machine is enabled for play. Other states such as door open states, fault conditions and audit mode must cause the disabling of the coin validator (other than in coin validator self test mode, if supported).
2. The coin acceptor device must be electronically based and be so designed that it accepts coins of authorized legal tender or approved tokens. It must credit the customer's credit balance by the appropriate amount for each accepted coin, and return to the coin tray all other coins.
3. In the case of coin validators which are electronically programmable to recognize a coin or token, the coin validator must be preprogrammed at the factory and it must not be capable of being reprogrammed in the field without access to the equipment used at the factory.

2.19 Coin Acceptor Error Conditions

Coin acceptors shall have a mechanism to allow software to interpret and act upon the following conditions:

1. Coin-in Jam;
2. Reverse Coin-in / Coin Yo-Yo;



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3. Diverter Fault.

2.20 Diverter

1. For games that accept coins or tokens, the software shall ensure that the diverter directs coins to the hopper or to the drop box when the hopper is full.
2. The hopper full detector must be continually monitored to determine whether a change in diverter status is required. If the state of the detector changes, the diverter shall operate as soon as possible, or within ten (10) games, after the state change, without causing a disruption of coin flow, or creating a coin jam.

2.21 Electronic Gaming Machines with Both Coin and Bill Acceptors Requirements

1. The Electronic Gaming Machine shall be able to cater for simultaneous input of bills and coins.
2. Any Electronic Gaming Machine that has both a coin and a bill acceptor shall have the security features as follows:
 - a. Access to the coin drop box is not to give access to the bill storage area.
 - b. Access to the bill storage area is not to give access to the coin drop box.

2.22 Credit Acceptance Conditions

Acceptance of any Coins, Bills or Tokens for crediting to the credit meter shall only be possible when the gaming device is enabled for play. Other states, such as error conditions, including door opens, audit mode and game play, shall cause the disabling of the credit acceptance system.

2.23 Coin Hoppers

1. Where an Electronic Gaming Machine may be operated using coins and is fitted with a coin hopper, the hopper shall be located in a suitably secured area (generally within the Electronic Gaming Machine).
2. Hoppers shall have detection devices that provide a method of enabling software to interpret and act, upon the following conditions:
 - a. Hopper full, when the hopper full condition is detected, coins are to be diverted to the drop box (this hopper full level must incorporate a physical sensor); *Note: The hopper level adjusts mechanism may be incorporated into the Electronic Gaming Machine's software in conjunction with a physical sensor which can over-ride the software counter.*
 - b. Hopper empty/ hopper jam; and
 - c. Extra coin paid/hopper runaway (one or more unintended coins exiting the hopper). *Note: When possible the manufacturer is to distinguish between the hopper runaway and the extra coin paid out condition.*
3. Hopper-less Electronic Gaming Machines must always divert coins to the drop box.

2.24 Hopper Error Conditions

The hopper shall be interfaced in such a way as to allow the gaming machine control program to monitor the hopper mechanism, in all game states, to identify at least the following conditions:

1. Hopper Jam;
2. Hopper Empty;



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3. Extra coin paid / Hopper Runaway.

2.25 Drop Boxes

1. For those upright_Electronic Gaming Machine equipped to accept coins or tokens shall contain a separate slot drop bucket or slot drop box to collect and retain all such slot coins or tokens that are diverted into the drop box.
2. The drop bucket shall be housed in a locked compartment separate from any other compartment of the gaming device.
3. An Electronic Gaming Machine must provide an input for software to detect drop box door open / close.
4. An appropriate coin chute must be provided within the Electronic Gaming Machine to deliver coins to the drop box.



3 SOFTWARE

3.1 Objective

This section describes the gaming software requirements so that the gaming software performs as anticipated and is reliable and fair to the player. It creates the minimum standards of function so that all conforming electronic gaming platforms would be reliable, honest, secure, auditable and, operate in conformance with their specifications.

3.2 Source Code Compilation

1. All source code submitted must be correct, complete and able to be compiled.
2. The resultant compiled object code must be identical to that in the storage media submitted to test laboratory for evaluation, and be verifiable with the media to be operational in sites.

3.3 Control Program Requirement

1. Gaming machine control programs (software that runs the gaming machine's functions) shall be authenticated against possible corruption caused by the failure of the program storage medium and all critical game functions during each power-up cycle. The method shall detect not less than 99.9% of all possible failures.
2. Any program component of the authentication or initialization mechanism must originate from a secure location that must be capable of being authenticated using commercially available tools.

3.4 Program Storage Media Identification

All discrete program storage media (e.g. Flash, CD-ROM) must be uniquely identified, displaying:

1. Game name (and/shell name, if applicable);
2. Manufacturer;
3. Version number;
4. Type and size of media (where applicable); and
5. Location in Electronic Gaming Machine (if critical, e.g. socket position U3 on PCB).

3.5 Soft Meters

3.5.1 Master Meters

1. All Electronic Gaming Machines shall be equipped with soft meters (electronic digital storage meters) of at least 10 digits capable of recording and displaying the required information listed in this section where applicable to the gaming machines.
2. All soft meters shall be updated upon the occurrence of the particular event the meter is monitoring. All meters shall be added to except for coin handling meters (i.e. Coin In and Coin Out meters) which may be added to or incremented if preferred. The term "added to" provides for a fetch of the current value from memory, conduct of arithmetic add operation and storage back in memory.
3. These meters, listed in section 3.5.2, shall display the following information in dollars and cents.
4. The Electronic Gaming Machines need to provide only the necessary meters for the authorized functions the devices support.



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3.5.2 Meter Definitions

1. **Coin In:** The machine must have a meter specifically labeled “Coin In” that accumulates the total value of all wagers, whether the wagered amount results from the insertion of coins, tokens, currency, deduction from a credit meter or any other means. This meter shall:
 - a. Not include subsequent wagers of intermediate winnings accumulated during game play sequence such as those acquired from “double up” games;
 - b. For multi-game and multi-denomination/multi-game gaming devices, provide the information necessary, on a per payable basis, to calculate a weighted average theoretical payback percentage; and
 - c. For gaming devices which are considered slot machines and which contain identifiably different games (such as an ante-bet game), maintain and display coin in meters and the associated theoretical payback percentage, for each wager category with a different theoretical payback percentage, and calculate a weighted average theoretical payback percentage for that payable.
2. **Coin Out:** The machine must have a meter specifically labeled “Coin Out” that accumulates the total value of all amounts directly paid by the machine as a result of winning wagers, whether the payout is made from the hopper, to a credit meter or by any other means. This meter will not record amounts awarded as the result of an external bonusing system or a progressive payout;
3. **Coin Drop:** The machine must have a meter specifically labeled “Coin Drop” that accumulates the total value of coins or tokens diverted to the drop;
4. **Attendant Paid Jackpots:** The machine must have a meter specifically labeled “Attendant Paid Jackpots” that accumulates the total value of credits paid by an attendant resulting from a single winning alignment or combination, the amount of which is not capable of being paid by the machine itself. This does not include progressive amounts or amounts awarded as a result of an external bonusing system. This meter is only to include awards resulting from a specifically identified amount listed in the manufacturer’s Probability and Accounting Report (par) sheet;
5. **Attendant Paid Cancelled Credits:** The machine must have a meter specifically labeled “Attendant Paid Cancelled Credits” that accumulates the total value paid by an attendant resulting from a player initiated cash-out that exceeds the physical or configured capability of the machine to make the proper payout amount;
6. **Physical Coin In:** The machine must have a meter specifically labeled “Physical Coin In” that accumulates the total value of coins or tokens inserted into the machine;
7. **Physical Coin Out:** The machine must have a meter specifically labeled “Physical Coin Out” that accumulates the value of all coins or tokens physically paid by the machine;
8. **Bill In:** The machine must have a meter specifically labeled “Bill In” that accumulates the total value of currency accepted. Additionally, the machine must have a specific meter for each denomination of currency accepted that records the number of bills accepted of each denomination;
9. **Voucher In:** The machine must have a meter specifically labeled “Voucher In” that accumulates the total value of all slot machine wagering vouchers accepted by the machine;
10. **Voucher Out:** The machine must have a meter specifically labeled “Voucher Out” that accumulates the total value of all slot machine wagering vouchers and payout receipts issued by the machine;
11. **Electronic Funds Transfer In (EFT In):** The machine must have a meter specifically labeled “EFT In” that accumulates the total value of cashable credits electronically transferred to the machine through a cashless wagering system;
12. **Wagering Account Transfer In (WAT In):** The machine must have a meter specifically labeled “WAT In” that accumulates the total value of cashable credits electronically transferred



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to the machine from a wagering account by means of an external connection between the machine and a cashless wagering system;

13. **Wagering Account Transfer Out (WAT Out):** The machine must have a meter specifically labeled “WAT Out” that accumulates the total value of cashable credits electronically transferred from the machine to a wagering account by means of an external connection between the machine and a cashless wagering system;
14. **Non-Cashable Electronic Promotion In:** The machine must have a meter specifically labeled “Non-Cashable Electronic Promotion In” that accumulates the total value of non-cashable credits electronically transferred to the machine from a promotional account by means of an external connection between the machine and a cashless wagering system;
15. **Cashable Electronic Promotion In:** The machine must have a meter specifically labeled “Cashable Electronic Promotion In” that accumulates the total value of cashable credits electronically transferred to the machine from a promotional account by means of an external connection between the machine and a cashless wagering system;
16. **Non-Cashable Electronic Promotion Out:** The machine must have a meter specifically labeled “Non-Cashable Electronic Promotion Out” that accumulates the total value of non-cashable credits electronically transferred from the machine to a promotional account by means of an external connection between the machine and a cashless wagering system;
17. **Cashable Electronic Promotion Out:** The machine must have a meter specifically labeled “Cashable Electronic Promotion Out” that accumulates the total value of cashable credits electronically transferred from the machine to a promotional account by means of an external connection between the machine and a cashless wagering system;
18. **Coupon Promotion In:** The machine must have a meter specifically labeled “Coupon Promotion In” that accumulates the total value of all slot machine coupons accepted by the machine;
19. **Coupon Promotion Out:** The machine must have a meter specifically labeled “Coupon Promotion Out” that accumulates the total value of all slot machine coupons issued by the machine;
20. **Machine Paid External Bonus Payout:** The machine must have a meter specifically labeled “Machine Paid External Bonus Payout” that accumulates the total value of additional amounts awarded as a result of an external bonusing system and paid by the slot machine;
21. **Attendant Paid External Bonus Payout:** The machine must have a meter specifically labeled “Attendant Paid External Bonus Payout” that accumulates the total value of amounts awarded as a result of an external bonusing system paid by an attendant;
22. **Attendant Paid Progressive Payout:** The machine must have a meter specifically labeled “Attendant Paid Progressive Payout” that accumulates the total value of credits paid by an attendant as a result of progressive awards that are not capable of being paid by the machine itself;
23. **Machine Paid Progressive Payout:** The machine must have a meter specifically labeled “Machine Paid Progressive Payout” that accumulates the total value of credits paid as a result of progressive awards paid directly by the machine. This meter does not include awards paid as a result of an external bonusing system.

3.5.3 Games Completed Meter

Electronic Gaming Machines shall have soft meters of at least eight digits that record the number of games completed:

1. Since power reset;
2. Since main door close; and
3. Since game initialization (RAM clear).



3.5.4 Bill In Count Meters

An Electronic Gaming Machine which contains a bill validator device shall maintain sufficient metering to be able to report the following:

1. Total monetary value of all items accepted;
2. Total Number of all items accepted;
3. Total monetary value of all bills accepted;
4. Total number of bills accepted;
5. Total count of rejected bills;
6. The number of bills accepted for each bill denomination;
7. The value of the last ten bills accepted with time stamps; and
8. For all other notes (ticket/vouchers and coupons) the Electronic Gaming Machine shall have a separate meter that reports the number of items accepted, excluding bills.

3.5.5 Residual Credit Removal Meters

If residual credit removal option is implemented, the following meters must be recorded and displayable in audit mode:

1. The number of times residual credit removal play has been used;
2. The residual credit removal amount played; and
3. The residual credit removal wins.

3.5.6 Gamble meters

If gamble is implemented, the following meters must be recorded and displayable in audit mode (If Gamble meters are not supported, the feature of Gamble should be disabled):

1. The number of games where gamble was invoked;
2. The number of games where gamble was won;
3. Amount played in the gamble feature; and
4. Amount won in the gamble feature.

3.6 Doors to be Monitored

The Electronic Gaming Machine shall be able to detect access to the following doors or secure areas:

1. Main door(s);
2. Logic area door(s);
3. Drop box door(s);
4. Bill acceptor doors (including stacker door);
5. Belly door(s);
6. Any other area housing a critical processor; and
7. Communication boards if accessible without opening any of the above.

When any doors are closed, a message stating that the door(s) has/have closed must be displayed. This message must be displayed until the next game play.

3.7 Credit Redemption Conditions

Available credits may be collected from the Electronic Gaming Machine by the patron pressing the "COLLECT / CASHOUT" button at any time other than:

1. During a play;



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2. While in audit mode;
3. While any door open condition exists;
4. While in test mode;
5. While the player's credit meter or total wins meter is incrementing;
6. While disabled by a Casino Monitoring System (CMS) or other external system;
7. While any fault condition exists, excluding :
 - a. Progressive controller failure (except when the progressive controller is required to validate the payment); and
 - b. Bill acceptor full.

3.8 Hopper Pay

1. If an Electronic Gaming Machines is equipped with a hopper, and if the current credit meter, when converted to a number of coins, is less than the maximum amount configured on the device for payment from the hopper and the COLLECT button is pressed, then these credits must be converted to the appropriate number of coins and dispensed from the hopper. Where the payment of the amount on the credit meter cannot be completed because the amount is less than the coin value, the manufacturer may implement a residual credit removal facility.
2. Once initiated, a hopper pay must not be able to be cancelled, paused or otherwise controlled by a player.

3.9 Residual Credit Removal

1. In the circumstance where the credit meter amount is less than the coin value in the hopper, or there is no hopper, the only valid means of removing the residual credits are via:
 - a. A cancel credit operation;
 - b. Printing of a ticket voucher; or
 - c. Residual credit removal option; a means of conducting a gaming transaction to convert the fractional amount to either the coin value or nothing.
2. If residual credit removal is implemented, the following requirements apply:
 - a. Residual credits bet on the residual credit removal play must be added to the Coin In meter.
 - b. If the residual credit removal play is won, the value of the win must be added to the Coin Out meter and must either:
 - I. Increment the player's credit meter; or
 - II. Be automatically dispensed, and the value of the coin(s) added to the Physical Coin Out meter.
 - c. If the residual credit removal play is lost, all residual credits are to be removed from the credit meter.
 - d. The residual credit removal play must return at least the minimum RTP specified for the games in Macau.
 - e. The player's current options and/or choices must be clearly indicated, either on static artwork, or electronically or by video display. These options must not be misleading.
 - f. If the residual credit removal play is offered on a multi-game gaming machine, the play must (for meter purposes of each individual game) either be considered to be a part of the game from which the play was invoked or be treated as a separate game.
 - g. The Game Recall must either display the residual credit removal play result or contain sufficient information (e.g. updated meters) to derive the result.



3.10 Transfers that are not Multiples of Credit Value

If the Electronic Gaming Machine is to accept credit transfer from external systems, such as Voucher Control or Bonusing systems, it must be properly able to handle the circumstance where the amount to be transferred is not an exact multiple of the credit value of the device. The Electronic Gaming Machine may handle this circumstance by:

1. Rejecting the cashless transfer;
2. Providing an appropriate means of redemption and displaying the odd cents; or
3. Automatically generate a credit out transaction for the odd cents (i.e. for example by printing a voucher for the odd cents or doing a cashless transfer back to the cashless system of the odd cents.).

3.11 Test/Diagnostic Mode

3.11.1 General

If in a test mode, any test that incorporates credit entering or leaving the gaming machine (e.g. a hopper test) shall be completed prior to resumption of normal operation. In addition, there shall not be any test mode that increments any of the electronic meters. Any credits on the gaming machine that were built up during the mode shall be cleared before the test mode is exited. Test meters are acceptable provided the meter indicates as such.

3.11.2 Enter to Test/Diagnostic Mode

The sensor of the main cabinet door of the gaming machine may automatically set the machine in a service or test-mode. Test/diagnostic mode may also be entered, via a proper instruction, from an attendant during an audit mode access.

3.11.3 Exit from Test/Diagnostic Mode

When exited from test mode, the game shall return to the original state it was in when the test mode was entered.

3.11.4 Test Games

If the gaming machine is in a test mode, the machine shall clearly specify that it is in a test mode and is not available for normal play.

3.12 Data Partitioning

Electronic Gaming Machine software must be designed so that machine specific information (e.g. machine address or other configurable parameters) are not stored within the same device (EPROM, flash or file for disc machines) as game and system software. This partitioning will provide for common game and system software devices among same type of machines when performing signature calculations.

3.13 Simultaneous Inputs

The Electronic Gaming Machine shall not be adversely affected by the simultaneous or sequential activation of the various inputs and outputs, such as 'play buttons', which might, whether intentionally or not, cause malfunctions or invalid results.



3.14 Electronic Gaming Machine Events (Tilt Situation)

A description of tilt codes and their meanings shall be attached inside the gaming machine unless the displayed codes are self-explanatory.

3.14.1 Self Clearing Events

Gaming machines shall detect and display the following conditions and may be automatically cleared when the fault is cleared by the gaming machine upon commencement of a new play sequence and also communicated to an on-line monitoring and control system if applicable:

1. Power reset;
2. Any door open (including bill acceptor & stacker);
3. Any door just closed;
4. Inappropriate coin-in if the inappropriate coin(s) in is returned to the player; and
5. Stacker removed/inserted.

3.14.2 Events Cleared by Attendant Intervention

Gaming machines shall be capable of detecting and displaying the following error conditions that shall disable the game play and shall only be cleared by an attendant and also communicated to an on-line monitoring and control system if applicable:

1. Coin-in error (e.g. coin jam, reverse coin-in, etc.);
2. Coin-out error (e.g. coin jam, extra coin paid out, etc.);
3. Hopper empty or timed-out (hopper failed to make payment);
4. Hopper jam;
5. Hopper runaway;
6. Extra coin paid / Hopper runaway;
7. Bill-in jam;
8. Low RAM battery for batteries external to the RAM itself or low power source;
9. Uncorrectable RAM error (defective or corruptive RAM);
10. Print failure, if the gaming machine has no other means to make a payout, a replacement voucher may be printed once the failure condition has been cleared;
11. Printer mechanism paper jam. A paper jam condition shall be monitored at all times during the print process;
12. Printer mechanism paper out;
13. Presentation error;
14. Program error (Defective program storage media);
15. Reels spin error of any type including a mis-index condition for mechanical reels. The specific reel number shall be identified as part of the error condition; microprocessor controlled reels as well, if applicable, shall be monitored to detect malfunctions such as a reel which is jammed, or is not spinning freely, or any attempt to manipulate their final resting position;
16. Removal of control program storage media; and
17. Player-initiated attempt to cash-out after insertion of an operator-specified threshold amount of coins, bills and/or cashless in without initiating any play.

Gaming machines shall be capable of storing and displaying a minimum of the last 100 events.



3.15 Audit Mode

3.15.1 Audit Mode Requirements

Audit mode is to include as a minimum the following items:

1. Display of all electronic meter information as per the section 3.5.2 'Meter Definitions';
2. Last Play Recall;
3. Display of terminal identification;
4. Display of software/game identification;
5. On-screen hashing algorithm signature verification;
6. Perform combination/paytable test.
7. Last Bill, Voucher In and Voucher Out Data;
8. Machine configuration information;
9. Display of minimum and maximum number of line(s)/way(s) for the game;
10. Display of minimum and maximum bet values for the game in credits and in dollars and cents for one spin;
11. Display of maximum win value of a single payline in a bought game excluding jackpots and bonus prizes in credits and in dollars and cents for one spin;
12. Display of denomination of all games configured for play;
13. Display of minimum RTP (not a range) of all games configured for play. If the game has different component games (such as Ante-bet games, jackpot) it must show the additional RTP(s) in separated line items (should not show it (them) as a range);
14. For games supporting Standalone jackpots, it should show the startup and increment percentage & minimum and maximum (if applicable) value for each level in dollars and cents with total RTP for each level and total RTP of the whole jackpot, and
15. Display of any other game statistics (e.g. wins by category), if maintained by the Electronic Gaming Machine and not transferred to and maintained by CMS.

3.15.2 Audit Mode Access

1. Access to Audit mode is limited to the operation of a key-switch or other secure methods.
2. Auditing of metering information must be accessible by an authorized person at any time, except during collect in progress or during play (except where play is interrupted by a fault condition).
3. The gaming machine must not be playable while in Audit mode.

3.15.3 Signature Verification

The gaming machine shall provide capability to verify the signature of all Programmable Storage Devices (PSDs) used in the EGM in the audit mode. This function shall support the following:

1. The gaming machine shall provide capability to verify the signature of all physical or logical PSDs using a secure hashing method such as HMAC-SHA1 or other better well-know security algorithms which are recognized by the gaming industry.
2. The gaming equipment must allow the manual entry of a signature key for the hashing algorithm. Signature key entry must be via an interface provided by the gaming equipment and there must be an on-screen legend displayed. The default signature key is hexadecimal 00 / 0000.
3. Signature key entry is to be :
 - a. In hexadecimal characters;
 - b. Entered least significant bytes (LSB) first;



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- c. Suitably formatted for displaying for easy reading; and
- d. For gaming equipment with multiple physical or logical PSDs, the gaming machine shall display individual signature results of each physical/logical PSD in the gaming equipment.

3.15.4 Combination and Paycheck Mode

The gaming machine shall provide a Combination and Paycheck Mode. This function shall support the following:

1. Every base game combination result may be selected, allowing testing of any combination;
2. The number of credits staked can be varied;
3. The number of lines can be varied;
4. The value of the prize attained for the combination with respect to the number of credits staked is displayed; and
5. Triggering the prize resulting from the feature is displayed.

It will clearly display on the screen of the game machine while performing this test mode.

3.16 Software Verification

1. The gaming machine shall allow for an independent integrity test of the machine's software from an external source. This may be performed by the medium being able to be removed and authenticated by an external device, or employing an interface port for an external device to authenticate the media. This integrity test procedure shall provide the means for field testing of machine software for verification purposes.
2. The gaming machine shall also be enabled for self-authentication of the machine software with its slot management system as specified in the protocol used for communication between the slot management system and the gaming machine.



4 GAMES

4.1 Objective

This section describes the game requirements so that the game performance is as anticipated and is reliable and fair to the player. It creates the minimum standards of function so that all conforming electronics gaming platforms would be reliable, honest, secure, auditable and operate in conformance with their specifications.

4.2 Game Content

4.2.1 Games Not To Be Approved

DICJ will not approve any game which:

1. Is derived from or based on a product that is currently and primarily intended or marketed for use by persons under the prescribed age at which it is legal to enter casinos in Macau;
2. Is offensive to public morality or order.

4.2.2 Intellectual Property

Manufacturers must complete and lodge with any application for DICJ Approval of a game a certification and indemnity, in the form of Attachment 1 to this document.

4.3 Game Play Information

An Electronic Gaming Machine must display the following information to the player at all times when the machine is available for player input:

1. The current credit balance;
2. The current bet amount;
3. All possible winning outcomes, or be available as a menu item or help menu;
4. Win amounts for each possible winning outcome or be available as payglass, menu or help screen item;
5. The amount won for the last completed game (until the next game starts or the betting options are changed);
6. The player options selected (e.g. bet amount, number of lines played) for the last completed game (until the next game starts or the betting options are changed);
7. The denomination of the game being played;
8. A disclaimer regarding malfunction voids all pays;
9. The winning playlines for the last completed game shall be clearly indicated to the player (until the next game starts or the betting options are changed); and
10. For multi-line games, the display shall provide a mechanism for clearly indicating to the player each possible line that can be played.

4.4 Display Requirements with Non-zero Credit Meter

While the Electronic Gaming Machine is in idle mode, if there are credits on the credit meter, the following must remain on view until the next play is initiated or the betting options are changed:

1. The total number of credits wagered for the last play;
2. The final results for the last game played;



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3. The total number of credits won and other prizes associated with the combination resulting from the last play; and
4. When the player has made one or more initial play selection decisions for the next game, the display must clearly indicate that the information displayed is appropriate to the potential next game to be played.

4.5 Wagers

4.5.1 Credits Bet

Credits bet must only come from the credit meter, which is to be decremented at the start of play or when additional wagers are made during the game as per the game rules. Additional wagers from the credit meter must not be available to gamble games.

4.5.2 Mandatory Credit Return (Forced Bet)

The EGM must reject and return the credits wagered by the player if the credits bet are less than the minimum bet value for the selected bet option.

4.5.3 Default Bet value

Bet values should not default to the maximum bet value except in cases where there is only a single wagering option available.

4.6 Games with Components of Skill

Games involving player physical dexterity (e.g. hand/eye coordination) must return at least the minimum return to player [MINRTP] without adaptive strategies.

4.7 Return to Player

1. A game must have a theoretical/estimated statistical expectation that the minimum player return (RTP) of the game will be greater than or equal to [MINRTP]. The minimum percentage requirement must be met when playing at the lowest percentage available. If no minimum RTP is prescribed by regulation for the time being, it shall be taken to be 80%.
2. A game must have a theoretical/estimated statistical expectation that the maximum player return (RTP) of the game will be less than or equal to [MAXRTP]. If no maximum RTP is prescribed by regulation for the time being, it shall be taken to be 98%.
3. Any EGM plays a game that is recognizable to be a simulation of a live casino game approved for play in Macau pursuant to Law 16/2001 must have an identical RTP.
4. Within a single game configuration, a change to the betting options selected must not cause a difference of more than 4% between the maximum theoretical RTP and the minimum theoretical RTP. Where one version of game software contains identifiably different games (such as ante-bet games) the requirement of the RTP difference will apply to each game separately.

4.8 Top Award

1. The highest single advertised payout on each gaming device shall occur, statistically, at least once in 50,000,000 games.
2. This does not apply to multiple awards won together on the same game play where the aggregate prize is not advertised.



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3. This odds rule shall not apply to games which make it possible for a player to win the highest win multiple times through the use of free games.
4. This rule does apply to each wager that wins the maximum award.
5. If the highest advertised award can occur within a bonus or free game feature, the odds calculation shall include the odds of obtaining the bonus round including the odds to achieve the top award.

4.9 Game Cycle

A game is considered completed when the final transfer to the player's credit meter takes place (in case of a win), or when all credits wagered or won that have not been transferred to the credit meter, are lost. The following are all considered to be part of a single game:

1. Games that trigger a free game feature and any subsequent free games;
2. "Second screen" bonus feature(s);
3. Games with player choice (e.g. Draw Poker or Blackjack);
4. Games where the rules permit wagering of additional credits (e.g. Blackjack insurance or the second part of a two-part Keno game);
5. Double-up/Gamble features; and
6. Games that trigger progressive jackpots.

4.10 Minimum Game Cycle Time

The minimum spin rate or interval between consecutive base game play on the gaming machine must not be less than 3 seconds.

4.11 Continuous Play

The player must initiate game play by pressing a play or bet button, or similar input device.

Each play must be initiated by a distinct and separate activation of the player interface (e.g. play button or touch screen etc.) and the gaming machine must not allow a player to circumvent this requirement by external interference (e.g. holding down or jamming play buttons).

4.12 Autoplay

Automated play is prohibited.

4.13 Game Fairness Objectives

1. All games are to be fair to players in that the game must not be designed to give the player a false expectation of better odds by falsely representing any occurrence or event.
2. The display of the result of a game outcome must not be misleading or deceptive to the player (e.g. must not improperly indicate a near-miss).
3. The mapping of numbers directly from the RNG output or through a scaling algorithm shall not influence a symbol to occur with a probability not equal to its statistical expectation.

4.14 Win Truncation

The win awarded in any individual game element or sequence of game elements must not be truncated.



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4.15 Display of Lines/Patterns/Ways Selected

The EGM shall employ a mechanism to clearly indicate each individual possible line/pattern/way sequentially or concurrently which is activated as a lit selected line (by betting additional credits), so that the player is in no doubt as to which line/pattern/way a wager was placed.

4.16 Display of Lines Won

The winning playline(s)/win pattern(s)/win way(s) must be clearly highlighted to the player.

4.17 Bonus Games

1. All gaming machines that offer bonus game or extended play feature, which requires player selection or interaction, are prohibited from automatically making selections or initiating games or features unless:
 - a. The patron is presented with a choice and specifically acknowledges his/her intent to have the gaming machine auto-initiate the bonus or extended play feature by means of a button press or other physical/machine interaction;
 - b. The bonus or extended feature provides only one choice to the patron (i.e. press button to spin wheel). In this case, the machine may auto initiate the bonus or extended feature after a time out period of at least two minutes; or
 - c. In cases where player input is required within a finite period of time (e.g. selection of bonus prize symbols), an appropriate time period of not less than 2 minutes shall be provided. When input time elapses, the EGM is suggested to make a random input for the player. Additionally, this random input operation will be displayed in the payable.
2. The game's player return including all bonuses over the cycle shall conform to the theoretical minimum RTP percentage stated in the above sections.
3. The game shall not adjust the likelihood of a bonus occurring, based on the history of prizes obtained in previous games (i.e. games shall not adapt their theoretical return to player based on past payouts).

4.18 Game Recall

4.18.1 General

1. For the Game Recall information held by the Electronic Gaming Machine, it must be possible to show to the player the results of the play(s) as the player originally saw it. The manner in which the information is provided must enable observers to clearly identify the game sequences and result(s) that occurred.
2. Information on at least the last ten (10) games is to be always retrievable on the operation of a suitable key-switch, or another secure method that is not available to the player.

4.18.2 Game Recall Information Required

1. Reels in final resting position, card values, balls drawn or other form of game result;
2. Total number of credits at the start of play (less credits bet);
3. Total number of credits at the end of play;
4. The total number of credits bet including number of lines played and credits per line;
5. The total number of credits won associated with the prize resulting from the last play or the value in dollars & cents for progressive prizes;



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6. The total number of credits added (separated into coins, bills and cashless) since the end of the previous play and through to the end of the last play;
7. The total number of credits collected (separated into coins, vouchers and cashless) since the end of the previous play and through to the end of the last play;
8. The total value of cancelled credits (in dollars & cents) since the end of the previous play and through to the end of the last play (credits added or collected after the last play will be recorded on the completion of the next play);
9. Any player choices involved in play outcome including lines selected, units wagered, cards held, balls selected, etc.;
10. Results of Gambles, (includes Residual Credit Removal features); and
11. The value of all Standard Meters (as defined in Section 3.5.2) as at the end of the last play. Specific meters that are not applicable, may be omitted.

Note: The above requirements are the default for Last Play Information in that events after the completion of the last play (such as inserting money to add credits, or collecting credits) do not form a part of the Last play Requirements. However, it is permissible for manufacturers to display this information provided it is clear what happened after the completion of the last play.

4.18.3 Game Sequences

1. If the feature is retriggerable within the feature (i.e. the number of games in a feature sequence can theoretically be infinite), the Last Play Recall function must be able to replay a minimum of last 50 feature games irrespective of number of played.
2. In all cases for a feature or free game sequence, the initial trigger game and final game must be available for display.
3. The replay of alternate display game sequences (free games, feature games etc) must allow each game in the sequence to be examined. Progression to the replay of the next game in the game sequence must require external input, e.g. button press, touch screen input etc. Alternatively, the replay function may provide a 'Pause' input to allow the replay to be suspended between games of a game sequence.

4.19 Gamble Feature

1. The gamble option must have a theoretical return to player of at least 100%.
2. If Gamble is offered on the result of bonus/feature games, only moneys not transferred from the win meter to the credit meter may be wagered on the gamble feature.
3. Amounts bet on gamble are not to be added to the Coin In meter.

4.20 Configuration Settings

1. It shall not be possible to change a configuration setting that causes an obstruction to the electronic accounting meters without a RAM clear.
2. Change of critical parameter (i.e. denomination, RTP etc.) must be done by a secure means, which includes access to the locked logic area.

4.21 Configuration of Multi-Game Electronic Gaming Machine

If it is possible to select between multiple games that are resident in an Electronic Gaming Machine's memory:

1. The set of games offered to the patron for selection or to the payable, can be changed only by a secure method approved by DICJ.



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2. No changes to the set of games offered to the patron for selection (or to the payable) are permitted while there are credits on the player's credit meter or while a game is in progress.

4.22 Random Number Generator

The purpose of this sub-section of the standards is to establish requirements for random selection processes with the use of random number generators (RNGs). In most implementations of an Electronic Gaming Machine, there will be the need for a Random Number Generator (RNG).

4.22.1 RNG Selection

1. A manufacturer may employ one or more RNG software algorithms, hardware devices or combinations of hardware and software.
2. The choice of algorithms and devices is left to the manufacturer. Each component or combination of components used to provide random numbers must satisfy the requirements of this document.
3. If an RNG is used for cryptography, it shall be separate from RNGs used for other purposes.

4.22.2 RNG Properties

1. Crypto-analytic attack of an RNG must not be practically possible. All RNGs must produce output having the following cryptographic properties:
 - a. **Statistical Randomness:** RNG outputs must pass statistical tests for randomness in the way they are to be used by the gaming application and the rules of the games;
 - b. **Unpredictability:** it must not be feasible to predict future outputs of an RNG even if the algorithm and the past sequence of outputs is known;

4.22.3 Scaling

1. An RNG which provides output scaled to given ranges must use an unbiased algorithm.
2. RNGs that provide numbers scaled to the ranges required by game rules shall retain the cryptographic properties described above, and in particular:
 - a. Scaled numbers must be unpredictable, independent and uniform over the range; and
 - b. Scaled numbers must pass statistical tests relevant to the application which may include one or more of the following:
 - i. chi-square test;
 - ii. equi-distribution (frequency) test;
 - iii. gap test;
 - iv. overlap test;
 - v. poker test;
 - vi. coupon collector's test;
 - vii. permutation test;
 - viii. run test (Patterns of occurrences must not be recurrent);
 - ix. spectral test;
 - x. serial correlation test potency and degree of serial correlation (outcomes must be independent from the previous game);
 - xi. test on subsequences; and
 - xii. die-hard tests.



4.23 Game Interruption and Resumption

4.23.1 Game Interruption

After a game interruption (e.g. power down), the software shall be able to recover to the state it was in prior to the interruption taking place.

4.23.2 Game Interruption Procedures

On game interruption, the following procedures shall be executed at the least:

1. The hopper shall be turned off;
2. The power-down routine, if any, shall be fully completed; and
3. The integrity of critical variables shall not be compromised by the interruption procedures.

4.23.3 Restoration from Error Situation

If a gaming machine is powered down while in an error situation, then upon restoring power, the error message shall be displayed and the gaming machine shall stay locked-up. This is unless power down is used as part of the error reset procedure, or if on power up or door closure, the gaming machine checks for the error situation and detects that the error is no longer in existence.

4.23.4 Game Resumption

On game resumption, the following procedures shall be executed at the least:

- 1 Any communication to an external device shall not begin until the game resumption procedure, including self-tests, is successfully completed;
- 2 Gaming machine control programs shall test themselves for possible corruption due to failure of the game storage media using a robust and proven means;
- 3 The integrity of all critical memory shall be checked;
- 4 The power down process, if any, shall be tested for correct completion, and a proper message shall be displayed if incorrect completion is detected; and
- 5 The software shall be able to detect any change in the gaming machine program from when the gaming machine was last powered down or interrupted. If a change is detected, the gaming machine shall lock-up, display a proper error message until the gaming machine is reset by an authorized person.

4.24 Artwork

1. There must be sufficient game instructions to allow a player to determine the correctness of prizes awarded.
2. All statements on the artwork must be true.
3. The payable applicable to the device must be clearly visible, or the means of displaying such information must be readily available to the player prior to committing to a bet and when the EGM is waiting for player input.
4. The pay scale on the artwork must correspond to the pay scale used in the par sheet.
5. The message "Malfunction Voids All Pays and Play" or its equivalent must be displayed on each Electronic Gaming Machine.
6. The game instructions must be clearly visible, or the means of displaying such instructions must be readily available to the player prior to committing to a bet and when the EGM is waiting for player input.
7. All game instructions on the artwork must be easily interpreted, not ambiguous, and sufficient to explain all game rules.



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8. The name of the game being played must be clearly visible to the player.
9. The display of the result of a game outcome must not be misleading or deceptive to the player (e.g. must not improperly indicate a near-miss or a future win).
10. Written messages shall be in English and Chinese (Traditional / Simplified) and there must be an option for the player to view all written messages in the artwork, game rules and messages displayed to the player either in English or in Chinese (Traditional / Simplified). All messages displayed shall be both grammatically and syntactically sound, in the languages.
11. The functions of all buttons (physical or touch screen) in normal game mode must be clearly indicated preferably on the button.
12. Any game instructions that appear on the video screen must only be accessible and visible without the need for credits to be inserted or wagered. This requirement does not apply to messages that will be displayed which are specific instructions that may be required to proceed to the next stage of the game.
13. Help screen shall provide adequate information in detail for the player to understand the game and all information provided must be correct.
14. All disclaimers shall be displayed either on machine cabinet or in game software.both in English & Chinese at all time; This can be implemented either by displaying the disclaimers in English & Chinese statically at all times or by scrolling the disclaimers in English & Chinese messages alternatively such that it is clearly visible to the player at all times while the gaming machine is available for game play.
15. Display of minimum and maximum line/way for the game be displayed to the player at all times the gaming machine is available for player input;
16. Display of minimum and maximum bet values for the game in credits and in dollars and cents for one spin be displayed to the player at all times the gaming machine is available for player input;
17. The denomination of all games configured for play must be displayed to the player at all times the gaming machine is available for player input.



5 EXTERNAL COMMUNICATIONS

5.1 Objective

The intent of this section is to ensure that communications with gaming machines are secure so as to avoid unauthorized access or modification of communicated data as well as to ensure that all related translations are precise and free from error.

5.2 Communication Requirement

1. All external data communication shall be protocol based and/or integrate an error detection and correction scheme to ensure an accuracy of not less than 99% of messages received.
2. The communication protocol shall ensure that incorrect data or signals would not harmfully affect the operation of the gaming machines.
3. Certificates, keys or seeds that are used for encryption purposes shall not be hard coded, and shall be changed from time to time.



6 VOUCHER IN/VOUCHER OUT

6.1 Objective

This section describes the requirements of Voucher In/Voucher Out system for gaming machines so that the gaming software performance is as anticipated and is reliable and fair to the player. It creates the minimum standards of function so that all conforming electronics gaming platforms would be reliable, honest, secure, auditable and, operate in conformance with their specifications.

6.2 General

1. Voucher In/Voucher Out is allowed only when the Electronic Gaming Machine is connected to a Central Monitoring System (CMS) and the validation information is generated from the CMS.
2. Electronic Gaming Machines shall have the capability to display a complete transaction history for the most recent thirty-five (35) voucher in and voucher out transactions.

6.3 Voucher In

1. The acceptance device must be able to detect the entry of a valid voucher by reading its barcode or other unique identifier via the bill acceptor or other barcode reading device.
2. If the Voucher is valid, it will be stacked and the appropriate credits will be transferred to the players account. The acceptance of the voucher is similar to the acceptance of Bills.
3. If the voucher is invalid, the voucher system will notify the Electronic Gaming Machine that the voucher is invalid.
4. If the voucher control system is offline, the Electronic Gaming Machine must always reject the ticket and return it to the player.

6.4 Voucher Out

6.4.1 Ticket Information Required

The Electronic Gaming Machine shall print out the ticket and provide the following information regarding each payout ticket printed:

1. Licensee (casino) name, city;
2. Gaming device number or printer station number, as applicable;
3. Date and time of issuance;
4. Alpha and numeric dollar amount;
5. Sequence number;
6. Validation number;
7. Transaction type or other acceptable method of differentiating ticket types; and
8. Expiration period or date when voucher or coupon will expire, if applicable.

6.4.2 Ticket Barcodes

Barcodes or other form of machine readable markings on a ticket must have enough redundancy and error checking to ensure that not less than 99.9% of all misreads are flagged as an error.



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6.4.3 Ticket Validation Numbers

1. Ticket validation numbers must be unique – i.e. the ticket support system must ensure that a repeated validation number cannot happen even if there is a total replacement of an Electronic Gaming Machine.
2. Ticket validation numbers must use methodology to prevent prediction of subsequent validation numbers without detailed knowledge of the algorithm and parameters.



7 GLOSSARY OF TERMS AND ABBREVIATIONS

Term or Abbreviation	Description
Approval	The legal act of approving gaming equipment.
Audit Mode	The mode where it is possible to view gaming machine meters, statistics, etc. and perform non-player related functions.
Bill Acceptor	The device using photo-optic, electromagnetic or magnetic sensors (internal or external to the gaming machine) and any additional devices used to validate a bill and/or printed ticket.
Bonus/Feature Game	An additional function not part of the base game which allows extra credits to be won. They may take the form of free games and/or second screen features.
Cancel Credit	Credits which are paid by manual cancellation at the gaming machine or by ticket payment to the player.
CMS	Central Monitoring System / Casino Management System
Coin Validator	The term “coin validator” refers to coin comparator, photo-optic sensors (internal or external to the comparator) and any additional devices used to validate a coin.
Critical Memory	Memory locations storing information that is considered vital for the continued proper operation of the gaming machine.
Electrostatic Interference (ESD)	The physical property of being able to create electronic interference to a device by either discharging static electricity onto the surface of the unit (such as from a user), or via a mains power or communication cable (from lightning for example).
Electromagnetic Interference	The physical characteristic of an electronic device to emit electronic noise either into free air, onto the mains power lines, or communication cables.
EPROM	Electrically Programmable Read Only Memory – a storage area which may be filled with data and information, which once written is not modifiable, and which is retained even if there is no power applied to the machine. Modification (erasure) is only possible by the application of an Ultra Violet (UV) light source.
Feature	Any additional free game, free spin of certain reels, metamorphosis of the basic game rules or secondary choice necessary to complete a game (except gamble) is considered a feature.



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Term or Abbreviation	Description
Gamble	A game option, such as Double-Up, that may be selected following a win. This refers to player options where some or all of the winnings may be wagered at a minimum of 100% player return - includes multipliers other than evens, e.g. "pick a suit" where four outcomes are offered at 0.25 probability.
Game	A game is a set of rules that a gaming machine follows. Major constituents of a game are rules, artwork (virtual or static and inclusive of game symbols and payable), winning combinations and game symbol distribution.
Hashing Algorithm	Generally, a function which accepts a variable length data message and produces a fixed length message digest (i.e. hashing algorithm signature). In this Standard, the term 'hashing algorithm' referred is the HMAC-SHA1 algorithm.
HMAC-SHA1	'Keyed-Hash Message Authentication Code'. Calculated using a cryptographic Hash Algorithm in combination with an input key. (refer: FIPS PUB 198).
Hopper	A device used to store and dispense coins.
Last Play	The Last play is the most recently completed play.
Master Meter	A meter whose value is reset only when a memory reset is performed. This meter represents the total of all updates since the last memory reset.
PAR	Probability and Accounting Report
Par Sheet	A document describing a set of rules, descriptions or graphical instructions relating to the prize(s) payable for all winning combinations.
PCB	Printed Circuit Board - the piece of board used to connect together electronic components in a certain manner using tracks and holes to route the signals.
Play	A sequence of actions and states in the gaming machine initiated by a player through a wagering of credits and terminated when all credits wagered have been lost or all winnings have been transferred to the gaming machine's total wins meter and the player's credit meter.
PLD	A programmable logic device or PLD is an electronic component used to build reconfigurable digital circuits. Unlike a logic gate, which has a fixed function, a PLD has an undefined function at the time of manufacture. Before the PLD can be used in a circuit it must be programmed, that is, reconfigured.



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Term or Abbreviation	Description
PSD	Programmable Storage Device, an integrated circuit including Flash-ROM, RAM, Hard Disk and logic functions on a single chip.
RAM	Random Access Memory.
Residual Credit Removal	A method for the player to remove any residual credits from the gaming machine.
Re-trigger	To trigger a feature during a feature of the same type.
Return to Player (RTP)	The ratio of total wins (including progressives and other features) to the total turnover in a game cycle (note gamble bets do not affect turnover and total wins is only affected by the final gamble outcome).
RFI	A Radio Frequency Interference which affects the operation of an electronic device.
RNG	Random Number Generator
Signature	The result from a mathematical algorithm, including the keyed HMACSHA1 algorithm, applied to the entire contents of a Program Storage Device or software file.
Signature Key	An input parameter used in conjunction with a signature algorithm.
Voucher In	A method for inserting a valid printed ticket to get the corresponding credits.
Voucher Out	A method for redeeming the current available credits by means of printing a ticket.
Win	The amount of credits (or money if applicable) that is awarded for a winning pattern, according to the game rules.



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8 ATTACHMENT 1: CERTIFICATION AND INDEMNITY

CERTIFICATION AND INDEMNITY FORM

I(full name)

Being.....(position held)

For and on behalf of.....(supplier)

Hereby certify that:

1. The statements contained in the attached submission for approval by DICJ, together with attached documents, are, to the best of my knowledge and belief true and correct in every detail, and constitute a complete disclosure of the information required to be lodged with DICJ.
2. The Director, DICJ, and all other officers and officially appointed agents of DICJ, shall be indemnified and held harmless from and against any and all claims, suits, demands, and costs, expense, losses and/or actions of any kind in consequence of any official action taken in respect to this application, and any intellectual property, such as a patent, trademark, copyright or registered design, relating thereto, and
3. The items submitted are complete and operational.

Name/Description of Equipment.....

Signed at

The.....day of.....20.....

.....(signature)

In the presence of

.....(witness)

Name and address of witness

.....